
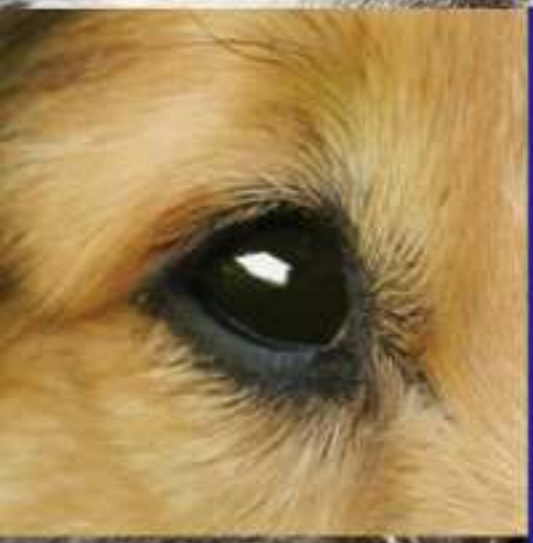

THE BLUE BOOK

Ocular Disorders
Presumed To Be Inherited in Purebred Dogs

2017

Genetics Committee of the
American College of Veterinary Ophthalmologists

TENTH EDITION

Foreword

Ocular disorders, proven or presumed to be inherited in purebred dogs, have been a topic of intense dialogue by Diplomates of the American College of Veterinary Ophthalmologists (ACVO) for many years. Discussions commenced in the latter half of the 20th century during the early days of this College's inception, have continued into the 21st century, and will no doubt continue for years to come. Our knowledge of the existence, nature, progression, and inheritance of ocular disorders continues to expand as this field of veterinary science evolves. The Genetics Committee of the ACVO was originally formed in response to requests by registries, breed groups, and veterinarians, with the intent to provide a scientific advisory panel and guidelines regarding ocular disorders in purebred dogs. The Genetics Committee of today remains engaged in an ongoing effort to update information on ocular disorders for this purpose.

The content of this production has originated from several sources as the ACVO recently created a Companion Animal Eye Registry (CAER), which is a joint effort between the Orthopedic Foundation for Animals (OFA) and the ACVO. The addition of eye examination results to the OFA database makes the OFA the most complete source of canine health screening results in the world, allowing responsible breeders to make more informed breeding decisions in an effort to reduce the incidence of inherited disease.

The generation of statistical information is made possible by the efforts of dedicated breeders of purebred dogs who present their dogs to Diplomates of the ACVO for an OFA Companion Animal Eye Registry examination. The research copies of these examinations are then conscientiously submitted to OFA by the examining Veterinary Ophthalmologists. These data generate annual statistics. The statistics for each breed are then reviewed by the Genetics Committee for the most recent year and from the previous 5 years. Recommendations regarding the ocular disorders listed for each breed and the breeding advice are compiled following guidelines detailed elsewhere in this publication. A comprehensive review of the scientific literature since the last published edition was undertaken by all committee members. The scientific articles and breed disorders from the statistical and literature review have been added to the information on each breed in the production of this document. The collective educated clinical experience of the committee members is utilized to reach a consensus of opinion in areas where there remains a paucity of hard scientific proof regarding certain identified breed problems.

The current Genetics Committee has instituted an annual scientific literature search, in addition to the previously established yearly statistical data review. This information is compiled and submitted in an effort to maintain a bank of current information for future editions and versions of this document. The content of all editions past, present, and future will remain dynamic and ever changing as more precise technologies advance the study of the canine genome, as continued scientific research expands our knowledge, and as the database grows.

It is an honor and a privilege to serve the ACVO, our fellow Diplomates, reputable dog breeders, and our most trusted canine companions in this endeavor.

Genetics Committee 2018
Renee Carter, Jessica Meekins, Caroline Betbeze, Adam King, Hans Westermeyer, Kathy Barrie,
Charlie Martin and Jane Ashley Huey
Gus Aguirre – Advisor
Katie Diehl – OFA Liason

10th Edition
2017 Version Acknowledgements

The following groups and individuals deserve credit for the production of this edition of Ocular Disorders Presumed to be Inherited in Purebred Dogs ("The Blue Book").

The ACVO Board of Regents

Genetics Committee Chairs Dr. Andras Komaromy 2006-2008, Dr. Katie Diehl (2009-2011), Dr. Jacqueline Pearce (2011-2012), Dr. Carrie Breaux (2011-2013), Dr. Kenneth Pierce (2014), Dr. Wendy Townsend (2015), Ellen Belknap (2016), Jessica Meekins (2017), Renee Carter (2018) and all Genetics Committee members

Eddie Dziuk, Chief Operating Officer and Erika Werne, CAER Program Manager for the OFA

Introduction

What is the purpose of this book?

The Orthopedic Foundation for Animals (OFA), Canine Eye Registration Foundation (CERF), other breed registry groups, breed clubs, and practicing veterinarians have requested that the American College of Veterinary Ophthalmologists (ACVO) provide a scientific advisory panel to furnish guidelines regarding ocular disorders of major concern to purebred dogs. The Genetics Committee of the ACVO was formed in response to these requests and is engaged in an ongoing effort to update information on ocular disorders proven or suspected to be hereditary in purebred dogs. The compendium of ocular disorders and breeding recommendations which follow are interim guidelines. They are reviewed regularly and revised whenever additional information becomes available.

How can this information be used?

National and international breed clubs are encouraged to submit their input regarding breeding decisions for ocular disorders found in their breeds. **Local breed clubs** can participate by encouraging and organizing ocular examination clinics and forwarding their requests and concerns to their national organization. **Practicing veterinarians** are encouraged to contribute by informing all owners of potential breeding animals of the value and availability of ocular examinations, prior to breeding. Information regarding ocular disorders found in litters or individuals can be forwarded to the Genetics Committee via any ACVO diplomate. **Individual breeders** wishing to uphold high ethical standards for the improvement of their breed are urged to contribute by annual examination of their breeding animals and by encouraging the same from other breeders. Further information can be obtained from the Orthopedic Foundation for Animals (OFA): 2300 E Nifong Boulevard, Columbia, MO, 65201-3806, 573-442-0418. Only through increased awareness of the problems and a sustained cooperative effort to disseminate accurate information, will we be able to control and/or eliminate hereditary eye diseases in purebred dogs.

How do we identify an inherited eye disease?

Although there are noteworthy exceptions, most of the ocular diseases of dogs which are presumed to be hereditary have not been adequately documented. Genetic studies require examination of large numbers of related animals in order to characterize the disorder (age of onset, characteristic appearance, rate of progression) and to define the mode of inheritance (recessive, dominant). In a clinical situation, related animals are frequently not available for examination once a disorder suspected to be inherited is identified in an individual dog. Maintaining a number of dogs for controlled breeding trials through several generations is a long and costly process. Both of these obstacles are compounded by the fact that many ocular conditions do not develop until later in life.

Until the genetic basis of an ocular disorder is defined in a published report, we rely on what statistical information is available from registry organizations, informed opinions and consensus from ACVO diplomates, and must satisfy ourselves with terms like "presumed inherited" and "suspected to be inherited." Several companies provide information on genetic testing which greatly assists in providing more information and data to aid in defining the canine genetics of ocular diseases.

When do we suspect that a disorder is inherited in a given breed?

- When the frequency is greater than in other breeds
- When the frequency increases in a given breed as a whole
- When the frequency is greater in related dogs within a breed
- When it has a characteristic appearance and location
- When it has a characteristic age of onset and course of progression (predictable stages of development and time for each stage to develop)
- When it looks identical to an entity which has been proven to be inherited in another breed

Guidelines Used by the ACVO Genetics Committee in Making Breeding Recommendations

In this book, we chose the term "**BREEDING ADVICE**" and intentionally avoided the words "certifiable" and "registerable." The ACVO does not serve as a registry organization. Registry organizations operate independently of the ACVO and set their own standards for registration. However, the OFA does follow the guidelines set forth by the ACVO Genetics Committee in this publication. Any registry organization may use the information in this compendium and results of examinations performed by ACVO Diplomates in the registering of animals with regard to breeding suitability as they see fit.

It is important to recognize that the sensitivity of genetic disorder detection is greater when large numbers of dogs are examined. The extensive number of disorders listed in this book for some breeds may reflect the popularity of the breed and the numbers of animals evaluated. Conversely, the lack of disorders listed for other breeds often reflects only the paucity of examinations reported for each breed. For these reasons, the ACVO Genetics Committee strongly recommends annual evaluations of dogs of all breeds as the imperative first step in the control of hereditary ocular disorders. We would like to acknowledge the contribution of the Orthopedic Foundation for Animals (OFA) and Canine Eye Registration Foundation (CERF) for providing statistical summaries of ophthalmic examinations from their files.

For each breed, specific ocular disorders have been listed which are known or suspected to be inherited based on one or more of the following criteria:

1) There are published reports in the scientific literature regarding a condition in a particular breed with evidence of inheritance.

2) The incidence of affected animals (from OFA and CERF reports) is greater than or equal to 1% of the examined population with a minimum of five affected animals per five year period. Regardless of the population of dogs examined, if 50 or more affected individuals are identified in a five year period, the entity will be listed for that breed.

3) A specific request from a breed club that a condition be included for their breed may be considered at the ACVO annual meeting of the Genetics Committee if information is received by August 1. Such requests are reviewed critically and must include specific documentation as to the disorder in question and the numbers seen. Further information from the breed club may be requested. The request must receive agreement by a majority of the committee.

4) There is overwhelming opinion by a majority of the Genetics Committee members that clinical experience by ACVO Diplomates would indicate a particular condition should be listed for a breed, in spite of the absence of direct evidence of affected animals on OFA or CERF reports.

5) Results of genetic laboratory research and genetic testing.

The "Breeding Advice" given is determined by the significance of the condition to vision and/or very strong evidence of heritability:

Two categories of advice regarding breeding have been established:

> **NO**: Substantial evidence exists to support the heritability of this entity AND/OR the entity represents a potential compromise of vision or other ocular function.
>
> **BREEDER OPTION**: Entity is suspected to be inherited but does not represent potential compromise of vision or other ocular function.

When the breeding advice is "**NO,**" even a minor clinical form of the entity would make this animal unsuitable for breeding. When the advice is "**BREEDER OPTION,**" caution is advised. In time, it may be appropriate to modify this stand to "**NO**" based on accumulated evidence. If, in time, it becomes apparent that there is insufficient evidence that an entity is inherited, it may be deleted from the list.

There are currently eleven disorders for which there is an unequivocal recommendation <u>against</u> breeding in all breeds:

These are conditions which frequently result in blindness and for which there is definite evidence of heritability in one or more breeds. However, these disorders will not be listed on the individual breed page for a given breed, unless they also meet the criteria described above.

- **Keratoconjunctivitis sicca (KCS)** – Breeding is not recommended for any animal demonstrating keratitis consistent with KCS. The prudent approach is to assume KCS to be hereditary except in cases suspected to be non-genetic in origin. See *note.
- **Glaucoma** – See *note.
- **Persistent Pupillary Membranes**
  - **Iris to Lens**
  - **Iris to Cornea**
  - **Iris Sheets**
- **Cataract** – Breeding is not recommended for any animal demonstrating partial or complete opacity of the lens or its capsule *unless the examiner has also checked the box for "suspect not inherited" or unless specified otherwise for the particular breed*. See *note.
- **Lens luxation or subluxation** – See *note.
- **Persistent hyperplastic primary vitreous (PHPV)/persistent hyperplastic tunica vasculosa lentis (PHTVL)** – See *note.
- **Retinal detachment** – See *note.
- **Retinal atrophy – generalized (PRA)** - Breeding is not advised for any animal demonstrating bilaterally symmetric retinal degeneration (considered to be PRA unless proven otherwise).
- **Retinal dysplasia, geographic or detached forms** – See *note.
- **Optic nerve coloboma**
- **Optic nerve hypoplasia**

*Note: The prudent approach of these disorders is to assume they are hereditary except in cases specifically known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, or nutritional deficiencies.

In breeds recognized with Persistent Pupillary Membrane (PPM) as an inherited problem there is an unequivocal recommendation against breeding when there is PPM iris to lens, or PPM iris to cornea, or iris sheets. Breeding advice is **"NO."**

The following breeds are recommended to have a preliminary examination prior to initial pharmacological dilation to best facilitate identification of these disorders:

Dalmatian – iris hypoplasia/sphincter dysplasia
Australian Shepherd – iris coloboma
Miniature American Shepherd/Miniature Australian Shepherd – iris coloboma
Toy Australian Shepherd – iris coloboma
Mastiff – persistent pupillary membrane
Basenji – persistent pupillary membrane
Pembroke Welsh Corgi – persistent pupillary membrane
Louisiana Catahoula Leopard Dog – iris coloboma/persistent pupillary membrane

What can be detected during an Eye Certification Examination?

A routine eye screening examination includes indirect ophthalmoscopy and slit lamp biomicroscopy following pharmacological dilation of the pupils. Gonioscopy, tonometry, Schirmer tear test, electroretinography, and ultrasonography are not routinely performed; thus, dogs with goniodysgenesis, glaucoma, keratoconjunctivitis sicca, or some early cases of progressive retinal atrophy might not be detected without further testing.

The diagnoses obtained during an ophthalmic eye certification examination refer only to the **phenotype** (clinical appearance) of an animal. Thus, it is possible for a clinically normal animal to be a carrier (abnormal **genotype**) of genetic abnormalities.

An individual ACVO Diplomate may disagree with the breeding advice contained in this compendium. It is appropriate for this examiner to contact the ACVO Genetics Committee to voice disagreement, initiate change, or suggest additions. The members of the Genetics Committee represent the ACVO but acknowledge that the information generated for a breed may not agree with the knowledge and clinical experience of every individual ACVO Diplomate.

What is the role of the responsible dog breeder?

The final beneficiary of the information in this book is the dog breeder. It is up to the conscientious breeder to use this information along with other criteria in selecting which animals to breed. To assist this determination, current certification is recommended. Animals currently free of heritable eye disease will be issued a certificate on receipt of the examination/application by OFA. To avoid confusion between a normal animal (no evidence of heritable eye disorders) and one that may have a minor fault coming under the advice of Breeder Option, the Breeder Option category will be printed on the certificate. This is intended to stimulate conversation as to the specific nature of the Breeder Option condition found in that particular animal, allowing breeders using a dog in a breeding program to make an informed decision.

There are many ocular conditions which are a direct result of selection for a facial conformation considered desirable by breeders.

These include:

- Entropion
- Ectropion
- Macroblepharon
- Exposure keratopathy syndrome

Facial conformation with excessively prominent eyes, heavy facial folds, or eyelids which are either inverted or everted predispose animals to corneal irritation, discomfort, and if left untreated, can lead to loss of vision. A responsible breeding program should recognize and select away from these exaggerated facial features.

Breeder Option Codes

A – Eyelids

A1 Entropion
A2 Ectropion
A3 Distichiasis
A4 Ectopic Cilia
A5 Macroblepharon

B – Nicitans

B1 Cartilage Anomaly/Eversion
B2 Gland Prolapse

C – Cornea

C1 Corneal Dystrophy – Epithelial/Stromal
C2 Corneal Dystrophy – Endothelial
C4 Exposure/Pigmentary Keratitis

D – Uvea

D1 Uveal Cyst
D2 Iris Coloboma
D3 Persistent Pupillary Membranes – Iris to Iris
D4 Iris Hypoplasia

E – Lens

E1 Cataract – Suspect Not Inherited
E2 Posterior Y Tip Suture Opacities

F – Vitreous

F1 Persistent Hyaloid Artery
F2a Vitreous Degeneration – Syneresis
F2b Vitreous Degeneration – Anterior Chamber

G – Fundus

G1 Retinal Dysplasia – Folds
G5 Micropapilla
G6 Retinopathy

Glossary of Terms

(For more detailed definitions, the reader is referred to medical and genetic scientific texts.)

Achromatopsia: see **Day blindness**

Canine multifocal retinopathy: characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). The condition includes numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina with accumulation of material that produces gray-tan-pink colored lesions (multifocal bullous retinal detachments). These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs and might not progress or progress slowly, or may appear to heal with discrete areas of tapetal hyper-reflectivity or hyperpigmentation. Most dogs exhibit no noticeable problem with vision despite their abnormal appearing retinas.

Cataract: any opacity of the lens and/or its capsule, regardless of size or location within the lens. Cataracts are assumed to be hereditary unless associated with known trauma, ocular inflammation, specific metabolic diseases, or nutritional deficiencies.

Ceroid lipofuscinosis: an inherited disease of man and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease.)

Choroidal hypoplasia: a congenital, inherited, non-progressive defect primarily affecting the choroid resulting in some or all of the following: decreased or lack of pigment in the retinal pigment epithelium or choroid, tapetal thinning, and reduced or abnormal choroidal blood vessels.

Chronic superficial keratitis (CSK): see **Pannus**

Collie eye anomaly: a congenital syndrome of ocular anomalies characterized by bilateral and often symmetrical defects including any combination of **choroidal hypoplasia**, **coloboma**, and **retinal detachment(s)**.

Coloboma: a congenital abnormality in ocular development usually characterized by focal absence of tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure.

Cone degeneration: the loss of photopic vision caused by selective degeneration of the cone photoreceptors. Also known as day blindness, hemeralopia, or achromatopsia.

Corneal degeneration: opacification of one or more of the corneal layers frequently resulting from deposition of lipid or mineral and occurring secondary to chronic inflammation.

Corneal dystrophy: non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers (**epithelium, stroma, endothelium**). The term dystrophy implies an inherited condition. It is usually bilateral although not necessarily symmetrical and the onset in one eye may precede the other.

> **Corneal dystrophy - endothelial:** breed-related loss or dysfunction of corneal endothelial cells resulting in bilateral, progressive corneal edema.
>
> **Corneal dystrophy - epithelial, stromal:** breed-related, non-inflammatory, white to silver-colored opacification of the corneal epithelium and/or stroma frequently resulting from deposition of lipid.

Day blindness: see **Cone degeneration**

Dermoid: a congenital, non-cancerous growth occurring on the cornea, conjunctiva, or eyelid typified by the presence of skin-like structures.

Distichiasis: the presence of abnormally oriented eyelashes, frequently protruding from Meibomian gland ductal openings.

Dry eye: see **Keratoconjunctivitis sicca**

Dysplasia: abnormality of development.

Dystrophy: non-inflammatory, developmental, nutritional, or metabolic abnormality; dystrophy implies a possible hereditary basis and is usually bilateral.

Ectopic cilia: aberrant hairs emerging through the palpebral conjunctiva which often causes ocular discomfort and corneal disease.

Ectropion: a conformational defect resulting in eversion of the eyelid margin, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several factors defining the skin and other structures, which make up the eyelids, orbital contents, and conformation of the skull.

Entropion: a conformational defect resulting in inversion of the eyelid margin which may cause ocular irritation. It is likely that entropion is influenced by several factors defining the skin and other structures, which make up the eyelids, orbital contents, and conformation of the skull.

Euryblepharon: an exceptionally long eyelid marginal length, which may lead to Ectropion or Entropion. Euryblepharon is synonymous with the term macropalpebral fissure.

Exposure/pigmentary keratitis: a condition characterized by variable degrees of superficial vascularization, fibrosis, and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos, and macropalpebral fissure.

Glaucoma: characterized by an elevation of intraocular pressure (IOP) which causes optic nerve and retinal degeneration and results in blindness. Diagnosis and classification of glaucoma requires tonometry and gonioscopy, which are not part of a routine eye certification examination.

Glaucoma, pigmentary: see O**cular melanosis**

Goniodysgenesis: congenital anomaly characterized by the persistence of a variably fenestrated sheet of uveal tissue spanning the iridocorneal angle, extending from the iris base to the peripheral cornea. Diagnosis is by gonioscopy, which is not part of a routine eye certification examination.

Hemeralopia: see **Cone degeneration**

Imperforate lacrimal punctum: developmental anomaly resulting in an imperforate opening of the lacrimal puncta. An imperforate lower punctum may result in epiphora, an overflow of tears onto the face.

Iridocorneal angle: the junction between the iris and the cornea; the drainage angle. Aqueous humor leaves the anterior chamber via the trabecular meshwork within the iridocorneal angle into the venous circulation.

Iris coloboma: a congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the eye certification form.

Iris cyst: see **Uveal cyst**

Iris hypoplasia: a congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the eye certification form.

Iris melanoma: see **Uveal melanoma**

Iris sphincter dysplasia: a congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue at the level of the iris sphincter, causing pupillary dilation. This abnormality has been noted in the Dalmatian breed.

Keratitis: inflammation of the cornea.

Keratitis, punctate: inflammation of the cornea accompanied by multifocal, coalescing areas of stromal corneal ulceration of variable depth.

Keratoconjunctivitis sicca (KCS): an abnormality of the tear film attributed to deficiency of the aqueous portion of the tears. Progressive KCS may result in ocular surface irritation and/or vision impairment via corneal opacification. Also called dry eye. The test for this condition is the Schirmer Tear Test, which is not part of a routine eye certification examination.

Lens subluxation/luxation: partial (subluxation) or complete displacement of the lens from the normal anatomic site. Lens luxation may result in elevated intraocular pressure (secondary glaucoma), causing vision impairment, pain, and/or retinal detachment.

Lenticonus: an anomaly of the lens in which the anterior or posterior surface protrudes in a conical form; usually congenital.

Macroblepharon: an exceptionally large palpebral fissure. Macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

Merle: an incompletely dominant phenotype in which heterozygous (M/m) dogs exhibit a coat color phenotype of various dilute color patches, while homozygous (M/M) dogs exhibit marked hypopigmentation and ocular defects, including microphthalmia, blindness and colobomas, and deafness. Deafness and ocular defects are sometimes seen in heterozygous individuals.

Micropapilla: a congenital anomaly which results in a small optic disk diameter without vision loss. Contrast with optic nerve hypoplasia, which may have a similar ophthalmoscopic appearance with vision loss.

Microphakia: a congenital anomaly in which there is an abnormally small lens.

Microphthalmos: a congenital anomaly in which the globe is abnormally small. Commonly associated with multiple ocular malformations and when severe, may affect vision.

Nictitans cartilage anomaly/eversion: a congenital anomaly in the nictitating membrane in which the T-shaped cartilage is malformed and/or folded.

Nictitans gland prolapse: protrusion of the tear-producing gland of the nictitating membrane from its normal position posterior to the nictitating membrane, to a position superior to the free margin of this structure.

Nodular granulomatous episclerokeratitis (NGE): an inflammatory disorder of the sclera and episclera, with occasional corneal involvement, characterized by granulomatous infiltrates. Previously known as **Proliferative keratoconjunctivitis**. This condition is most commonly seen in the Collie.

Nyctalopia: loss of scotopic (night) vision. Causes include genetic defects in photoreceptors and in retinal pigment epithelium, either dystrophy or degeneration of affected cells.

Ocular melanosis: progressive bilateral and sometimes asymetrical increase in pigmentation with melanocytic accumulation the uveal tract and adjacent tissues. Ultimately progresses to glaucoma and loss of vision in most cases (melanocytic glaucoma). Not associated with systemic disease or metastases. Most often recognized in Cairn Terriers.

Optic nerve coloboma: a congenital abnormality of the optic nerve commonly associated with failure of closure of the optic fissure, resulting in a defect in the optic nerve in the anterior-posterior plane. May result in partial or total vision loss.

Optic nerve hypoplasia: a congenital anomaly, which results in a small optic disk diameter and vision loss. Contrast with micropapilla, which may have a similar ophthalmoscopic appearance but without loss of vision.

Pannus: a bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the inferior or inferiotemporal cornea, followed by the formation of a vascularized subepithelial opacity that begins to spread toward the central cornea; pigmentation may follow the vascularization. If severe, vision impairment occurs. Plasma cell infiltration of the nictitans may occur in conjunction with CSK, or on its own. (Also called "CSK".)

Persistent hyaloid artery (PHA): congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

Persistent hyperplastic primary vitreous (PHPV): congenital defect resulting from abnormalities in the regression of the hyaloid artery (the primary vitreous) and the interaction of the blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with congenital cataracts and frequently seen with PHTVL.

Persistent hyperplastic tunica vasculosa lentis (PHTVL): congenital defect resulting from failure of regression of the embryonic vascular network which surrounds the developing lens. Often associated with PHPV and a patent hyaloid artery.

Persistent pupillary membranes (PPM): persistent blood vessel remnants in the anterior chamber which fail to regress normally by 3 months of age. These strands arise from the iris collaret and may bridge from iris to iris, iris to lens, iris to cornea, or form sheets of tissue in the anterior chamber.

Persistent tunica vasculosa lentis (PTVL): clinically insignificant posterior epicapsular lenticular opacities resulting from incomplete regression of the embryonic vascular network which surrounds the developing lens.

Pigmentary glaucoma: see **Ocular melanosis**

Pigmentary uveitis: see **Uveitis, pigmentary**

Pigmentary keratopathy: a condition reported in Pugs in which the cornea becomes pigmented, often resulting in vision impairment. Development of pigmentary keratopathy is associated with congenital uveal pathology – iris hypoplasia and the presence of persistent pupillary membranes – but not with other factors such as Schirmer tear test values or medial canthal entropion.

Plasmoma: see **Pannus**. Also called Atypical Pannus. Bilateral thickening and depigmentation of the nictitans due to invasion of lymphocytes and plasma cells. It may or may not be associated with corneal involvement (Pannus).

Progressive rod-cone degeneration (PRCD): see **PRA**

Typically refers to recessively inherited generalized loss of rod photoreceptors followed by cone degeneration. Many different genetic mutations result in a similar phenotypic presentation.

Progressive retinal atrophy (PRA): an umbrella term used to describe a group of inherited dysplastic, dystrophic, or degenerative diseases of the retinal visual cells (photoreceptors, retinal pigment epithelium, or both).

Proliferative keratoconjunctivitis: see **Nodular granulomatous episclerokeratitis**

Retinal atrophy: a non-specific term used to describe a decrease in the number and deterioration of the cells of the retina, regardless of cause.

Retinal degeneration: see **Retinal atrophy**

Retinal detachment: a separation of the neurosensory retina from the retinal pigment epithelium.

Retinal dysplasia: abnormal development of the retina present at birth. This condition is non-progressive and recognized in 3 forms: **folds**, **geographic**, **detached**.

Retinal dysplasia – folds: seen ophthalmoscopically as linear, triangular, curved or curvilinear foci of retinal folding. May be single or multiple. In puppies, retinal folds can be seen as a transient phenomenon, resolving as the eye retains maturity.

Retinal dysplasia – geographic: an irregularly shaped area of retinal development containing both areas of thinning and areas of elevation. This form may be associated with visual impairment.

Retinal dysplasia – detached: severe retinal disorganization associated with separation of the neurosensory retina from the retinal pigmented epithelium. This form results in visual impairment.

Retinopathy: any non-inflammatory condition of the retina. These conditions can usually be detected by ophthalmoscopic examination, but an electroretinogram (ERG) may be required in some instances (e.g. canine multifocal retinopathy).

Rod-cone dysplasia: an inherited retinal disease characterized by abortive or abnormal development of rods and cones. Affected animals become blind early in life, usually within the first 6 months, with the exception of *rcd4* in the Gordon and Irish Setter dogs. See specific breed pages for rod-cone dysplasia type descriptions.

Rod dysplasia: abnormal development of the visual cells resulting in vision impairment in dim light by 6 months and total blindness at 3-5 years.

Uveal cyst: a pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions in various breeds.

> **Uveal cyst, anterior chamber:** a pigmented, fluid-filled, epithelial-lined structure arising from the posterior iris or ciliary body epithelium which has detached from its site of origin and is free-floating in the anterior chamber.
>
> **Uveal cyst, ciliary body:** a pigmented, fluid-filled, epithelial-lined structure arising from the ciliary body epithelium and attached to the ciliary body.
>
> **Uveal cyst, iris:** a pigmented, fluid-filled, epithelial-lined structure arising from the posterior iris epithelium and attached to the iris.

Uveal melanoma: a locally invasive melanocytic neoplasm arising within the uveal tract, may be benign (melanocytoma) or malignant (malignant melanoma). Uveal melanomas are reported in higher frequency in German Shepherd Dogs and Labrador Retrievers. Inherited iris melanoma has been reported in Labrador Retrievers.

Uveitis, pigmentary: a specific form of uveitis most commonly seen in middle-aged to older Golden Retrievers. Clinically manifests early as pigment deposition in a radial fashion on the anterior lens capsule with iridociliary cysts. Later stages are associated with posterior synechia, fibrinous anterior uveitis, cataract, and ultimately glaucoma. Not associated with systemic disease; may be asymmetric in presentation.

Uveodermatologic syndrome: an immune-mediated syndrome of anterior uveitis, chorioretinitis, dermal depigmentation (vitiligo), and hair depigmentation (poliosis). A similar syndrome in humans, called Vogt-Koyanagi-Harada syndrome (VKH), is an autoimmune disease directed against melanocytes. Secondary glaucoma and/or retinal detachment are frequent complications of this disease. Seen most commonly in the Akita, Samoyed, and Siberian Husky breeds.

Vitreous degeneration: Liquefaction of the vitreous gel which may predispose to retinal detachment resulting in blindness.

Breeds Not Listed for Insufficient Data

Attempts have been made to confirm information on the following list of breeds/rare breeds. This list is not an endorsement of the breed status and may change from time to time as additional information is available.

To date there are no published reports of inherited ocular conditions in these breeds and/or the numbers of individuals for which examinations are recorded are too low to identify the presence of significant ocular disorders. Examinations are encouraged to accumulate information and reduce the likelihood of undetected conditions becoming problematic.

American Bandogge Mastiff
American Bully
American English Coonhound
American Foxhound
American Husky
Anatolian Shepherd
Azawakh
Bavarian Mountain Scent Hound
Bergamasco
Blue Lacy
Bluetick Coonhound
Braque d'Auvergne
Braque du Bourbonnais
Braque Francais Pyrenees
Caucasian Ovcharka
Central Asian Shepherd
Chart Polski
Cirneco Dell'Etna
Czechoslovakian Vlcak
Danish Swedish Farmhound
Drentsch Partrijshond
Drever
English Cockapoo
English Coonhound
English Foxhound
Epagneul Breton
Estrela Mountain Dog
Fila Brasileiro
French Spaniel
German Longhaired Pointer
Hovawart
Japanese Akita
Jindo
Kai Ken
Kishu Ken
Kromforhlander
Kyi Leo
Large Munsterlander
New Zealand Huntaway
North American Shepherd
Otterhound
Peruvian Inca Orchid
Plott
Polish Tatra Sheepdog
Porcelaine Hound
Portuguese Podengo
Portuguese Pointer
Pudelpointer
Pumi
Pyrenean Mastiff
Redbone Coonhound
Russian Toy
Scottish Deerhound
Shikoku
Skye Terrier
Small Munsterlander
Spanish Greyhound
Spanish Mastiff
Stabyhoun
Tamaskan
Treeing Walker Coonhound
Wachtelhund
Welsh Sheepdog
White Shepherd

AFFENPINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	3	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Affenpinscher breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

2. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2009.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
AFFENPINSCHER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 52 #	 %	2000-2009 155 #	 %	2010-2016 180 #	 %
GLOBE							
0.110	microphthalmia	1	1.9%	0		0	
EYELIDS							
20.140	ectopic cilia	0		0		1	0.6%
25.110	distichiasis	4	7.7%	9	5.8%	8	4.4%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		1	0.6%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		1	0.6%
CORNEA							
70.700	corneal dystrophy	1	1.9%	1	0.6%	4	2.2%
UVEA							
93.710	persistent pupillary membranes, iris to iris	2	3.8%	7	4.5%	18	10.0%
93.730	persistent pupillary membranes, iris to cornea	0		0		1	0.6%
93.740	persistent pupillary membranes, iris sheets	0		1	0.6%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		4	2.2%
LENS							
100.200	cataract, unspecified	3	5.8%	0		0	
100.210	cataract, suspect not inherited	1	1.9%	4	2.6%	3	1.7%
100.302	punctate cataract, posterior cortex	1	1.9%	0		0	
100.311	incipient cataract, anterior cortex	0		1	0.6%	0	
100.312	incipient cataract, posterior cortex	2	3.8%	1	0.6%	0	
100.316	incipient cataract, nucleus	0		0		1	0.6%
100.330	generalized/complete cataract	2	3.8%	1	0.6%	0	
100.999	*significant cataracts (summary)*	*8*	*15.4%*	*3*	*1.9%*	*1*	*0.6%*
VITREOUS							
110.320	vitreal degeneration	0		1	0.6%	4	2.2%
RETINA							
120.170	retinal dysplasia, folds	0		2	1.3%	0	
OPTIC NERVE							
130.120	optic nerve hypoplasia	0		0		1	0.6%
OTHER							
900.000	other, unspecified	0		2	1.3%	1	0.6%
900.100	other, not inherited	1	1.9%	7	4.5%	0	
900.110	other, suspected as inherited	1	1.9%	0		0	
NORMAL							
0.000	normal globe	41	78.8%	137	88.4%	148	82.2%

OCULAR DISORDERS REPORT

AFGHAN HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2, 3	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
D.	Cataract	Not defined	2, 4-7	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The characteristic cataract in the Afghan Hound begins as equatorial lens vacuoles in dogs from 4 months to 2 years of age. The opacities then extend into the anterior and posterior cortices. Rapid progression can occur with visual impairment in young adults. Test breedings have been done which support a hereditary basis; however, the exact mode of inheritance is unknown.

References

1. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. Vainisi SJ, Goldberg MF. *Animal models of inherited disease. In: Genetic and Metabolic Eye Disease* Little Brown and Company, Boston, 1974.

4. Roberts SR, Helper LC. Cataracts in Afghan hounds. *J Am Vet Med Assoc*. 1972; 160: 427.

5. Roberts SR. Hereditary cataracts. *Vet Clin North Am*. 1973; 3: 433.

6. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985; 26: 305.

7. Barnett KC. Hereditary cataract in the dog. *J Small Anim Pract*. 1978; 19: 109-120.

OCULAR DISORDERS REPORT
AFGHAN HOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 800 #	%	2000-2009 778 #	%	2010-2016 674 #	%
GLOBE								
0.110	microphthalmia		0		0		1	0.1%
10.000	glaucoma		1	0.1%	1	0.1%	0	
EYELIDS								
21.000	entropion, unspecified		2	0.2%	0		0	
25.110	distichiasis		12	1.5%	6	0.8%	8	1.2%
NASOLACRIMAL								
32.110	imperforate lower nasolacrimal punctum		0		0		1	0.1%
40.910	keratoconjunctivitis sicca		0		0		1	0.1%
NICTITANS								
51.100	third eyelid cartilage anomaly		0		0		1	0.1%
CORNEA								
70.210	corneal pannus		2	0.2%	0		1	0.1%
70.700	corneal dystrophy		75	9.4%	85	10.9%	80	11.9%
70.730	corneal endothelial degeneration		0		1	0.1%	2	0.3%
UVEA								
93.710	persistent pupillary membranes, iris to iris		10	1.2%	29	3.7%	24	3.6%
93.720	persistent pupillary membranes, iris to lens		0		1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		1	0.1%	0		0	
93.740	persistent pupillary membranes, iris sheets		1	0.1%	1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		1	0.1%
93.999	uveal cysts		0		4	0.5%	0	
LENS								
100.200	cataract, unspecified		9	1.1%	0		0	
100.210	cataract, suspect not inherited		35	4.4%	44	5.7%	52	7.7%
100.301	punctate cataract, anterior cortex		0		0		1	0.1%
100.302	punctate cataract, posterior cortex		1	0.1%	0		1	0.1%
100.303	punctate cataract, equatorial cortex		0		1	0.1%	0	
100.305	punctate cataract, posterior sutures		3	0.4%	2	0.3%	3	0.4%
100.306	punctate cataract, nucleus		0		0		1	0.1%
100.307	punctate cataract, capsular		0		3	0.4%	0	
100.311	incipient cataract, anterior cortex		1	0.1%	3	0.4%	0	
100.312	incipient cataract, posterior cortex		0		1	0.1%	2	0.3%
100.313	incipient cataract, equatorial cortex		0		1	0.1%	1	0.1%
100.314	incipient cataract, anterior sutures		1	0.1%	1	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures		5	0.6%	4	0.5%	3	0.4%
100.316	incipient cataract, nucleus		2	0.2%	1	0.1%	0	
100.317	incipient cataract, capsular		0		1	0.1%	2	0.3%
100.321	incomplete cataract, anterior cortex		0		0		2	0.3%
100.322	incomplete cataract, posterior cortex		0		0		2	0.3%
100.323	incomplete cataract, equatorial cortex		0		0		1	0.1%
100.324	incomplete cataract, anterior sutures		0		0		1	0.1%
100.325	incomplete cataract, posterior sutures		0		0		1	0.1%
100.326	incomplete cataract, nucleus		0		0		2	0.3%

OCULAR DISORDERS REPORT
AFGHAN HOUND

LENS CONTINUED	1991-1999		2000-2009		2010-2016	
100.330 generalized/complete cataract	1	0.1%	1	0.1%	0	
100.375 subluxation/luxation, unspecified	0		1	0.1%	0	
100.999 significant cataracts (summary)	*23*	*2.9%*	*19*	*2.4%*	*24*	*3.6%*
VITREOUS						
110.120 persistent hyaloid artery/remnant	0		0		1	0.1%
110.135 PHPV/PTVL	0		1	0.1%	0	
110.320 vitreal degeneration	1	0.1%	4	0.5%	8	1.2%
FUNDUS						
97.120 coloboma	1	0.1%	1	0.1%	0	
RETINA						
120.170 retinal dysplasia, folds	0		4	0.5%	2	0.3%
120.180 retinal dysplasia, geographic	0		0		2	0.3%
120.310 generalized progressive retinal atrophy (PRA)	4	0.5%	2	0.3%	3	0.4%
120.960 retinopathy	0		0		3	0.4%
OPTIC NERVE						
130.150 optic disc coloboma	0		3	0.4%	0	
OTHER						
900.000 other, unspecified	0		5	0.6%	15	2.2%
900.100 other, not inherited	4	0.5%	30	3.9%	12	1.8%
900.110 other, suspected as inherited	9	1.1%	2	0.3%	0	
NORMAL						
0.000 normal globe	647	80.9%	623	80.1%	514	76.3%

AIREDALE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder option
	- iris to cornea	Not defined	2	NO
D.	Cataract	Not defined	2	NO
E.	Vitreous degeneration	Not defined	3	Breeder option
F.	Retinal dysplasia - folds	Not defined	4	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal Dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and the more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Airedale Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2014 and/or Data from OFA/CERF All-Breeds Report, 2013.

4. ACVO Genetics Committee 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
AIREDALE TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 317 #	%	2000-2009 305 #	%	2010-2016 168 #	%
GLOBE								
0.110	microphthalmia		3	0.9%	0		0	
EYELIDS								
20.140	ectopic cilia		2	0.6%	0		0	
21.000	entropion, unspecified		1	0.3%	3	1.0%	0	
25.110	distichiasis		19	6.0%	22	7.2%	13	7.7%
CORNEA								
70.210	corneal pannus		1	0.3%	0		0	
70.700	corneal dystrophy		7	2.2%	1	0.3%	1	0.6%
70.730	corneal endothelial degeneration		3	0.9%	0		0	
UVEA								
93.710	persistent pupillary membranes, iris to iris		9	2.8%	9	3.0%	7	4.2%
93.720	persistent pupillary membranes, iris to lens		3	0.9%	4	1.3%	0	
93.730	persistent pupillary membranes, iris to cornea		14	4.4%	3	1.0%	4	2.4%
93.740	persistent pupillary membranes, iris sheets		2	0.6%	0		0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		4	2.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		3	1.8%
93.999	uveal cysts		0		1	0.3%	0	
LENS								
100.200	cataract, unspecified		7	2.2%	0		0	
100.210	cataract, suspect not inherited		10	3.2%	30	9.8%	11	6.5%
100.301	punctate cataract, anterior cortex		4	1.3%	1	0.3%	2	1.2%
100.302	punctate cataract, posterior cortex		2	0.6%	3	1.0%	1	0.6%
100.303	punctate cataract, equatorial cortex		2	0.6%	0		0	
100.304	punctate cataract, anterior sutures		0		0		1	0.6%
100.305	punctate cataract, posterior sutures		2	0.6%	1	0.3%	2	1.2%
100.306	punctate cataract, nucleus		0		0		1	0.6%
100.307	punctate cataract, capsular		1	0.3%	0		0	
100.311	incipient cataract, anterior cortex		3	0.9%	5	1.6%	1	0.6%
100.312	incipient cataract, posterior cortex		5	1.6%	4	1.3%	0	
100.313	incipient cataract, equatorial cortex		2	0.6%	3	1.0%	1	0.6%
100.315	incipient cataract, posterior sutures		2	0.6%	1	0.3%	1	0.6%
100.316	incipient cataract, nucleus		0		2	0.7%	0	
100.317	incipient cataract, capsular		0		1	0.3%	2	1.2%
100.330	generalized/complete cataract		4	1.3%	0		0	
100.999	*significant cataracts (summary)*		*34*	*10.7%*	*21*	*6.9%*	*12*	*7.1%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		3	0.9%	0		0	
110.135	PHPV/PTVL		1	0.3%	0		0	
110.320	vitreal degeneration		0		2	0.7%	5	3.0%
FUNDUS								
97.120	coloboma		1	0.3%	0		0	

OCULAR DISORDERS REPORT
AIREDALE TERRIER

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	8	2.5%	8	2.6%	5	3.0%
120.180	retinal dysplasia, geographic	4	1.3%	1	0.3%	4	2.4%
120.310	generalized progressive retinal atrophy (PRA)	9	2.8%	2	0.7%	1	0.6%
120.910	retinal detachment without dialysis	1	0.3%	0		0	
OTHER							
900.000	other, unspecified	0		2	0.7%	6	3.6%
900.100	other, not inherited	5	1.6%	30	9.8%	7	4.2%
900.110	other, suspected as inherited	2	0.6%	3	1.0%	0	
NORMAL							
0.000	normal globe	226	71.3%	231	75.7%	125	74.4%

OCULAR DISORDERS REPORT

AKBASH DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Akbash breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
AKBASH DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 25 #	%	2000-2009 11 #	%	2010-2016 3 #	%
GLOBE							
0.110	microphthalmia	1	4.0%	0		0	
EYELIDS							
21.000	entropion, unspecified	3	12.0%	0		0	
22.000	ectropion, unspecified	0		1	9.1%	0	
UVEA							
93.999	uveal cysts	1	4.0%	1	9.1%	0	
LENS							
100.210	cataract, suspect not inherited	2	8.0%	0		0	
100.303	punctate cataract, equatorial cortex	1	4.0%	0		0	
100.316	incipient cataract, nucleus	1	4.0%	0		0	
100.330	generalized/complete cataract	1	4.0%	0		0	
100.999	*significant cataracts (summary)*	*3*	*12.0%*	*0*		*0*	
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	4.0%	0		0	
NORMAL							
0.000	normal globe	19	76.0%	10	90.9%	3	100.0%

AKITA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1, 2	NO
B.	Entropion	Not defined	1, 3	Breeder option
C.	Distichiasis	Not defined	4	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
E.	Cataract	Not defined	1	NO
F.	Retinal atrophy - generalized	Not defined	1, 5	NO
G.	Retinal dysplasia - folds	Not defined	1	Breeder option
H.	Strabismus	Not defined	6	NO
I.	Uveodermatologic syndrome	Not defined	1, 7-15	NO

Description and Comments

A. Microphthalmia with multiple ocular defects

Multiple ocular defects consisting of small eye (microphthalmia), opacity of the lens (cataract), conical shape of the posterior lens (posterior lenticonus), and folding of the retina into rosettes (retinal dysplasia) have been reported in related Akita pups. Cataracts affected primarily the nuclear and cortical lens. Retinal dysplasia affected the superior retina overlying the tapetal fundus. Affected dogs may have severe visual dysfunction. An autosomal recessive mode of inheritance is suspected but not proven.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. OFA/CERF data indicates that entropion in the Akita usually occurs by 2 years of age.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make strong recommendations with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Akita, many of these strands bridge between the iris and lens, thus resulting in focal cataract and possible vision impairment.

E. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

The age of onset has been reported to be between 2 and 3 years of age with initial loss of night vision progressing to complete blindness.

G. Retinal Dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and the more severe forms of retinal dysplasia is undetermined.

H. Strabismus

Strabismus is characterized as the deviation of one or both eyes from the normal position; the eyes may turn in, out, up or down. In the Akita, a severe unilateral or bilateral ventral (down) or ventromedial (down and in) strabismus has been described with resulting vision loss. The strabismus was caused by restrictive fibrosis (scarring) of the extraocular muscles (the muscles that rotate the eye in different directions), possibly due to chronic inflammation (extraocular myositis).

I. Uveodermatologic syndrome

Uveodermatologic syndrome in the Akita bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. The genetics of this condition are unclear, but some genetic predisposition is indicated by the higher prevalence of this disorder in Akitas compared with other dog breeds. Affected dogs are generally young, ranging in age between 1 ½ to 4 years.

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OCULAR DISORDERS REPORT
AKITA

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 5124 #	%	2000-2009 4138 #	%	2010-2016 1721 #	%
GLOBE							
0.110	microphthalmia	20	0.4%	10	0.2%	4	0.2%
10.000	glaucoma	2	0.0%	0		0	
EYELIDS							
21.000	entropion, unspecified	58	1.1%	40	1.0%	7	0.4%
22.000	ectropion, unspecified	9	0.2%	4	0.1%	2	0.1%
25.110	distichiasis	23	0.4%	24	0.6%	23	1.3%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	6	0.1%	0		0	
NICTITANS							
51.100	third eyelid cartilage anomaly	3	0.1%	3	0.1%	1	0.1%
CORNEA							
70.700	corneal dystrophy	25	0.5%	22	0.5%	7	0.4%
UVEA							
93.150	iris coloboma	1	0.0%	0		0	
93.710	persistent pupillary membranes, iris to iris	110	2.1%	106	2.6%	58	3.4%
93.720	persistent pupillary membranes, iris to lens	22	0.4%	12	0.3%	3	0.2%
93.730	persistent pupillary membranes, iris to cornea	10	0.2%	10	0.2%	4	0.2%
93.740	persistent pupillary membranes, iris sheets	2	0.0%	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		10	0.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		2	0.1%
93.999	uveal cysts	0		1	0.0%	0	
LENS							
100.200	cataract, unspecified	28	0.5%	0		0	
100.210	cataract, suspect not inherited	72	1.4%	123	3.0%	54	3.1%
100.301	punctate cataract, anterior cortex	5	0.1%	1	0.0%	0	
100.302	punctate cataract, posterior cortex	4	0.1%	2	0.0%	1	0.1%
100.303	punctate cataract, equatorial cortex	2	0.0%	2	0.0%	0	
100.304	punctate cataract, anterior sutures	0		1	0.0%	2	0.1%
100.305	punctate cataract, posterior sutures	16	0.3%	9	0.2%	11	0.6%
100.306	punctate cataract, nucleus	2	0.0%	0		0	
100.307	punctate cataract, capsular	0		4	0.1%	1	0.1%
100.311	incipient cataract, anterior cortex	8	0.2%	1	0.0%	1	0.1%
100.312	incipient cataract, posterior cortex	22	0.4%	12	0.3%	4	0.2%
100.313	incipient cataract, equatorial cortex	5	0.1%	2	0.0%	1	0.1%
100.314	incipient cataract, anterior sutures	2	0.0%	0		0	
100.315	incipient cataract, posterior sutures	7	0.1%	7	0.2%	4	0.2%
100.316	incipient cataract, nucleus	5	0.1%	1	0.0%	0	
100.317	incipient cataract, capsular	2	0.0%	3	0.1%	4	0.2%
100.322	incomplete cataract, posterior cortex	0		0		1	0.1%
100.330	generalized/complete cataract	20	0.4%	3	0.1%	3	0.2%
100.375	subluxation/luxation, unspecified	1	0.0%	0		0	
100.999	*significant cataracts (summary)*	*128*	*2.5%*	*48*	*1.2%*	*33*	*1.9%*

OCULAR DISORDERS REPORT
AKITA

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	9	0.2%	3	0.1%	5	0.3%
110.135	PHPV/PTVL	4	0.1%	1	0.0%	0	
110.320	vitreal degeneration	2	0.0%	5	0.1%	3	0.2%
RETINA							
120.170	retinal dysplasia, folds	103	2.0%	77	1.9%	25	1.5%
120.180	retinal dysplasia, geographic	11	0.2%	10	0.2%	1	0.1%
120.190	retinal dysplasia, detached	2	0.0%	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	64	1.2%	21	0.5%	5	0.3%
120.910	retinal detachment without dialysis	5	0.1%	1	0.0%	0	
120.920	retinal detachment with dialysis	0		0		1	0.1%
OPTIC NERVE							
130.120	optic nerve hypoplasia	3	0.1%	3	0.1%	2	0.1%
130.150	optic disc coloboma	2	0.0%	0		0	
OTHER							
900.000	other, unspecified	0		11	0.3%	41	2.4%
900.100	other, not inherited	13	0.3%	161	3.9%	36	2.1%
900.110	other, suspected as inherited	54	1.1%	12	0.3%	6	0.3%
NORMAL							
0.000	normal globe	4550	88.8%	3740	90.4%	1501	87.2%

OCULAR DISORDERS REPORT

ALASKAN KLEE KAI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	3	Breeder option
	- iris sheets	Not defined	4, 5	NO
D.	Cataract	Not defined	6	NO
E.	Vitreous degeneration	Not defined	2	Breeder Option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Alaskan Klee Kai breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2010.

2. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

3. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

4. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

5. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
ALASKAN KLEE KAI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 26 #	%	2000-2009 184 #	%	2010-2016 454 #	%
EYELIDS								
25.110	distichiasis		1	3.8%	9	4.9%	39	8.6%
NASOLACRIMAL								
32.110	imperforate lower nasolacrimal punctum		0		0		2	0.4%
CORNEA								
70.220	pigmentary keratitis		0		0		2	0.4%
70.700	corneal dystrophy		0		4	2.2%	7	1.5%
70.730	corneal endothelial degeneration		0		0		2	0.4%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		1	0.5%	6	1.3%
93.730	persistent pupillary membranes, iris to cornea		0		1	0.5%	0	
93.740	persistent pupillary membranes, iris sheets		0		5	2.7%	0	
LENS								
100.210	cataract, suspect not inherited		1	3.8%	5	2.7%	6	1.3%
100.307	punctate cataract, capsular		0		0		1	0.2%
100.311	incipient cataract, anterior cortex		0		4	2.2%	3	0.7%
100.312	incipient cataract, posterior cortex		0		1	0.5%	0	
100.999	*significant cataracts (summary)*		*0*		*5*	*2.7%*	*4*	*0.9%*
VITREOUS								
110.320	vitreal degeneration		0		1	0.5%	8	1.8%
RETINA								
120.170	retinal dysplasia, folds		1	3.8%	3	1.6%	1	0.2%
OTHER								
900.000	other, unspecified		0		2	1.1%	4	0.9%
900.100	other, not inherited		1	3.8%	3	1.6%	9	2.0%
NORMAL								
0.000	normal globe		24	92.3%	168	91.3%	388	85.5%

OCULAR DISORDERS REPORT

ALASKAN MALAMUTE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1,2	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
D.	Cataract	Not defined	1	NO
E.	Cone degeneration - day blindness * a DNA test is available	Autosomal recessive	1,3-9	NO

Descriptions and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma require measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day-blindness, color blindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a deletion in the *CNGB3* gene. A DNA test is available.

References

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OCULAR DISORDERS REPORT
ALASKAN MALAMUTE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 3490 #	%	2000-2009 3591 #	%	2010-2016 1907 #	%
GLOBE							
0.110	microphthalmia	0		1	0.0%	1	0.1%
10.000	glaucoma	1	0.0%	1	0.0%	0	
EYELIDS							
20.140	ectopic cilia	1	0.0%	0		0	
21.000	entropion, unspecified	1	0.0%	4	0.1%	0	
22.000	ectropion, unspecified	1	0.0%	0		0	
25.110	distichiasis	66	1.9%	80	2.2%	54	2.8%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	2	0.1%	0		0	
NICTITANS							
51.100	third eyelid cartilage anomaly	0		1	0.0%	0	
52.110	prolapsed gland of the third eyelid	0		0		1	0.1%
CORNEA							
70.220	pigmentary keratitis	0		0		1	0.1%
70.700	corneal dystrophy	29	0.8%	32	0.9%	14	0.7%
UVEA							
93.140	corneal endothelial pigment without PPM	0		0		1	0.1%
93.150	iris coloboma	0		3	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	133	3.8%	306	8.5%	138	7.2%
93.720	persistent pupillary membranes, iris to lens	7	0.2%	26	0.7%	6	0.3%
93.730	persistent pupillary membranes, iris to cornea	3	0.1%	6	0.2%	3	0.2%
93.740	persistent pupillary membranes, iris sheets	2	0.1%	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		9	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		4	0.2%
93.810	uveal melanoma	0		1	0.0%	1	0.1%
93.999	uveal cysts	3	0.1%	3	0.1%	0	
LENS							
100.200	cataract, unspecified	125	3.6%	0		0	
100.210	cataract, suspect not inherited	95	2.7%	163	4.5%	102	5.3%
100.301	punctate cataract, anterior cortex	10	0.3%	8	0.2%	3	0.2%
100.302	punctate cataract, posterior cortex	87	2.5%	37	1.0%	16	0.8%
100.303	punctate cataract, equatorial cortex	6	0.2%	7	0.2%	2	0.1%
100.304	punctate cataract, anterior sutures	5	0.1%	10	0.3%	2	0.1%
100.305	punctate cataract, posterior sutures	29	0.8%	29	0.8%	6	0.3%
100.306	punctate cataract, nucleus	3	0.1%	2	0.1%	6	0.3%
100.307	punctate cataract, capsular	1	0.0%	22	0.6%	5	0.3%
100.311	incipient cataract, anterior cortex	8	0.2%	15	0.4%	5	0.3%
100.312	incipient cataract, posterior cortex	148	4.2%	146	4.1%	62	3.3%
100.313	incipient cataract, equatorial cortex	14	0.4%	17	0.5%	9	0.5%
100.314	incipient cataract, anterior sutures	4	0.1%	3	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures	30	0.9%	33	0.9%	17	0.9%
100.316	incipient cataract, nucleus	8	0.2%	9	0.3%	3	0.2%
100.317	incipient cataract, capsular	3	0.1%	26	0.7%	11	0.6%

OCULAR DISORDERS REPORT
ALASKAN MALAMUTE

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.321	incomplete cataract, anterior cortex	0		0		3	0.2%
100.322	incomplete cataract, posterior cortex	0		0		17	0.9%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.1%
100.324	incomplete cataract, anterior sutures	0		0		1	0.1%
100.325	incomplete cataract, posterior sutures	0		0		3	0.2%
100.326	incomplete cataract, nucleus	0		0		3	0.2%
100.327	incomplete cataract, capsular	0		0		1	0.1%
100.330	generalized/complete cataract	43	1.2%	36	1.0%	2	0.1%
100.375	subluxation/luxation, unspecified	3	0.1%	3	0.1%	1	0.1%
100.999	*significant cataracts (summary)*	*524*	*15.0%*	*400*	*11.1%*	*179*	*9.4%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	4	0.1%	5	0.1%	1	0.1%
110.135	PHPV/PTVL	5	0.1%	1	0.0%	0	
110.320	vitreal degeneration	3	0.1%	9	0.3%	1	0.1%
FUNDUS							
97.110	choroidal hypoplasia	0		2	0.1%	1	0.1%
97.120	coloboma	1	0.0%	0		0	
RETINA							
120.170	retinal dysplasia, folds	22	0.6%	32	0.9%	6	0.3%
120.180	retinal dysplasia, geographic	10	0.3%	7	0.2%	2	0.1%
120.190	retinal dysplasia, detached	1	0.0%	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	6	0.2%	9	0.3%	2	0.1%
120.400	retinal hemorrhage	2	0.1%	0		0	
120.910	retinal detachment without dialysis	2	0.1%	6	0.2%	2	0.1%
120.960	retinopathy	0		0		1	0.1%
OPTIC NERVE							
130.110	micropapilla	0		2	0.1%	1	0.1%
130.120	optic nerve hypoplasia	5	0.1%	3	0.1%	1	0.1%
130.150	optic disc coloboma	1	0.0%	1	0.0%	0	
OTHER							
900.000	other, unspecified	0		16	0.4%	59	3.1%
900.100	other, not inherited	9	0.3%	246	6.9%	69	3.6%
900.110	other, suspected as inherited	33	0.9%	17	0.5%	2	0.1%
NORMAL							
0.000	normal globe	2760	79.1%	2850	79.4%	1460	76.6%

ALASKAN NOBLE COMPANION DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Alaskan Noble Companion Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
ALASKAN NOBLE COMPANION DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 # %	2000-2009 3 # %	2010-2016 64 # %
UVEA				
93.710	persistent pupillary membranes, iris to iris	0	0	5 7.8%
RETINA				
120.170	retinal dysplasia, folds	0	0	1 1.6%
NORMAL				
0.000	normal globe	0	3 100.0%	60 93.8%

AMERICAN BULLDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1	NO
B.	Entropion	Not defined	2	Breeder option
C.	Distichiasis	Not defined	3	Breeder option
D.	Multifocal retinopathy - cmr1 * a DNA test is available	Autosomal recessive	4	NO

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

American Bulldogs with glaucoma were reported to have uveal cysts (evident on ophthalmic exam, ultrasound biomicroscopy and/or histopathology), goniodysgenesis, and anterior segment inflammation. Consistent clinical findings among reported individuals included an absent menace response, diminished to absent light perception, mydriasis, and elevated intraocular pressures.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Multifocal retinopathy

Canine Multi-focal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas. A DNA test is available.

Canine Multi-focal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

References

1. Pumphrey SA, Pizzirani S, Pirie CG, et al. Glaucoma associated with uveal cysts and goniodysgenesis in American Bulldogs: a case series. *Vet Ophthalmol*. 2012:1-9.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

3. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

4. Guziewicz KE, Zangerl B, Lindauer SJ, et al. Bestrophin gene mutations cause canine multifocal retinopathy: a novel animal model for best disease. *Invest Ophthalmol Vis Sci.* 2007 May;48:1959-1967.

OCULAR DISORDERS REPORT
AMERICAN BULLDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 35 #	%	2010-2016 104 #	%
EYELIDS							
20.160	macropalpebral fissure	0		0		3	2.9%
21.000	entropion, unspecified	0		3	8.6%	6	5.8%
22.000	ectropion, unspecified	0		0		2	1.9%
25.110	distichiasis	0		10	28.6%	21	20.2%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		4	3.8%
CORNEA							
70.220	pigmentary keratitis	0		1	2.9%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		4	3.8%
93.730	persistent pupillary membranes, iris to cornea	0		0		1	1.0%
93.999	uveal cysts	0		0		1	1.0%
LENS							
100.210	cataract, suspect not inherited	0		0		2	1.9%
RETINA							
120.170	retinal dysplasia, folds	0		0		3	2.9%
OTHER							
900.000	other, unspecified	0		8	22.9%	8	7.7%
900.100	other, not inherited	0		0		1	1.0%
NORMAL							
0.000	normal globe	0		24	68.6%	74	71.2%

AMERICAN ESKIMO DOG

(all varieties)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO
B.	Lens luxation * a DNA test is available	Not defined	2	NO
C.	Retinal atrophy - generalized *(prcd)* * a DNA test is available	Autosomal recessive	3	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

C. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the American Eskimo is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at

least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

3. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

OCULAR DISORDERS REPORT
AMERICAN ESKIMO DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 990 #	 %	2000-2009 1199 #	 %	2010-2016 272 #	 %
EYELIDS							
21.000	entropion, unspecified	4	0.4%	0		0	
25.110	distichiasis	9	0.9%	5	0.4%	4	1.5%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.1%	0		0	
CORNEA							
70.700	corneal dystrophy	4	0.4%	4	0.3%	1	0.4%
70.730	corneal endothelial degeneration	1	0.1%	3	0.3%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	8	0.8%	10	0.8%	3	1.1%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	0		0	
93.730	persistent pupillary membranes, iris to cornea	3	0.3%	1	0.1%	1	0.4%
93.740	persistent pupillary membranes, iris sheets	4	0.4%	0		0	
93.999	uveal cysts	1	0.1%	1	0.1%	2	0.7%
LENS							
100.200	cataract, unspecified	3	0.3%	0		0	
100.210	cataract, suspect not inherited	35	3.5%	74	6.2%	30	11.0%
100.301	punctate cataract, anterior cortex	8	0.8%	12	1.0%	4	1.5%
100.302	punctate cataract, posterior cortex	2	0.2%	4	0.3%	3	1.1%
100.303	punctate cataract, equatorial cortex	1	0.1%	3	0.3%	2	0.7%
100.304	punctate cataract, anterior sutures	1	0.1%	1	0.1%	1	0.4%
100.305	punctate cataract, posterior sutures	3	0.3%	1	0.1%	0	
100.306	punctate cataract, nucleus	2	0.2%	1	0.1%	0	
100.307	punctate cataract, capsular	0		3	0.3%	0	
100.311	incipient cataract, anterior cortex	3	0.3%	14	1.2%	5	1.8%
100.312	incipient cataract, posterior cortex	5	0.5%	17	1.4%	1	0.4%
100.313	incipient cataract, equatorial cortex	2	0.2%	7	0.6%	4	1.5%
100.314	incipient cataract, anterior sutures	0		5	0.4%	0	
100.315	incipient cataract, posterior sutures	1	0.1%	1	0.1%	1	0.4%
100.316	incipient cataract, nucleus	0		4	0.3%	3	1.1%
100.317	incipient cataract, capsular	0		5	0.4%	1	0.4%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.4%
100.327	incomplete cataract, capsular	0		0		1	0.4%
100.330	generalized/complete cataract	5	0.5%	5	0.4%	0	
100.340	resorbing/hypermature cataract	0		0		1	0.4%
100.375	subluxation/luxation, unspecified	0		1	0.1%	2	0.7%
100.999	*significant cataracts (summary)*	*36*	*3.6%*	*83*	*6.9%*	*28*	*10.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	0.3%	2	0.2%	1	0.4%
110.135	PHPV/PTVL	0		2	0.2%	1	0.4%
110.320	vitreal degeneration	6	0.6%	9	0.8%	4	1.5%
RETINA							
120.170	retinal dysplasia, folds	4	0.4%	4	0.3%	0	
120.180	retinal dysplasia, geographic	2	0.2%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	84	8.5%	88	7.3%	11	4.0%

OCULAR DISORDERS REPORT
AMERICAN ESKIMO DOG

RETINA CONTINUED	1991-1999	2000-2009	2010-2016
120.910 retinal detachment without dialysis	1 0.1%	0	0
120.960 retinopathy	0	0	1 0.4%
OPTIC NERVE			
130.110 micropapilla	0	1 0.1%	1 0.4%
130.120 optic nerve hypoplasia	0	1 0.1%	0
130.150 optic disc coloboma	2 0.2%	1 0.1%	0
OTHER			
900.000 other, unspecified	0	2 0.2%	6 2.2%
900.100 other, not inherited	12 1.2%	74 6.2%	13 4.8%
900.110 other, suspected as inherited	5 0.5%	7 0.6%	0
NORMAL			
0.000 normal globe	810 81.8%	946 78.9%	213 78.3%

AMERICAN HAIRLESS TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Lens luxation * a DNA test is available	Not defined	1, 2	NO
B.	Retinal atrophy - generalized *(prcd)* * a DNA test is available	Autosomal recessive	3	NO

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

B. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the American Eskimo is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

1. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sc*i. 2010 Sep;51:4716-4721.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol.* 2011 Nov;14:378-384.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
AMERICAN HAIRLESS TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 # %	2000-2009 5 # %	2010-2016 28 # %
UVEA				
93.710	persistent pupillary membranes, iris to iris	0	0	2 7.1%
LENS				
100.210	cataract, suspect not inherited	0	0	1 3.6%
RETINA				
120.910	retinal detachment without dialysis	0	0	1 3.6%
OTHER				
900.000	other, unspecified	0	0	1 3.6%
NORMAL				
0.000	normal globe	0	5 100.0%	24 85.7%

AMERICAN PIT BULL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - cone-rod dystrophy 2 (*crd2*) * a DNA test is available	Autosomal recessive	1-3	NO
B.	Retinal atrophy - cone-rod dystrophy 1 (*CRD1/rcd1b)* * a DNA test is available	Autosomal recessive	4	NO

Description and Comments

A. Retinal Atrophy - Cone-rod dystrophy 2 (*crd2*)

A cone rod dystrophy characterized by initial loss of cones (day vision) followed by degeneration of the rods (night vision). Evidence of vision loss is evident at an early age with severe retinal degeneration and complete blindness by a year of age. The disease is a severe early onset retinal blindness more appropriately considered a form of Leber congenital amaurosis (LCA). The condition is inherited as an autosomal recessive trait and caused by a mutation in *IQCB1.* A DNA test is available. (Gustavo Aguirre, personal communication, 2016).

B. Retinal Atrophy - Rod-cone dysplasia 1b [previously considered cone-rod dystrophy 1(*crd1*)]

The disease was previously considered a cone-rod dystrophy (crd1) based on incorrect phenotype ascertainment using ERG (Aguirre, personal communication, 2016). The term crd1 should no longer be used to refer to the disease in this breed. The disease is more appropriately classified as rod-cone dysplasia 1b (rcd1b). In affected dogs there is evidence of vision loss at an early age with severe retinal degeneration and complete blindness by early adulthood, and ophthalmoscopic evidence of advanced retinal degeneration by 1 year of age. The disease is caused by a mutation in the *PDE6B* gene, with clinical abnormalities similar to what is found in rcd1-affected Irish Setters and rcd1a affected Sloughis. A DNA test is available.

References

1. Miyadera K, Acland GM, Aguirre GD. Genetic and phenotypic variations of inherited retinal diseases in dogs: the power of within- and across-breed studies. *Mamm Genome*. 2012;23:40-61.

2. Goldstein O, Mezey JG, Schweitzer P, et al. IQCB1 and PDE6B mutations cause similar early onset retinal degenerations in two closely related terrier dog breeds. *Invest Ophthalmol*. 2013;54:7005-7019.

3. Kijas JW, Zanger B, Miller B, et al. Cloning of the canine ABCA4 gene and evaluation in canine cone-rod dystrophies and progressive retinal atrophies. *Mol Vis*. 2004;10:223-232.

4. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
AMERICAN PIT BULL TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 14 #	 %	2000-2009 133 #	 %	2010-2016 51 #	 %
EYELIDS							
25.110	distichiasis	0		5	3.8%	1	2.0%
CORNEA							
70.700	corneal dystrophy	1	7.1%	0		0	
70.730	corneal endothelial degeneration	1	7.1%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		1	0.8%	4	7.8%
93.720	persistent pupillary membranes, iris to lens	1	7.1%	1	0.8%	0	
93.730	persistent pupillary membranes, iris to cornea	1	7.1%	1	0.8%	0	
93.740	persistent pupillary membranes, iris sheets	1	7.1%	0		0	
LENS							
100.210	cataract, suspect not inherited	0		5	3.8%	2	3.9%
100.301	punctate cataract, anterior cortex	0		0		1	2.0%
100.302	punctate cataract, posterior cortex	0		1	0.8%	1	2.0%
100.305	punctate cataract, posterior sutures	0		1	0.8%	0	
100.326	incomplete cataract, nucleus	0		0		1	2.0%
100.375	subluxation/luxation, unspecified	0		1	0.8%	0	
100.999	*significant cataracts (summary)*	*0*		*2*	*1.5%*	*3*	*5.9%*
RETINA							
120.170	retinal dysplasia, folds	0		2	1.5%	0	
120.180	retinal dysplasia, geographic	0		1	0.8%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	7.1%	0		1	2.0%
OTHER							
900.000	other, unspecified	0		0		1	2.0%
900.100	other, not inherited	0		10	7.5%	0	
NORMAL							
0.000	normal globe	11	78.6%	118	88.7%	40	78.4%

OCULAR DISORDERS REPORT

AMERICAN STAFFORDSHIRE TERRIER*

*Please note that since 1972 the AKC considers the Staffordshire Bull Terrier a different breed from the American Staffordshire Terrier. Since the latter breed evolved from the former, it is possible that the same genetic diseases exist in both.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	2	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2, 3	Breeder option
C.	Cataract	Not defined	1, 4, 5	NO
D.	Persistent hyperplastic primary vitreous/persistent hyperplastic tunica vasculosa lentis (PHPV/PHVL)	Not defined	1, 6, 7	NO
E.	Retinal atrophy - cone-rod dystrophy 2 (*crd2*) * a DNA test is available	Autosomal recessive	8	NO
F.	Retinal atrophy - cone-rod dystrophy 1 (*CRD1/rcd1b)* * a DNA test is available	Autosomal recessive	9-11	NO
G.	Retinal dysplasia - folds	Not defined	2	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make strong recommendations with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In this breed, cataracts usually develop by one year of age. There is initial opacification of the suture lines progressing to nuclear and cortical cataract formation; complete cataracts and blindness develop by three years of age. A simple autosomal recessive mode of inheritance has been proposed; however, the genetics have not been defined and additional studies will be required.

D. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis (PHTVL) which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The majority of affected dogs have a retrolental fibrovascular plaque and variable lenticular defects which include posterior lenticonus/globus, colobomata, intralenticular hemorrhage, and/or secondary cataracts. Vision impairment may result. The disease is an inherited disorder in the breed, but the mode of inheritance has not been defined. The results of current studies cannot rule out autosomal recessive or a dominant trait with incomplete penetrance.

E. Retinal Atrophy - Cone-rod dystrophy 2 (*crd2*)

A cone rod dystrophy characterized by initial loss of cones (day vision) followed by degeneration of the rods (night vision). Evidence of vision loss is evident at an early age with severe retinal degeneration and complete blindness by a year of age. The disease is a severe early onset retinal blindness more appropriately considered a form of Leber congenital amaurosis (LCA). The condition is inherited as an autosomal recessive trait and caused by a mutation in *IQCB1.* A DNA test is available. (Gustavo Aguirre, personal communication, 2016).

F. Retinal Atrophy - Rod-cone dysplasia 1b [previously considered cone-rod dystrophy 1(*crd1*)]

The disease was previously considered a cone-rod dystrophy (crd1) based on incorrect phenotype ascertainment using ERG (Aguirre, personal communication, 2016). The term crd1 should no longer be used to refer to the disease in this breed. The disease is more appropriately classified as rod-cone dysplasia 1b (rcd1b). In affected dogs there is evidence of vision loss at an early age with severe retinal degeneration and complete blindness by early adulthood, and ophthalmoscopic evidence of advanced retinal degeneration by 1 year of age. The disease is caused by a mutation in the *PDE6B* gene, with clinical abnormalities similar to what is found in rcd1-affected Irish Setters and rcd1a affected Sloughis. A DNA test is available.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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11. Goldstein O, Mezey JG, Schweitzer P, et al. IQCB1 and PDE6B mutations cause similar early onset retinal degenerations in two closely related terrier dog breeds. *Invest Ophthalmol*. 2013;54:7005-7019.

OCULAR DISORDERS REPORT
AMERICAN STAFFORDSHIRE TERRIER

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**125**		**451**		**180**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
EYELIDS							
21.000	entropion, unspecified	0		2	0.4%	0	
25.110	distichiasis	7	5.6%	25	5.5%	2	1.1%
CORNEA							
70.210	corneal pannus	1	0.8%	0		0	
70.220	pigmentary keratitis	0		1	0.2%	0	
70.730	corneal endothelial degeneration	1	0.8%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	5	4.0%	18	4.0%	8	4.4%
93.720	persistent pupillary membranes, iris to lens	0		1	0.2%	1	0.6%
93.730	persistent pupillary membranes, iris to cornea	0		1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.2%	0	
93.999	uveal cysts	0		1	0.2%	1	0.6%
LENS							
100.200	cataract, unspecified	1	0.8%	0		0	
100.210	cataract, suspect not inherited	2	1.6%	26	5.8%	1	0.6%
100.301	punctate cataract, anterior cortex	1	0.8%	0		0	
100.302	punctate cataract, posterior cortex	1	0.8%	1	0.2%	0	
100.303	punctate cataract, equatorial cortex	1	0.8%	0		1	0.6%
100.304	punctate cataract, anterior sutures	0		1	0.2%	0	
100.305	punctate cataract, posterior sutures	1	0.8%	0		0	
100.311	incipient cataract, anterior cortex	0		4	0.9%	0	
100.312	incipient cataract, posterior cortex	0		2	0.4%	1	0.6%
100.313	incipient cataract, equatorial cortex	1	0.8%	2	0.4%	1	0.6%
100.330	generalized/complete cataract	1	0.8%	0		0	
100.375	subluxation/luxation, unspecified	0		2	0.4%	0	
100.999	*significant cataracts (summary)*	*7*	*5.6%*	*10*	*2.2%*	*3*	*1.7%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		2	0.4%	0	
110.320	vitreal degeneration	0		3	0.7%	0	
RETINA							
120.170	retinal dysplasia, folds	0		8	1.8%	0	
120.180	retinal dysplasia, geographic	0		2	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		3	0.7%	0	
OTHER							
900.000	other, unspecified	0		2	0.4%	6	3.3%
900.100	other, not inherited	0		30	6.7%	6	3.3%
900.110	other, suspected as inherited	1	0.8%	2	0.4%	0	
NORMAL							
0.000	normal globe	108	86.4%	373	82.7%	166	92.2%

OCULAR DISORDERS REPORT

AMERICAN WATER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	2	Breeder option
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
D.	Cataract	Not defined	1	NO

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the American Water Spaniel breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
AMERICAN WATER SPANIEL

	TOTAL DOGS EXAMINED	1991-1999 418		2000-2009 466		2010-2016 201	
	Diagnostic Name	**#**	**%**	**#**	**%**	**#**	**%**
GLOBE							
0.110	microphthalmia	2	0.5%	0		0	
10.000	glaucoma	2	0.5%	0		1	0.5%
EYELIDS							
20.160	macropalpebral fissure	1	0.2%	0		1	0.5%
21.000	entropion, unspecified	5	1.2%	0		2	1.0%
22.000	ectropion, unspecified	0		1	0.2%	1	0.5%
25.110	distichiasis	113	27.0%	160	34.3%	77	38.3%
CORNEA							
70.220	pigmentary keratitis	0		0		1	0.5%
70.700	corneal dystrophy	1	0.2%	2	0.4%	2	1.0%
UVEA							
93.150	iris coloboma	1	0.2%	0		1	0.5%
93.710	persistent pupillary membranes, iris to iris	3	0.7%	7	1.5%	1	0.5%
93.730	persistent pupillary membranes, iris to cornea	1	0.2%	0		0	
93.740	persistent pupillary membranes, iris sheets	1	0.2%	1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		6	3.0%
93.999	uveal cysts	0		1	0.2%	0	
LENS							
100.200	cataract, unspecified	5	1.2%	0		0	
100.210	cataract, suspect not inherited	10	2.4%	20	4.3%	10	5.0%
100.301	punctate cataract, anterior cortex	2	0.5%	1	0.2%	2	1.0%
100.302	punctate cataract, posterior cortex	3	0.7%	3	0.6%	1	0.5%
100.303	punctate cataract, equatorial cortex	0		1	0.2%	1	0.5%
100.305	punctate cataract, posterior sutures	1	0.2%	2	0.4%	3	1.5%
100.306	punctate cataract, nucleus	1	0.2%	0		0	
100.307	punctate cataract, capsular	0		1	0.2%	1	0.5%
100.311	incipient cataract, anterior cortex	4	1.0%	2	0.4%	1	0.5%
100.312	incipient cataract, posterior cortex	7	1.7%	4	0.9%	0	
100.315	incipient cataract, posterior sutures	3	0.7%	2	0.4%	0	
100.317	incipient cataract, capsular	0		0		1	0.5%
100.330	generalized/complete cataract	1	0.2%	0		0	
100.999	*significant cataracts (summary)*	*27*	*6.5%*	*16*	*3.4%*	*10*	*5.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		2	0.4%	0	
110.135	PHPV/PTVL	0		0		1	0.5%
110.320	vitreal degeneration	0		0		1	0.5%
RETINA							
120.170	retinal dysplasia, folds	1	0.2%	5	1.1%	2	1.0%
120.180	retinal dysplasia, geographic	0		1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.7%	1	0.2%	1	0.5%
120.960	retinopathy	0		0		1	0.5%

OCULAR DISORDERS REPORT
AMERICAN WATER SPANIEL

	1991-1999	2000-2009	2010-2016
OTHER			
900.000 other, unspecified	0	0	5 2.5%
900.100 other, not inherited	0	18 3.9%	4 2.0%
900.110 other, suspected as inherited	0	1 0.2%	0
NORMAL			
0.000 normal globe	271 64.8%	295 63.3%	108 53.7%

ARGENTINE DOGO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Argentine Dogo breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
ARGENTINE DOGO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 84 #	 %	2000-2009 29 #	 %	2010-2016 17 #	 %
EYELIDS							
25.110	distichiasis	0		0		1	5.9%
CORNEA							
70.700	corneal dystrophy	1	1.2%	0		0	
70.730	corneal endothelial degeneration	1	1.2%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	12	14.3%	2	6.9%	0	
93.720	persistent pupillary membranes, iris to lens	1	1.2%	0		0	
LENS							
100.200	cataract, unspecified	1	1.2%	0		0	
100.210	cataract, suspect not inherited	1	1.2%	0		0	
100.302	punctate cataract, posterior cortex	0		0		1	5.9%
100.312	incipient cataract, posterior cortex	0		1	3.4%	2	11.8%
100.316	incipient cataract, nucleus	1	1.2%	1	3.4%	0	
100.330	generalized/complete cataract	1	1.2%	0		0	
100.999	*significant cataracts (summary)*	*3*	*3.6%*	*2*	*6.9%*	*3*	*17.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	1.2%	0		0	
OTHER							
900.100	other, not inherited	0		1	3.4%	0	
900.110	other, suspected as inherited	1	1.2%	0		0	
NORMAL							
0.000	normal globe	71	84.5%	25	86.2%	13	76.5%

OCULAR DISORDERS REPORT

AUSTRALIAN CATTLE DOG

(Queensland Heeler or Blue Heeler)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1	NO
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	3	Breeder option
D.	Cataract	Not defined	4	NO
E.	Lens luxation * a DNA test is available	Not defined	4-6	NO
F.	Retinal atrophy - generalized (*prcd)* * a DNA test is available	Autosomal recessive	4, 7, 8	NO
G.	Retinal atrophy - rod-cone dysplasia type 4 (*rcd4*) * a DNA test is available	Autosomal recessive	9	NO
H.	Retinal dysplasia - folds	Not defined	10	Breeder option
I.	Ceroid lipofuscinosis	Not defined	4, 11	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy).

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

F. Retinal atrophy - generalized *(prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Australian Cattle Dog is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the Australian Cattle Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

G. Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified also in the Australian Cattle Dog breed. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is available. The test is accurate only for this mutation and is of no value in identifying other forms of PRA.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

I. Ceroid lipofuscinosis

A metabolic disorder of the retina and retinal pigment epithelium with accumulation of lipopigments resulting in retinal degeneration.

References

1. Gelatt KN, MacKay EO. Prevalence of the breed-related glaucomas in pure-bred dogs in North America. *Vet Ophthalmol*. 2004;7:97-111.

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OCULAR DISORDERS REPORT
AUSTRALIAN CATTLE DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 2298 #	%	2000-2009 1805 #	%	2010-2016 654 #	%
GLOBE							
0.110	microphthalmia	0		0		1	0.2%
EYELIDS							
22.000	ectropion, unspecified	1	0.0%	0		0	
25.110	distichiasis	7	0.3%	5	0.3%	3	0.5%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0		0	
NICTITANS							
50.210	pannus of third eyelid	0		0		2	0.3%
CORNEA							
70.210	corneal pannus	0		2	0.1%	0	
70.700	corneal dystrophy	9	0.4%	10	0.6%	5	0.8%
70.730	corneal endothelial degeneration	1	0.0%	3	0.2%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	16	0.7%	18	1.0%	10	1.5%
93.720	persistent pupillary membranes, iris to lens	1	0.0%	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.1%	0		1	0.2%
93.740	persistent pupillary membranes, iris sheets	5	0.2%	1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.1%	1	0.2%
93.999	uveal cysts	3	0.1%	7	0.4%	1	0.2%
LENS							
100.200	cataract, unspecified	35	1.5%	0		0	
100.210	cataract, suspect not inherited	89	3.9%	155	8.6%	44	6.7%
100.301	punctate cataract, anterior cortex	15	0.7%	19	1.1%	5	0.8%
100.302	punctate cataract, posterior cortex	20	0.9%	9	0.5%	7	1.1%
100.303	punctate cataract, equatorial cortex	12	0.5%	7	0.4%	0	
100.304	punctate cataract, anterior sutures	2	0.1%	1	0.1%	0	
100.305	punctate cataract, posterior sutures	4	0.2%	5	0.3%	7	1.1%
100.306	punctate cataract, nucleus	1	0.0%	2	0.1%	1	0.2%
100.307	punctate cataract, capsular	1	0.0%	2	0.1%	1	0.2%
100.311	incipient cataract, anterior cortex	18	0.8%	23	1.3%	5	0.8%
100.312	incipient cataract, posterior cortex	30	1.3%	34	1.9%	6	0.9%
100.313	incipient cataract, equatorial cortex	23	1.0%	25	1.4%	4	0.6%
100.314	incipient cataract, anterior sutures	2	0.1%	0		0	
100.315	incipient cataract, posterior sutures	5	0.2%	13	0.7%	0	
100.316	incipient cataract, nucleus	1	0.0%	2	0.1%	1	0.2%
100.317	incipient cataract, capsular	0		3	0.2%	1	0.2%
100.322	incomplete cataract, posterior cortex	0		0		2	0.3%
100.326	incomplete cataract, nucleus	0		0		2	0.3%
100.327	incomplete cataract, capsular	0		0		1	0.2%
100.330	generalized/complete cataract	11	0.5%	11	0.6%	1	0.2%
100.375	subluxation/luxation, unspecified	2	0.1%	1	0.1%	1	0.2%
100.999	*significant cataracts (summary)*	*180*	*7.8%*	*156*	*8.6%*	*44*	*6.7%*

OCULAR DISORDERS REPORT
AUSTRALIAN CATTLE DOG

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	5	0.2%	3	0.2%	0	
110.135	PHPV/PTVL	0		1	0.1%	0	
110.320	vitreal degeneration	5	0.2%	8	0.4%	0	
FUNDUS							
97.110	choroidal hypoplasia	0		0		3	0.5%
97.120	coloboma	1	0.0%	0		0	
RETINA							
120.170	retinal dysplasia, folds	15	0.7%	20	1.1%	2	0.3%
120.180	retinal dysplasia, geographic	4	0.2%	8	0.4%	1	0.2%
120.190	retinal dysplasia, detached	0		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	122	5.3%	114	6.3%	15	2.3%
120.400	retinal hemorrhage	1	0.0%	0		0	
120.910	retinal detachment without dialysis	0		2	0.1%	1	0.2%
120.960	retinopathy	0		0		2	0.3%
OPTIC NERVE							
130.120	optic nerve hypoplasia	2	0.1%	0		0	
130.150	optic disc coloboma	0		0		1	0.2%
OTHER							
900.000	other, unspecified	0		10	0.6%	10	1.5%
900.100	other, not inherited	14	0.6%	111	6.1%	23	3.5%
900.110	other, suspected as inherited	13	0.6%	4	0.2%	1	0.2%
NORMAL							
0.000	normal globe	1925	83.8%	1446	80.1%	544	83.2%

OCULAR DISORDERS REPORT

AUSTRALIAN KELPIE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO
B.	Retinal atrophy - generalized	Not defined	2	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

The age of onset has been reported to be between 2 and 3 years of age with initial loss of night vision progressing to complete blindness.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Australian Kelpie breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

OCULAR DISORDERS REPORT
AUSTRALIAN KELPIE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 77 #	 %	2000-2009 113 #	 %	2010-2016 37 #	 %
CORNEA							
70.700	corneal dystrophy	1	1.3%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		1	0.9%	0	
93.810	uveal melanoma	0		1	0.9%	2	5.4%
LENS							
100.200	cataract, unspecified	5	6.5%	0		0	
100.210	cataract, suspect not inherited	7	9.1%	15	13.3%	7	18.9%
100.301	punctate cataract, anterior cortex	2	2.6%	3	2.7%	2	5.4%
100.302	punctate cataract, posterior cortex	1	1.3%	7	6.2%	0	
100.306	punctate cataract, nucleus	1	1.3%	0		0	
100.311	incipient cataract, anterior cortex	1	1.3%	8	7.1%	0	
100.312	incipient cataract, posterior cortex	5	6.5%	2	1.8%	0	
100.313	incipient cataract, equatorial cortex	0		2	1.8%	0	
100.315	incipient cataract, posterior sutures	1	1.3%	0		0	
100.330	generalized/complete cataract	1	1.3%	0		0	
100.999	*significant cataracts (summary)*	*17*	*22.1%*	*22*	*19.5%*	*2*	*5.4%*
VITREOUS							
110.320	vitreal degeneration	1	1.3%	1	0.9%	1	2.7%
FUNDUS							
97.110	choroidal hypoplasia	1	1.3%	0		0	
RETINA							
120.170	retinal dysplasia, folds	4	5.2%	0		1	2.7%
120.310	generalized progressive retinal atrophy (PRA)	8	10.4%	3	2.7%	0	
OTHER							
900.000	other, unspecified	0		4	3.5%	3	8.1%
900.100	other, not inherited	0		8	7.1%	0	
900.110	other, suspected as inherited	0		1	0.9%	0	
NORMAL							
0.000	normal globe	52	67.5%	89	78.8%	31	83.8%

OCULAR DISORDERS REPORT

AUSTRALIAN SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Presumed autosomal recessive with incomplete penetrance	1-6	NO
B.	Distichiasis	Not defined	1, 7	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	8	Breeder option
D.	Iris coloboma	Not defined	1	NO
E.	Iris hypoplasia	Not defined	9	Breeder option
F.	Persistent pupillary membranes - iris to iris - all other forms	 Not defined Not defined	 1 1, 8	 Breeder option NO
G.	Cataract * a DNA test is available	Autosomal co-dominant	1, 10, 11	NO
H.	Vitreous degeneration	Not defined	21	Breeder option
I.	Persistent hyaloid artery	Not defined		Breeder option
J.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1, 9, 12, 13	NO
K.	Cone degeneration - day blindness * a DNA test is available	Autosomal recessive	14	NO

OCULAR DISORDERS REPORT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
L.	Multifocal retinopathy - cmr1 * a DNA test is available	Autosomal recessive	15	Breeder option
M.	Retinal dysplasia - folds	Not defined	8	Breeder option
N.	Choroidal hypoplasia (Collie Eye Anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma * a DNA test is available	Autosomal recessive	1, 7, 16-19	NO
O.	Coloboma/staphyloma without microphthalmia	Not defined	1	NO
P.	Micropapilla	Not defined	20	Breeder option

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma.

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye with associated defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (dysplasia). In the Australian Shepherd, microphthalmia has long been suspected to be associated with merle coat coloration but a definitive genetic relationship has not been established. The eyes of affected homozygous merle (usually white) dogs have extreme forms of this entity and are usually blind at birth. Affected heterozygous merle-coated dogs demonstrate less severe manifestations.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Iris coloboma

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the OFA form.

E. Iris hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Australian Shepherd, a mutation in *HSF4* (heat shock transcription factor 4), the HSF4-2 mutation, has been shown to increase the likelihood of cataract formation. The mutation is inherited in a co-dominant manner. Dogs with one copy of the mutation develop bilateral posterior cataracts and homozygotes develop a nuclear cataract that typically progresses to a mature cataract. A DNA test is available for this mutation. Other genetic factors can contribute to cataract formation in this breed and will not be detected by this test.

H. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

OCULAR DISORDERS REPORT

I. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

J. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Australian Shepherd is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

K. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day-blindness, color blindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a mutation in the *CNGB3* gene. A DNA test is available.

L. Multifocal retinopathy

Canine Multi-focal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multi-focal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

M. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

N. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

O. Coloboma/staphyloma (unassociated with microphthalmia)

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia (entity "A" above).

P. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment.

Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

References

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17. Lowe JK, Kukekova AV, Kirkness EF, et al. Linkage mapping of the primary disease locus for collie eye anomaly. *Genomics*. 2003;82:86-95.

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21. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

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OCULAR DISORDERS REPORT
AUSTRALIAN SHEPHERD

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 26846 #	%	2000-2009 44675 #	%	2010-2016 29626 #	%
GLOBE							
0.110	microphthalmia	42	0.2%	36	0.1%	15	0.1%
10.000	glaucoma	6	0.0%	2	0.0%	0	
EYELIDS							
20.110	eyelid dermoid	1	0.0%	0		0	
20.140	ectopic cilia	1	0.0%	4	0.0%	0	
20.160	macropalpebral fissure	0		3	0.0%	1	0.0%
21.000	entropion, unspecified	2	0.0%	6	0.0%	8	0.0%
22.000	ectropion, unspecified	2	0.0%	3	0.0%	1	0.0%
25.110	distichiasis	410	1.5%	726	1.6%	501	1.7%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	2	0.0%	0		4	0.0%
40.910	keratoconjunctivitis sicca	0		0		1	0.0%
NICTITANS							
51.100	third eyelid cartilage anomaly	2	0.0%	1	0.0%	1	0.0%
52.110	prolapsed gland of the third eyelid	0		1	0.0%	1	0.0%
CORNEA							
70.210	corneal pannus	5	0.0%	1	0.0%	3	0.0%
70.220	pigmentary keratitis	0		1	0.0%	0	
70.700	corneal dystrophy	123	0.5%	156	0.3%	214	0.7%
70.730	corneal endothelial degeneration	6	0.0%	6	0.0%	2	0.0%
UVEA							
93.110	iris hypoplasia	0		63	0.1%	177	0.6%
93.140	corneal endothelial pigment without PPM	0		1	0.0%	0	
93.150	iris coloboma	402	1.5%	697	1.6%	375	1.3%
93.710	persistent pupillary membranes, iris to iris	679	2.5%	2164	4.8%	2123	7.2%
93.720	persistent pupillary membranes, iris to lens	27	0.1%	36	0.1%	27	0.1%
93.730	persistent pupillary membranes, iris to cornea	17	0.1%	20	0.0%	6	0.0%
93.740	persistent pupillary membranes, iris sheets	50	0.2%	42	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.0%	26	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		5	0.0%	17	0.1%
93.810	uveal melanoma	0		2	0.0%	6	0.0%
93.999	uveal cysts	9	0.0%	19	0.0%	14	0.0%
97.150	chorioretinal coloboma, congenital	0		0		20	0.1%
LENS							
100.200	cataract, unspecified	169	0.6%	0		0	
100.210	cataract, suspect not inherited	495	1.8%	1249	2.8%	639	2.2%
100.301	punctate cataract, anterior cortex	66	0.2%	95	0.2%	67	0.2%
100.302	punctate cataract, posterior cortex	111	0.4%	158	0.4%	61	0.2%
100.303	punctate cataract, equatorial cortex	34	0.1%	38	0.1%	12	0.0%
100.304	punctate cataract, anterior sutures	4	0.0%	19	0.0%	8	0.0%
100.305	punctate cataract, posterior sutures	55	0.2%	98	0.2%	64	0.2%
100.306	punctate cataract, nucleus	35	0.1%	73	0.2%	53	0.2%
100.307	punctate cataract, capsular	5	0.0%	58	0.1%	30	0.1%

OCULAR DISORDERS REPORT
AUSTRALIAN SHEPHERD

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.311	incipient cataract, anterior cortex	92	0.3%	142	0.3%	79	0.3%
100.312	incipient cataract, posterior cortex	211	0.8%	380	0.9%	164	0.6%
100.313	incipient cataract, equatorial cortex	60	0.2%	90	0.2%	44	0.1%
100.314	incipient cataract, anterior sutures	3	0.0%	17	0.0%	4	0.0%
100.315	incipient cataract, posterior sutures	54	0.2%	76	0.2%	27	0.1%
100.316	incipient cataract, nucleus	49	0.2%	120	0.3%	36	0.1%
100.317	incipient cataract, capsular	7	0.0%	73	0.2%	30	0.1%
100.321	incomplete cataract, anterior cortex	0		0		8	0.0%
100.322	incomplete cataract, posterior cortex	0		0		22	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		5	0.0%
100.325	incomplete cataract, posterior sutures	0		0		2	0.0%
100.326	incomplete cataract, nucleus	0		0		7	0.0%
100.327	incomplete cataract, capsular	0		0		1	0.0%
100.330	generalized/complete cataract	94	0.4%	110	0.2%	29	0.1%
100.340	resorbing/hypermature cataract	0		0		1	0.0%
100.375	subluxation/luxation, unspecified	2	0.0%	12	0.0%	4	0.0%
100.999	*significant cataracts (summary)*	*1049*	*3.9%*	*1547*	*3.5%*	*754*	*2.5%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	213	0.8%	195	0.4%	114	0.4%
110.135	PHPV/PTVL	24	0.1%	45	0.1%	41	0.1%
110.320	vitreal degeneration	50	0.2%	132	0.3%	82	0.3%
FUNDUS							
97.110	choroidal hypoplasia	46	0.2%	50	0.1%	64	0.2%
97.120	coloboma	44	0.2%	44	0.1%	8	0.0%
RETINA							
120.170	retinal dysplasia, folds	191	0.7%	421	0.9%	371	1.3%
120.180	retinal dysplasia, geographic	18	0.1%	16	0.0%	11	0.0%
120.190	retinal dysplasia, detached	3	0.0%	1	0.0%	5	0.0%
120.310	generalized progressive retinal atrophy (PRA)	47	0.2%	73	0.2%	14	0.0%
120.400	retinal hemorrhage	10	0.0%	3	0.0%	0	
120.910	retinal detachment without dialysis	31	0.1%	24	0.1%	6	0.0%
120.920	retinal detachment with dialysis	0		0		12	0.0%
120.960	retinopathy	0		0		9	0.0%
OPTIC NERVE							
130.110	micropapilla	8	0.0%	90	0.2%	125	0.4%
130.120	optic nerve hypoplasia	71	0.3%	32	0.1%	18	0.1%
130.150	optic disc coloboma	64	0.2%	49	0.1%	46	0.2%
OTHER							
900.000	other, unspecified	0		148	0.3%	397	1.3%
900.100	other, not inherited	70	0.3%	1173	2.6%	401	1.4%
900.110	other, suspected as inherited	153	0.6%	96	0.2%	30	0.1%
NORMAL							
0.000	normal globe	23562	87.8%	39799	89.1%	24957	84.2%

AUSTRALIAN STUMPY TAIL CATTLE DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1	NO

Description and Comments

A. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Australian Stumpy Tail Cattle Dog is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Australian Stumpy Tail Cattle Dog. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563.

OCULAR DISORDERS REPORT
AUSTRALIAN STUMPY TAIL CATTLE DOG

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 0 #	%	2000-2009 44 #	%	2010-2016 0 #	%
LENS							
100.210	cataract, suspect not inherited	0		2	4.5%	0	
100.301	punctate cataract, anterior cortex	0		1	2.3%	0	
100.305	punctate cataract, posterior sutures	0		1	2.3%	0	
100.311	incipient cataract, anterior cortex	0		1	2.3%	0	
100.312	incipient cataract, posterior cortex	0		2	4.5%	0	
100.313	incipient cataract, equatorial cortex	0		2	4.5%	0	
100.316	incipient cataract, nucleus	0		1	2.3%	0	
100.999	*significant cataracts (summary)*	*0*		*8*	*18.2%*	*0*	
RETINA							
120.170	retinal dysplasia, folds	0		1	2.3%	0	
120.180	retinal dysplasia, geographic	0		1	2.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		3	6.8%	0	
OTHER							
900.100	other, not inherited	0		1	2.3%	0	
900.110	other, suspected as inherited	0		1	2.3%	0	
NORMAL							
0.000	normal globe	0		38	86.4%	0	

OCULAR DISORDERS REPORT

AUSTRALIAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
B.	Cataract	Not defined	2	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Australian Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
AUSTRALIAN TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 360 #	 %	2000-2009 225 #	 %	2010-2016 288 #	 %
GLOBE							
10.000	glaucoma	0		1	0.4%	0	
EYELIDS							
21.000	entropion, unspecified	2	0.6%	0		0	
25.110	distichiasis	0		3	1.3%	0	
CORNEA							
70.220	pigmentary keratitis	0		0		1	0.3%
70.700	corneal dystrophy	3	0.8%	1	0.4%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	7	1.9%	5	2.2%	30	10.4%
93.720	persistent pupillary membranes, iris to lens	1	0.3%	0		0	
93.730	persistent pupillary membranes, iris to cornea	3	0.8%	0		0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		7	2.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.3%
LENS							
100.200	cataract, unspecified	2	0.6%	0		0	
100.210	cataract, suspect not inherited	10	2.8%	7	3.1%	15	5.2%
100.301	punctate cataract, anterior cortex	2	0.6%	0		1	0.3%
100.302	punctate cataract, posterior cortex	1	0.3%	0		1	0.3%
100.303	punctate cataract, equatorial cortex	0		0		2	0.7%
100.305	punctate cataract, posterior sutures	1	0.3%	0		1	0.3%
100.306	punctate cataract, nucleus	0		0		2	0.7%
100.311	incipient cataract, anterior cortex	1	0.3%	2	0.9%	2	0.7%
100.312	incipient cataract, posterior cortex	2	0.6%	2	0.9%	0	
100.313	incipient cataract, equatorial cortex	2	0.6%	1	0.4%	2	0.7%
100.314	incipient cataract, anterior sutures	0		1	0.4%	0	
100.316	incipient cataract, nucleus	0		0		1	0.3%
100.317	incipient cataract, capsular	0		0		1	0.3%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.3%
100.326	incomplete cataract, nucleus	0		0		1	0.3%
100.330	generalized/complete cataract	3	0.8%	2	0.9%	3	1.0%
100.375	subluxation/luxation, unspecified	1	0.3%	0		0	
100.999	*significant cataracts (summary)*	*14*	*3.9%*	*8*	*3.6%*	*18*	*6.2%*
VITREOUS							
110.320	vitreal degeneration	0		2	0.9%	1	0.3%
RETINA							
120.170	retinal dysplasia, folds	2	0.6%	1	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	0.6%	1	0.4%	0	
120.400	retinal hemorrhage	1	0.3%	0		0	
OPTIC NERVE							
130.110	micropapilla	0		0		1	0.3%

OCULAR DISORDERS REPORT
AUSTRALIAN TERRIER

	1991-1999	2000-2009	2010-2016
OTHER			
900.000 other, unspecified	0	3 1.3%	1 0.3%
900.100 other, not inherited	1 0.3%	7 3.1%	4 1.4%
900.110 other, suspected as inherited	1 0.3%	0	0
NORMAL			
0.000 normal globe	325 90.3%	204 90.7%	228 79.2%

BARBET

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1, 2	NO

Description and Comments

A. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Australian Stumpy Tail Cattle Dog is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

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2. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
BARBET

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 8 #	%	2010-2016 186 #	%
EYELIDS							
25.110	distichiasis	0		1	12.5%	9	4.8%
CORNEA							
70.700	corneal dystrophy	0		0		1	0.5%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		5	2.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		5	2.7%
93.999	uveal cysts	0		0		1	0.5%
LENS							
100.210	cataract, suspect not inherited	0		0		28	15.1%
100.301	punctate cataract, anterior cortex	0		1	12.5%	0	
100.303	punctate cataract, equatorial cortex	0		0		1	0.5%
100.305	punctate cataract, posterior sutures	0		0		1	0.5%
100.311	incipient cataract, anterior cortex	0		0		1	0.5%
100.312	incipient cataract, posterior cortex	0		0		1	0.5%
100.313	incipient cataract, equatorial cortex	0		0		1	0.5%
100.330	generalized/complete cataract	0		0		1	0.5%
100.999	*significant cataracts (summary)*	*0*		*1*	*12.5%*	*6*	*3.2%*
VITREOUS							
110.320	vitreal degeneration	0		0		1	0.5%
FUNDUS							
97.110	choroidal hypoplasia	0		0		1	0.5%
RETINA							
120.170	retinal dysplasia, folds	0		0		1	0.5%
120.920	retinal detachment with dialysis	0		0		1	0.5%
120.960	retinopathy	0		0		1	0.5%
OTHER							
900.000	other, unspecified	0		2	25.0%	0	
900.100	other, not inherited	0		0		7	3.8%
900.110	other, suspected as inherited	0		0		2	1.1%
NORMAL							
0.000	normal globe	0		7	87.5%	144	77.4%

BASENJI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Corneal dystrophy - endothelial	Not defined	1	NO
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1-6	Breeder option
	- iris to cornea	Not defined	6	NO
	- iris to lens	Not defined	6	NO
	- endothelial opacity/no strands	Not defined	7	NO
D.	Cataract	Not defined	1	NO
E.	Retinal atrophy - generalized	Not defined	1, 8, 9	NO
	- Bas_PRA1 * a DNA test is available	Autosomal recessive	1, 8, 9	NO
F.	Optic nerve coloboma	Not defined	1, 2	NO

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of persistent pupillary membranes.

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older. In the Basenji, this condition is less common than corneal endothelial disease caused by attachment of persistent pupillary membranes.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Basenji, this is a particularly significant problem with many cases reported where the strands bridge between the iris and the cornea resulting in localized corneal opacities which may cause vision impairment. This has also been associated with optic nerve coloboma (see "F" below).

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

Bas_PRA1

A specific mutation has been located in the S-antigen (*SAG)* gene that causes a late onset form of retinal degeneration in the Basenji. The condition is inherited in an autosomal recessive fashion. Initial thinning of the retina evidenced by irregular hypo and hyper-reflectivity of the tapetal fundus is typically noted at 5 years of age with retinal vascular attenuation noted by 6-7 years of age. Clinically the disease closely resembles *prcd*-PRA. The retinal degeneration progresses gradually and ultimately results in complete vision loss. This mutation is responsible for the majority, but not all cases of PRA within the Basenji breed.

F. Optic nerve coloboma

A congenital cavity in the optic nerve which, if large, may cause blindness or vision impairment.

In the Basenji, this condition has been associated with persistent pupillary membranes (see "C" above).

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2. Barnett KC and Knight CG. Persistent pupillary membrane and associated defects in the Basenji. *Vet Rec*. 1969 Aug 30;85:242-248.

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6. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

7. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

8. Priester W. Canine progressive retinal atrophy: Occurrence by age, breed, and sex. *American Journal of Veterinary Research*. 1974;35:571-574.

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OCULAR DISORDERS REPORT
BASENJI

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 4293 #	%	2000-2009 4463 #	%	2010-2016 2061 #	%
GLOBE							
0.110	microphthalmia	7	0.2%	1	0.0%	0	
EYELIDS							
20.160	macropalpebral fissure	1	0.0%	0		0	
21.000	entropion, unspecified	0		3	0.1%	3	0.1%
22.000	ectropion, unspecified	0		1	0.0%	0	
25.110	distichiasis	28	0.7%	25	0.6%	11	0.5%
CORNEA							
70.210	corneal pannus	2	0.0%	0		0	
70.220	pigmentary keratitis	0		2	0.0%	0	
70.700	corneal dystrophy	137	3.2%	120	2.7%	68	3.3%
70.730	corneal endothelial degeneration	118	2.7%	106	2.4%	25	1.2%
UVEA							
90.250	pigmentary uveitis	0		1	0.0%	0	
93.140	corneal endothelial pigment without PPM	0		18	0.4%	0	
93.150	iris coloboma	6	0.1%	3	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	2112	49.2%	2199	49.3%	1201	58.3%
93.720	persistent pupillary membranes, iris to lens	221	5.1%	165	3.7%	71	3.4%
93.730	persistent pupillary membranes, iris to cornea	591	13.8%	391	8.8%	154	7.5%
93.740	persistent pupillary membranes, iris sheets	20	0.5%	19	0.4%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		17	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		22	0.5%	165	8.0%
93.999	uveal cysts	1	0.0%	0		1	0.0%
97.150	chorioretinal coloboma, congenital	0		0		1	0.0%
LENS							
100.200	cataract, unspecified	47	1.1%	0		0	
100.210	cataract, suspect not inherited	138	3.2%	248	5.6%	92	4.5%
100.301	punctate cataract, anterior cortex	20	0.5%	17	0.4%	6	0.3%
100.302	punctate cataract, posterior cortex	8	0.2%	4	0.1%	4	0.2%
100.303	punctate cataract, equatorial cortex	4	0.1%	4	0.1%	1	0.0%
100.304	punctate cataract, anterior sutures	1	0.0%	2	0.0%	2	0.1%
100.305	punctate cataract, posterior sutures	25	0.6%	23	0.5%	19	0.9%
100.306	punctate cataract, nucleus	6	0.1%	8	0.2%	1	0.0%
100.307	punctate cataract, capsular	10	0.2%	42	0.9%	8	0.4%
100.311	incipient cataract, anterior cortex	10	0.2%	14	0.3%	5	0.2%
100.312	incipient cataract, posterior cortex	12	0.3%	9	0.2%	5	0.2%
100.313	incipient cataract, equatorial cortex	11	0.3%	5	0.1%	2	0.1%
100.314	incipient cataract, anterior sutures	2	0.0%	1	0.0%	0	
100.315	incipient cataract, posterior sutures	14	0.3%	11	0.2%	5	0.2%
100.316	incipient cataract, nucleus	4	0.1%	11	0.2%	6	0.3%
100.317	incipient cataract, capsular	0		20	0.4%	3	0.1%
100.330	generalized/complete cataract	13	0.3%	7	0.2%	2	0.1%
100.375	subluxation/luxation, unspecified	3	0.1%	5	0.1%	1	0.0%
100.999	*significant cataracts (summary)*	*187*	*4.4%*	*178*	*4.0%*	*69*	*3.3%*

OCULAR DISORDERS REPORT
BASENJI

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	5	0.1%	3	0.1%	2	0.1%
110.135	PHPV/PTVL	0		8	0.2%	0	
110.320	vitreal degeneration	8	0.2%	16	0.4%	7	0.3%
FUNDUS							
97.110	choroidal hypoplasia	1	0.0%	0		0	
97.120	coloboma	8	0.2%	5	0.1%	0	
RETINA							
120.170	retinal dysplasia, folds	7	0.2%	9	0.2%	4	0.2%
120.180	retinal dysplasia, geographic	4	0.1%	11	0.2%	4	0.2%
120.190	retinal dysplasia, detached	1	0.0%	3	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	237	5.5%	125	2.8%	18	0.9%
120.400	retinal hemorrhage	1	0.0%	4	0.1%	0	
120.910	retinal detachment without dialysis	2	0.0%	5	0.1%	0	
120.960	retinopathy	0		0		9	0.4%
OPTIC NERVE							
130.110	micropapilla	1	0.0%	0		0	
130.120	optic nerve hypoplasia	2	0.0%	1	0.0%	0	
130.150	optic disc coloboma	63	1.5%	28	0.6%	11	0.5%
OTHER							
900.000	other, unspecified	0		23	0.5%	55	2.7%
900.100	other, not inherited	29	0.7%	189	4.2%	56	2.7%
900.110	other, suspected as inherited	135	3.1%	85	1.9%	7	0.3%
NORMAL							
0.000	normal globe	1501	35.0%	2008	45.0%	697	33.8%

OCULAR DISORDERS REPORT

BASSET FAUVE DE BRETAGNE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Basset Fauve de Bretagne breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
BASSET FAUVE DE BRETAGNE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	% 	2000-2009 0 #	% 	2010-2016 55 #	%
GLOBE							
10.000	glaucoma	0		0		2	3.6%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		2	3.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		17	30.9%
LENS							
100.210	cataract, suspect not inherited	0		0		6	10.9%
OTHER							
900.100	other, not inherited	0		0		4	7.3%
NORMAL							
0.000	normal globe	0		0		29	52.7%

BASSET HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma * a DNA test is available for POAG	Not defined	1-8	NO
B.	Entropion	Not defined	1	Breeder option
C.	Ectropion	Not defined	1, 9, 10	Breeder option
D.	Macroblepharon	Not defined	9, 10	Breeder option
E.	Distichiasis	Not defined	11	Breeder option
F.	Nictitans cartilage anomaly/eversion	Not defined	12	Breeder option
G.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 13	Breeder option
	- iris to cornea	Not defined	13	NO
H.	Cataract	Not defined	1	NO

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

In the Basset Hound, both closed angle (PCAG) and open angle (POAG) forms of glaucoma are present. Some Basset Hounds have an abnormality of the iridocorneal angle termed goniodysgenesis. This abnormality is not visible during routine ophthalmologic examination using an indirect ophthalmoscope or a slit-lamp microscope. There appears to be an association between goniodysgenesis and glaucoma, but the mechanism by which the angle defect results in glaucoma has not been determined. It is suspected that mild to severe anterior uveitis impairs outflow of aqueous through the small perforations that are present in

the sheet of tissue in the iridocorneal angle; this results in a secondary and often irreversible rise in intraocular pressure that causes blindness.

The inheritance of PCAG and goniodysgenesis in the Basset Hound are not known. Until the inheritance is determined, control should be directed to removing dogs from breeding that have glaucoma and have goniodysgenesis, as well as those dogs that produce progeny affected with glaucoma. Three genetic loci, *COL1A2, RAB22A,* and *NEB,* have been implicated as possible contributors to the development of PCAG in the Basset Hound. One is an autosomal recessive missense mutation of a nebulin (NEB) residue on chromosome 19. Because 33% of unaffected animals were homozygous for the risk allele, it was hypothesized that modifying factors may be present. A genetic test is not yet available for PCAG.

POAG in the Basset Hound is caused by a 19 base pair deletion in exon 2 of *ADAMTS17.* This deletion alters the reading frame and is suspected to cause a truncated protein. The trait shows an autosomal recessive mode of inheritance. A DNA test is available.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

In the Basset Hound, ectropion is associated with an exceptionally large palpebral fissure (macroblepharon) and laxity of the canthal structures. Central lower lid ectropion is often associated with entropion of the adjacent lid segment. This causes severe ocular irritation.

It is acknowledged that factors other than genetics may play a role or be the cause of entropion and/or ectropion. However, when non-genetic factors can be ruled out, selection should be directed to a more normal head conformation that minimizes or eliminates the likelihood of the defects.

D. Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation. This terms is no longer listed on the CAER form. Please mark other conditions suspected as inherited and write macroblepharon in the comments section.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

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12. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

13. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
BASSET HOUND

	TOTAL DOGS EXAMINED	1991-1999 561		2000-2009 919		2010-2016 339	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	0		1	0.1%	0	
EYELIDS							
20.140	ectopic cilia	0		1	0.1%	0	
20.160	macropalpebral fissure	2	0.4%	15	1.6%	0	
21.000	entropion, unspecified	2	0.4%	10	1.1%	11	3.2%
22.000	ectropion, unspecified	28	5.0%	85	9.2%	18	5.3%
25.110	distichiasis	6	1.1%	11	1.2%	8	2.4%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	2	0.4%	1	0.1%	3	0.9%
NICTITANS							
51.100	third eyelid cartilage anomaly	3	0.5%	7	0.8%	10	2.9%
52.110	prolapsed gland of the third eyelid	5	0.9%	3	0.3%	1	0.3%
CORNEA							
70.210	corneal pannus	3	0.5%	0		0	
70.220	pigmentary keratitis	2	0.4%	0		1	0.3%
70.700	corneal dystrophy	1	0.2%	2	0.2%	1	0.3%
70.730	corneal endothelial degeneration	3	0.5%	1	0.1%	1	0.3%
UVEA							
93.140	corneal endothelial pigment without PPM	0		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	12	2.1%	31	3.4%	8	2.4%
93.720	persistent pupillary membranes, iris to lens	2	0.4%	8	0.9%	1	0.3%
93.730	persistent pupillary membranes, iris to cornea	10	1.8%	16	1.7%	2	0.6%
93.740	persistent pupillary membranes, iris sheets	1	0.2%	0		0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.1%	3	0.9%
93.999	uveal cysts	1	0.2%	3	0.3%	0	
LENS							
100.200	cataract, unspecified	6	1.1%	0		0	
100.210	cataract, suspect not inherited	9	1.6%	30	3.3%	13	3.8%
100.301	punctate cataract, anterior cortex	3	0.5%	9	1.0%	5	1.5%
100.302	punctate cataract, posterior cortex	1	0.2%	6	0.7%	3	0.9%
100.303	punctate cataract, equatorial cortex	0		0		5	1.5%
100.304	punctate cataract, anterior sutures	0		3	0.3%	0	
100.305	punctate cataract, posterior sutures	0		4	0.4%	3	0.9%
100.306	punctate cataract, nucleus	1	0.2%	1	0.1%	1	0.3%
100.307	punctate cataract, capsular	0		3	0.3%	3	0.9%
100.311	incipient cataract, anterior cortex	2	0.4%	3	0.3%	2	0.6%
100.312	incipient cataract, posterior cortex	6	1.1%	5	0.5%	2	0.6%
100.313	incipient cataract, equatorial cortex	0		2	0.2%	0	
100.314	incipient cataract, anterior sutures	0		1	0.1%	0	
100.315	incipient cataract, posterior sutures	2	0.4%	1	0.1%	0	
100.316	incipient cataract, nucleus	2	0.4%	0		2	0.6%
100.317	incipient cataract, capsular	0		3	0.3%	0	

OCULAR DISORDERS REPORT
BASSET HOUND

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.326	incomplete cataract, nucleus	0		0		2	0.6%
100.327	incomplete cataract, capsular	0		0		1	0.3%
100.330	generalized/complete cataract	0		5	0.5%	0	
100.375	subluxation/luxation, unspecified	1	0.2%	1	0.1%	0	
100.999	*significant cataracts (summary)*	*23*	*4.1%*	*46*	*5.0%*	*29*	*8.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.2%	6	0.7%	0	
110.135	PHPV/PTVL	0		1	0.1%	0	
110.320	vitreal degeneration	2	0.4%	1	0.1%	2	0.6%
RETINA							
120.170	retinal dysplasia, folds	3	0.5%	7	0.8%	1	0.3%
120.310	generalized progressive retinal atrophy (PRA)	0		2	0.2%	0	
120.400	retinal hemorrhage	1	0.2%	0		0	
120.910	retinal detachment without dialysis	1	0.2%	0		1	0.3%
OPTIC NERVE							
130.120	optic nerve hypoplasia	1	0.2%	0		0	
OTHER							
900.000	other, unspecified	0		4	0.4%	15	4.4%
900.100	other, not inherited	0		39	4.2%	11	3.2%
900.110	other, suspected as inherited	46	8.2%	43	4.7%	4	1.2%
NORMAL							
0.000	normal globe	432	77.0%	711	77.4%	253	74.6%

OCULAR DISORDERS REPORT

BEAGLE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	See below	1, 2	NO
B.	Glaucoma *a DNA test is available	Presumed autosomal recessive	1, 3-14	NO
C.	Distichiasis	Not defined	1	Breeder option
D.	Prolapsed gland of third eyelid	Not defined	1	Breeder option
E.	Corneal dystrophy - epithelial/stromal	Not defined	15-20	Breeder option
F.	Persistent pupillary membranes - iris to iris	Not defined	21	Breeder option
G.	Cataract	Not defined	21-23	NO
H.	Tapetal degeneration	Presumed autosomal recessive	24-27	Breeder option
I.	Retinal atrophy - generalized	Not defined	1	NO
J.	Retinal dysplasia - folds	Not defined	1	Breeder option
K.	Congenital stationary night blindness * A DNA test is available	Autosomal recessive	28	NO

Description and Comments

A. Microphthalmia with multiple congenital ocular defects

A developmental anomaly in which the eyeball is abnormally small. This is often associated with other ocular malformations, including defects of the cornea, anterior chamber, lens, and/or retina.

In the Beagle, the condition may be present unilaterally or bilaterally and is characterized by a small globe and associated ocular defects which are variable. Several forms of the condition, all apparently different, are recognized:

1) In one study, complete lens opacities were noted by 5-6 months of age; the severity of the cataract correlated closely with the extent of microphthalmia. Severely microphthalmic eyes also had multiple retinal folds. The disorder appeared to be inherited; the exact mode was not fully defined, although an X-linked disorder could not be ruled out.

2) A different form of microphthalmia is recognized in association with microphakia and persistent pupillary membrane (PPM). Based on a limited pedigree of one cross, a dominant inheritance was proposed; heterozygotes have PPM and microphakia/cataract and homozygous affected show microphthalmia and multiple congenital ocular anomalies.

3) A third form of microphthalmia is recognized in the breed. This condition is usually unilateral and the fellow eye is normal. The mode of inheritance has not been defined, but autosomal recessive inheritance is suspected.

B. Glaucoma

Glaucoma is an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

Primary open angle glaucoma is present in the breed, and extensive breeding studies have demonstrated its inheritance as autosomal recessive. By one year of age, the intraocular pressure (IOP) is elevated, but the filtration angle is open (early glaucoma). Animals with moderate glaucoma show sustained elevations of IOP, focal disinsertions of the lens zonules and focal closures of the iridocorneal angle. Later the globe enlarges, the lens luxates and the eyes become blind and show the effects of chronic glaucoma. The causative mutation in *ADAMTS10* causes an arginine for glycine substitution at position 661. A DNA test is available.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye." In the Beagle, there is an association between this condition and keratoconjunctivitis sicca (KCS).

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

In the Beagle, corneal dystrophy has been described as an oval opacity located at the junction at the middle and inferior thirds of the cornea. The opacities are caused by accumulation of cholesterol and other lipids within the cornea. Progression was noted with possible vision impairment.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Several different types of cataract (anterior capsular, posterior cortical, other) have been reported in the Beagle, but the mode of inheritance of the defects is unknown. When one considers that this breed, particularly the laboratory-bred Beagle, has been the subject of extensive ophthalmological examination, the relatively low incidence of cataracts is surprising.

H. Tapetal degeneration

The tapetum lucidum is a modified choroidal structure present in the eyes of many animals that have good night vision. In Beagles there is a recessively inherited defect of the tapetal layer. Absence of this layer is determined by ophthalmoscopy which shows that the fundus has a uniform reddish coloration. The degeneration of the tapetum occurs as a result of abnormal postnatal development of this structure. The degeneration of the tapetum does not affect vision and does not result in functional or structural damage to the retina. As such, the condition probably represents an insignificant inherited variation of no functional significance.

I. Retinal atrophy - generalized (PRA)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality may be detected by electroretinogram before it is apparent clinically. In all breeds studied to date, PRA is recessively inherited. The disease in the Beagle has not been characterized sufficiently to establish the disease frequency, the disease mechanism, or the age when early diagnosis by ophthalmoscopy and/or electroretinography is possible.

J. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

K. Congenital stationary night blindness (CSNB)

A non-progressive retinal disease characterized by night blindness; day vision is normal. This condition is very rare and has only been found to date in a research colony in Japan. The condition is inherited in an autosomal recessive manner. Affected dogs had normal retinas on clinical examination, but no detectable rod photoreceptor responses with an electroretinogram (ERG). A DNA test is available.

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OCULAR DISORDERS REPORT
BEAGLE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 429 #	 %	2000-2009 758 #	 %	2010-2016 482 #	 %
GLOBE							
0.110	microphthalmia	2	0.5%	2	0.3%	0	
EYELIDS							
21.000	entropion, unspecified	1	0.2%	1	0.1%	2	0.4%
22.000	ectropion, unspecified	0		1	0.1%	0	
25.110	distichiasis	55	12.8%	143	18.9%	108	22.4%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.2%	0		3	0.6%
40.910	keratoconjunctivitis sicca	1	0.2%	1	0.1%	1	0.2%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		1	0.2%
52.110	prolapsed gland of the third eyelid	0		8	1.1%	2	0.4%
CORNEA							
70.220	pigmentary keratitis	0		1	0.1%	0	
70.700	corneal dystrophy	1	0.2%	2	0.3%	3	0.6%
70.730	corneal endothelial degeneration	1	0.2%	1	0.1%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	3	0.7%	13	1.7%	4	0.8%
93.730	persistent pupillary membranes, iris to cornea	1	0.2%	2	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.2%
93.999	uveal cysts	0		1	0.1%	1	0.2%
LENS							
100.200	cataract, unspecified	9	2.1%	0		0	
100.210	cataract, suspect not inherited	8	1.9%	24	3.2%	17	3.5%
100.301	punctate cataract, anterior cortex	1	0.2%	4	0.5%	4	0.8%
100.302	punctate cataract, posterior cortex	1	0.2%	4	0.5%	1	0.2%
100.303	punctate cataract, equatorial cortex	0		1	0.1%	1	0.2%
100.305	punctate cataract, posterior sutures	0		3	0.4%	0	
100.307	punctate cataract, capsular	0		3	0.4%	0	
100.311	incipient cataract, anterior cortex	3	0.7%	0		0	
100.312	incipient cataract, posterior cortex	8	1.9%	5	0.7%	1	0.2%
100.313	incipient cataract, equatorial cortex	4	0.9%	2	0.3%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	0		0	
100.316	incipient cataract, nucleus	1	0.2%	3	0.4%	0	
100.317	incipient cataract, capsular	0		2	0.3%	0	
100.322	incomplete cataract, posterior cortex	0		0		1	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.2%
100.330	generalized/complete cataract	12	2.8%	6	0.8%	1	0.2%
100.375	subluxation/luxation, unspecified	0		1	0.1%	0	
100.999	*significant cataracts (summary)*	*40*	*9.3%*	*33*	*4.4%*	*10*	*2.1%*

OCULAR DISORDERS REPORT
BEAGLE

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.2%	0		0	
110.135	PHPV/PTVL	1	0.2%	0		0	
110.320	vitreal degeneration	0		2	0.3%	4	0.8%
RETINA							
120.170	retinal dysplasia, folds	11	2.6%	18	2.4%	4	0.8%
120.180	retinal dysplasia, geographic	0		2	0.3%	4	0.8%
120.310	generalized progressive retinal atrophy (PRA)	6	1.4%	2	0.3%	0	
120.910	retinal detachment without dialysis	2	0.5%	0		0	
OPTIC NERVE							
130.110	micropapilla	0		1	0.1%	0	
130.120	optic nerve hypoplasia	2	0.5%	2	0.3%	0	
130.150	optic disc coloboma	0		1	0.1%	0	
OTHER							
900.000	other, unspecified	0		4	0.5%	14	2.9%
900.100	other, not inherited	2	0.5%	42	5.5%	18	3.7%
900.110	other, suspected as inherited	5	1.2%	3	0.4%	0	
NORMAL							
0.000	normal globe	329	76.7%	556	73.4%	341	70.7%

BEARDED COLLIE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	2,3	Breeder option
D.	Cataract	Not defined	2	NO
E.	Retinal dysplasia - folds	Not defined	2	Breeder option
F.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma * a DNA test is available	Autosomal recessive	3-6	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

OCULAR DISORDERS REPORT

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached), which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

F. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

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OCULAR DISORDERS REPORT
BEARDED COLLIE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1485 #	%	2000-2009 1733 #	%	2010-2016 653 #	%
GLOBE							
0.110	microphthalmia	2	0.1%	0		0	
EYELIDS							
25.110	distichiasis	8	0.5%	10	0.6%	11	1.7%
CORNEA							
70.700	corneal dystrophy	18	1.2%	22	1.3%	9	1.4%
70.730	corneal endothelial degeneration	0		1	0.1%	0	
UVEA							
93.150	iris coloboma	1	0.1%	0		0	
93.710	persistent pupillary membranes, iris to iris	45	3.0%	79	4.6%	34	5.2%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	4	0.2%	4	0.6%
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0		0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.2%
93.999	uveal cysts	1	0.1%	4	0.2%	4	0.6%
LENS							
100.200	cataract, unspecified	12	0.8%	0		0	
100.210	cataract, suspect not inherited	114	7.7%	187	10.8%	89	13.6%
100.301	punctate cataract, anterior cortex	24	1.6%	8	0.5%	6	0.9%
100.302	punctate cataract, posterior cortex	10	0.7%	3	0.2%	2	0.3%
100.303	punctate cataract, equatorial cortex	14	0.9%	12	0.7%	1	0.2%
100.304	punctate cataract, anterior sutures	3	0.2%	2	0.1%	0	
100.305	punctate cataract, posterior sutures	13	0.9%	5	0.3%	3	0.5%
100.306	punctate cataract, nucleus	1	0.1%	3	0.2%	2	0.3%
100.307	punctate cataract, capsular	3	0.2%	3	0.2%	3	0.5%
100.311	incipient cataract, anterior cortex	13	0.9%	19	1.1%	6	0.9%
100.312	incipient cataract, posterior cortex	9	0.6%	18	1.0%	6	0.9%
100.313	incipient cataract, equatorial cortex	5	0.3%	15	0.9%	3	0.5%
100.314	incipient cataract, anterior sutures	1	0.1%	2	0.1%	0	
100.315	incipient cataract, posterior sutures	0		10	0.6%	0	
100.316	incipient cataract, nucleus	8	0.5%	4	0.2%	1	0.2%
100.317	incipient cataract, capsular	2	0.1%	5	0.3%	3	0.5%
100.321	incomplete cataract, anterior cortex	0		0		3	0.5%
100.322	incomplete cataract, posterior cortex	0		0		1	0.2%
100.330	generalized/complete cataract	2	0.1%	3	0.2%	0	
100.375	subluxation/luxation, unspecified	1	0.1%	4	0.2%	1	0.2%
100.999	*significant cataracts (summary)*	*120*	*8.1%*	*112*	*6.5%*	*40*	*6.1%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	5	0.3%	1	0.1%	0	
110.320	vitreal degeneration	1	0.1%	4	0.2%	2	0.3%
FUNDUS							
97.110	choroidal hypoplasia	7	0.5%	15	0.9%	0	
97.120	coloboma	1	0.1%	3	0.2%	0	

OCULAR DISORDERS REPORT
BEARDED COLLIE

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	21	1.4%	26	1.5%	5	0.8%
120.180	retinal dysplasia, geographic	0		0		2	0.3%
120.310	generalized progressive retinal atrophy (PRA)	4	0.3%	4	0.2%	0	
120.960	retinopathy	0		0		2	0.3%
OPTIC NERVE							
130.150	optic disc coloboma	0		1	0.1%	0	
OTHER							
900.000	other, unspecified	0		14	0.8%	23	3.5%
900.100	other, not inherited	10	0.7%	63	3.6%	11	1.7%
900.110	other, suspected as inherited	15	1.0%	5	0.3%	0	
NORMAL							
0.000	normal globe	1191	80.2%	1411	81.4%	510	78.1%

BEAUCERON

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - lens pigment foci/no strands	Not defined	1	Passes with no notation
B.	Vitreous degeneration	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Beauceron breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
BEAUCERON

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 0 #	 %	2000-2009 12 #	 %	2010-2016 150 #	 %
GLOBE							
0.110	microphthalmia	0		0		1	0.7%
EYELIDS							
25.110	distichiasis	0		0		2	1.3%
CORNEA							
70.210	corneal pannus	0		0		1	0.7%
70.700	corneal dystrophy	0		0		1	0.7%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		2	1.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		8	5.3%
LENS							
100.210	cataract, suspect not inherited	0		0		3	2.0%
100.302	punctate cataract, posterior cortex	0		0		1	0.7%
100.305	punctate cataract, posterior sutures	0		0		2	1.3%
100.307	punctate cataract, capsular	0		0		1	0.7%
100.315	incipient cataract, posterior sutures	0		0		2	1.3%
100.316	incipient cataract, nucleus	0		0		1	0.7%
100.317	incipient cataract, capsular	0		0		1	0.7%
100.999	*significant cataracts (summary)*	*0*		*0*		*8*	*5.3%*
VITREOUS							
110.320	vitreal degeneration	0		0		6	4.0%
RETINA							
120.180	retinal dysplasia, geographic	0		1	8.3%	0	
OTHER							
900.000	other, unspecified	0		2	16.7%	1	0.7%
900.100	other, not inherited	0		0		5	3.3%
NORMAL							
0.000	normal globe	0		11	91.7%	121	80.7%

BEDLINGTON TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Imperforate lacrimal punctum	Not defined	1, 2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	3, 4	Breeder option
D.	Cataract	Not defined	1	
E.	Retinal dysplasia - geographic - detached	Presumed autosomal recessive	1, 5, 6	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

B. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct located at the medial lid margins. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

In the Bedlington Terrier, studies have indicated an autosomal recessive mode of inheritance for this form of retinal dysplasia. Affected animals are generally blind at birth due to complete retinal detachment and disorganization. Cataracts may also be seen with this condition.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Barnett KC. Imperforate and micro-lachrymal puncta in the dog. *J Small Anim Pract*. 1979 Aug;20:481-490.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. Rubin LF. Heredity of retinal dysplasia in the Bedlington terrier. *J Am Vet Med Assoc*. 1968;152:260.

6. Rubin LF. Hereditary retinal detachment in Bedlington terriers. *Vet Med Small Anim Clin*. 1963;3:387.

OCULAR DISORDERS REPORT
BEDLINGTON TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 416 #	%	2000-2009 780 #	%	2010-2016 454 #	%
GLOBE								
0.110	microphthalmia		1	0.2%	2	0.3%	1	0.2%
EYELIDS								
20.140	ectopic cilia		2	0.5%	0		0	
21.000	entropion, unspecified		1	0.2%	1	0.1%	0	
25.110	distichiasis		49	11.8%	51	6.5%	29	6.4%
NASOLACRIMAL								
32.110	imperforate lower nasolacrimal punctum		4	1.0%	0		8	1.8%
NICTITANS								
52.110	prolapsed gland of the third eyelid		0		0		1	0.2%
CORNEA								
70.220	pigmentary keratitis		0		0		1	0.2%
70.700	corneal dystrophy		1	0.2%	5	0.6%	1	0.2%
UVEA								
93.710	persistent pupillary membranes, iris to iris		5	1.2%	73	9.4%	52	11.5%
93.720	persistent pupillary membranes, iris to lens		1	0.2%	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		4	1.0%	1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		2	0.5%	1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		1	0.1%	0	
LENS								
100.200	cataract, unspecified		13	3.1%	0		0	
100.210	cataract, suspect not inherited		24	5.8%	53	6.8%	42	9.3%
100.301	punctate cataract, anterior cortex		0		6	0.8%	2	0.4%
100.302	punctate cataract, posterior cortex		1	0.2%	1	0.1%	1	0.2%
100.303	punctate cataract, equatorial cortex		0		6	0.8%	2	0.4%
100.304	punctate cataract, anterior sutures		1	0.2%	0		1	0.2%
100.305	punctate cataract, posterior sutures		0		9	1.2%	6	1.3%
100.307	punctate cataract, capsular		0		1	0.1%	2	0.4%
100.311	incipient cataract, anterior cortex		7	1.7%	23	2.9%	9	2.0%
100.312	incipient cataract, posterior cortex		5	1.2%	8	1.0%	5	1.1%
100.313	incipient cataract, equatorial cortex		10	2.4%	13	1.7%	8	1.8%
100.314	incipient cataract, anterior sutures		0		4	0.5%	0	
100.315	incipient cataract, posterior sutures		0		7	0.9%	2	0.4%
100.316	incipient cataract, nucleus		0		3	0.4%	0	
100.317	incipient cataract, capsular		0		0		1	0.2%
100.321	incomplete cataract, anterior cortex		0		0		1	0.2%
100.322	incomplete cataract, posterior cortex		0		0		1	0.2%
100.330	generalized/complete cataract		3	0.7%	11	1.4%	0	
100.375	subluxation/luxation, unspecified		0		1	0.1%	0	
100.999	*significant cataracts (summary)*		*40*	*9.6%*	*92*	*11.8%*	*41*	*9.0%*
VITREOUS								
110.320	vitreal degeneration		1	0.2%	2	0.3%	4	0.9%

OCULAR DISORDERS REPORT
BEDLINGTON TERRIER

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	3	0.7%	3	0.4%	2	0.4%
120.190	retinal dysplasia, detached	0		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.2%	0		2	0.4%
120.910	retinal detachment without dialysis	0		1	0.1%	0	
120.960	retinopathy	0		0		1	0.2%
OPTIC NERVE							
130.120	optic nerve hypoplasia	1	0.2%	0		0	
130.150	optic disc coloboma	1	0.2%	4	0.5%	0	
OTHER							
900.000	other, unspecified	0		8	1.0%	5	1.1%
900.100	other, not inherited	2	0.5%	31	4.0%	11	2.4%
900.110	other, suspected as inherited	3	0.7%	3	0.4%	1	0.2%
NORMAL							
0.000	normal globe	324	77.9%	590	75.6%	314	69.2%

BELGIAN LAEKENOIS

There are 4 varieties of Belgian Shepherd- the Groenendael, Laekenois, Malinois and Tervuren. In Europe these varieties may be interbred and are not considered genetically distinct, thus it is likely that the same genetic diseases exist in all four. In the United States the Groenendael (known as the Belgian Sheepdog), Malinois, Tervuren and Laekenois are recognized as separate breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Belgian Laekenois breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

OCULAR DISORDERS REPORT
BELGIAN LAEKENOIS

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 18 #	%	2000-2009 94 #	%	2010-2016 47 #	%
EYELIDS							
25.110	distichiasis	0		5	5.3%	0	
CORNEA							
70.700	corneal dystrophy	0		1	1.1%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		1	1.1%	0	
LENS							
100.210	cataract, suspect not inherited	0		8	8.5%	8	17.0%
VITREOUS							
110.320	vitreal degeneration	0		2	2.1%	3	6.4%
RETINA							
120.170	retinal dysplasia, folds	1	5.6%	5	5.3%	0	
OTHER							
900.000	other, unspecified	0		3	3.2%	1	2.1%
900.100	other, not inherited	0		4	4.3%	2	4.3%
NORMAL							
0.000	normal globe	17	94.4%	76	80.9%	38	80.9%

OCULAR DISORDERS REPORT

BELGIAN MALINOIS

There are 4 varieties of Belgian Shepherd- the Groenendael, Laekenois, Malinois and Tervuren. In Europe these varieties may be interbred and are not considered genetically distinct, thus it is likely that the same genetic diseases exist in all four. In the United States the Groenendael (known as the Belgian Sheepdog), Malinois, Tervuren and Laekenois are recognized as separate breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Chronic superficial keratitis/pannus	Not defined	1	NO
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	3	NO
D.	Vitreous degeneration	Not defined	4	Breeder Option
E.	Retinal dysplasia - folds	Not defined	3	Breeder option
F.	Retinal atrophy - generalized/ retinopathy	Not defined	2, 5	NO

Description and Comments

A. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

OCULAR DISORDERS REPORT

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Belgian Malinois, cataract most often occurs as a non-progressive, triangular opacity in the posterior cortex.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

F. Retinal degeneration – generalized/Retinopathy

A unilateral or bilateral retinal disease which can be progressive. When bilateral, the ophthalmoscopic lesions are sometimes asymmetrical, particularly in the early stages of the disease. Fundus examination shows initially single or multiple focal retinal lesions that appear active (local infiltrative inflammation or granulation) or inactive. The lesions can progress resulting in widespread retinal atrophy. The end-stage ophthalmoscopic lesions vary and may appear indistinguishable from PRA, or may be more characteristic of an inflammatory retinopathy. The asymmetry of the fundus abnormalities and the presence of inflammatory lesions in the retina and choroid help to differentiate this disorder from PRA. The mode of inheritance of this disease is not known; however, studies of different families suggest that it is possibly inherited.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Belgian Malinois breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

5. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

CVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

OCULAR DISORDERS REPORT
BELGIAN MALINOIS

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 562 #	%	2000-2009 1248 #	%	2010-2016 957 #	%
GLOBE							
0.110	microphthalmia	0		1	0.1%	1	0.1%
EYELIDS							
22.000	ectropion, unspecified	0		0		1	0.1%
25.110	distichiasis	2	0.4%	0		0	
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		2	0.2%
CORNEA							
70.210	corneal pannus	2	0.4%	5	0.4%	3	0.3%
70.220	pigmentary keratitis	0		1	0.1%	0	
70.700	corneal dystrophy	7	1.2%	5	0.4%	5	0.5%
70.730	corneal endothelial degeneration	0		2	0.2%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	4	0.7%	13	1.0%	14	1.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.1%
93.999	uveal cysts	1	0.2%	7	0.6%	2	0.2%
LENS							
100.200	cataract, unspecified	3	0.5%	0		0	
100.210	cataract, suspect not inherited	16	2.8%	49	3.9%	57	6.0%
100.301	punctate cataract, anterior cortex	4	0.7%	6	0.5%	4	0.4%
100.302	punctate cataract, posterior cortex	0		4	0.3%	4	0.4%
100.303	punctate cataract, equatorial cortex	0		1	0.1%	0	
100.304	punctate cataract, anterior sutures	2	0.4%	0		0	
100.305	punctate cataract, posterior sutures	1	0.2%	6	0.5%	5	0.5%
100.306	punctate cataract, nucleus	0		1	0.1%	1	0.1%
100.307	punctate cataract, capsular	0		1	0.1%	0	
100.311	incipient cataract, anterior cortex	1	0.2%	8	0.6%	7	0.7%
100.312	incipient cataract, posterior cortex	6	1.1%	11	0.9%	7	0.7%
100.313	incipient cataract, equatorial cortex	1	0.2%	4	0.3%	1	0.1%
100.314	incipient cataract, anterior sutures	4	0.7%	3	0.2%	0	
100.315	incipient cataract, posterior sutures	2	0.4%	6	0.5%	0	
100.316	incipient cataract, nucleus	8	1.4%	6	0.5%	1	0.1%
100.317	incipient cataract, capsular	0		0		2	0.2%
100.324	incomplete cataract, anterior sutures	0		0		1	0.1%
100.330	generalized/complete cataract	1	0.2%	4	0.3%	1	0.1%
100.375	subluxation/luxation, unspecified	1	0.2%	0		0	
100.999	*significant cataracts (summary)*	*33*	*5.9%*	*61*	*4.9%*	*34*	*3.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.1%	1	0.1%
110.135	PHPV/PTVL	0		0		2	0.2%
110.320	vitreal degeneration	3	0.5%	13	1.0%	2	0.2%

OCULAR DISORDERS REPORT
BELGIAN MALINOIS

		1991-1999		2000-2009		2010-2016	
FUNDUS							
97.120	coloboma	0		0		1	0.1%
RETINA							
120.170	retinal dysplasia, folds	14	2.5%	6	0.5%	4	0.4%
120.180	retinal dysplasia, geographic	4	0.7%	0		2	0.2%
120.190	retinal dysplasia, detached	1	0.2%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	7	1.2%	5	0.4%	1	0.1%
120.910	retinal detachment without dialysis	2	0.4%	2	0.2%	0	
120.920	retinal detachment with dialysis	0		0		6	0.6%
120.960	retinopathy	0		0		1	0.1%
OPTIC NERVE							
130.150	optic disc coloboma	0		0		3	0.3%
OTHER							
900.000	other, unspecified	0		6	0.5%	15	1.6%
900.100	other, not inherited	4	0.7%	74	5.9%	24	2.5%
900.110	other, suspected as inherited	8	1.4%	1	0.1%	0	
NORMAL							
0.000	normal globe	484	86.1%	1128	90.4%	833	87.0%

BELGIAN SHEEPDOG

(BELGIAN SHEPHERD-GROENENDAEL)

There are 4 varieties of Belgian Shepherd- the Groenendael, Laekenois, Malinois and Tervuren. In Europe these varieties may be interbred and are not considered genetically distinct, thus it is likely that the same genetic diseases exist in all four. In the United States the Groenendael (known as the Belgian Sheepdog), Malinois, Tervuren and Laekenois are recognized as separate breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Chronic superficial keratitis/pannus	Not defined	1	NO
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
D.	Cataract	Not defined	1	NO
E.	Retinal atrophy - generalized	Presumed autosomal recessive	1, 3	NO
F.	Retinal dysplasia - folds	Not defined	2, 4	Breeder option
G.	Micropapilla	Not defined	1	Breeder option
H.	Achiasmic optic nerves with nystagmus	Autosomal recessive	5	NO

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

OCULAR DISORDERS REPORT

B. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Belgian Sheepdog, cataract most often occurs as a non-progressive, triangular opacity in the posterior cortex.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Limited breeding studies in the Belgian Sheepdog suggest an autosomal recessive mode of inheritance.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

H. Achiasmatic optic nerves with nystagmus

Achiasmatic optic nerves with nystagmus have been described in a small family of black Belgian Sheepdogs. Congenital nystagmus is the clinical sign most commonly noted. All retinal ganglion cell axons extend directly into the ipsilateral optic disc with no chiasmal decussation. No optic nerve hypoplasia/micropapilla was noted in the animals studied and reported.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. Miller TR. Generalized retinopathy in the Belgian shepherds. *Invest Ophthalmol Vis Sci*. 1986;27 (Suppl):310.

4. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

5. Hogan D and Williams RW. Analysis of the retinas and optic nerves of achiasmatic Belgian sheepdogs. *The Journal of comparative neurology.* 1995 Feb 13;352:367-380.

5. *rative neurology*. 1995 Feb 13;352:367-380.

OCULAR DISORDERS REPORT
BELGIAN SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1742 #	 %	2000-2009 2648 #	 %	2010-2016 1464 #	 %
GLOBE							
10.000	glaucoma	0		1	0.0%	0	
EYELIDS							
22.000	ectropion, unspecified	0		1	0.0%	0	
25.110	distichiasis	4	0.2%	4	0.2%	4	0.3%
NICTITANS							
50.210	pannus of third eyelid	0		0		3	0.2%
51.100	third eyelid cartilage anomaly	0		1	0.0%	2	0.1%
CORNEA							
70.210	corneal pannus	11	0.6%	23	0.9%	21	1.4%
70.220	pigmentary keratitis	1	0.1%	2	0.1%	0	
70.700	corneal dystrophy	11	0.6%	15	0.6%	6	0.4%
70.730	corneal endothelial degeneration	1	0.1%	0		0	
UVEA							
93.140	corneal endothelial pigment without PPM	0		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	78	4.5%	204	7.7%	143	9.8%
93.720	persistent pupillary membranes, iris to lens	0		3	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	0		3	0.1%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	2	0.1%	3	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		11	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		3	0.2%
93.999	uveal cysts	0		3	0.1%	0	
97.150	chorioretinal coloboma, congenital	0		0		1	0.1%
LENS							
100.200	cataract, unspecified	13	0.7%	0		0	
100.210	cataract, suspect not inherited	48	2.8%	95	3.6%	66	4.5%
100.301	punctate cataract, anterior cortex	2	0.1%	9	0.3%	8	0.5%
100.302	punctate cataract, posterior cortex	12	0.7%	24	0.9%	4	0.3%
100.303	punctate cataract, equatorial cortex	1	0.1%	4	0.2%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	1	0.0%	1	0.1%
100.305	punctate cataract, posterior sutures	4	0.2%	5	0.2%	6	0.4%
100.306	punctate cataract, nucleus	1	0.1%	3	0.1%	0	
100.307	punctate cataract, capsular	0		3	0.1%	6	0.4%
100.311	incipient cataract, anterior cortex	3	0.2%	17	0.6%	5	0.3%
100.312	incipient cataract, posterior cortex	15	0.9%	32	1.2%	12	0.8%
100.313	incipient cataract, equatorial cortex	6	0.3%	4	0.2%	3	0.2%
100.314	incipient cataract, anterior sutures	1	0.1%	3	0.1%	0	
100.315	incipient cataract, posterior sutures	5	0.3%	8	0.3%	1	0.1%
100.316	incipient cataract, nucleus	10	0.6%	1	0.0%	0	
100.317	incipient cataract, capsular	0		4	0.2%	2	0.1%
100.325	incomplete cataract, posterior sutures	0		0		1	0.1%
100.330	generalized/complete cataract	0		3	0.1%	4	0.3%
100.375	subluxation/luxation, unspecified	0		0		1	0.1%
100.999	*significant cataracts (summary)*	*74*	*4.2%*	*121*	*4.6%*	*53*	*3.6%*

OCULAR DISORDERS REPORT
BELGIAN SHEEPDOG

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.1%	2	0.1%	0	
110.320	vitreal degeneration	0		1	0.0%	3	0.2%
FUNDUS							
97.120	coloboma	1	0.1%	1	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	6	0.3%	28	1.1%	4	0.3%
120.180	retinal dysplasia, geographic	2	0.1%	3	0.1%	2	0.1%
120.310	generalized progressive retinal atrophy (PRA)	1	0.1%	3	0.1%	0	
120.910	retinal detachment without dialysis	0		1	0.0%	1	0.1%
OPTIC NERVE							
130.110	micropapilla	1	0.1%	11	0.4%	17	1.2%
130.120	optic nerve hypoplasia	11	0.6%	1	0.0%	1	0.1%
130.150	optic disc coloboma	5	0.3%	0		0	
OTHER							
900.000	other, unspecified	0		20	0.8%	34	2.3%
900.100	other, not inherited	5	0.3%	107	4.0%	32	2.2%
900.110	other, suspected as inherited	11	0.6%	8	0.3%	0	
NORMAL							
0.000	normal globe	1503	86.3%	2305	87.0%	1192	81.4%

BELGIAN TERVUREN

There are 4 varieties of Belgian Shepherd- the Groenendael, Laekenois, Malinois and Tervuren. In Europe these varieties may be interbred and are not considered genetically distinct, thus it is likely that the same genetic diseases exist in all four. In the United States the Groenendael (known as the Belgian Sheepdog), Malinois, Tervuren and Laekenois are recognized as separate breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Chronic superficial keratitis/pannus	Not defined	2, 3	NO
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
D.	Cataract	Not defined	2	NO
E.	Retinal atrophy - generalized	Presumed autosomal recessive	2	NO
F.	Retinal dysplasia - folds	Not defined	1, 4	Breeder option
G.	Retinal dysplasia - geographic	Not defined	1	NO
H.	Micropapilla	Not defined	2	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Belgian Tervuren, cataract most often occurs as a non-progressive, triangular opacity in the posterior cortex.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

In the Belgian Tervuren concern has been high regarding PRA. Recently, an entire litter from known carrier background were examined with 4 of 6 individuals affected. Age of clinical onset appears to be about 4-5 yrs.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Retinal dysplasia - geographic

Abnormal development of the retina present at birth. Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

H. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

References

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. Chavkin MJ, Roberts SM, Salman MD, et al. Risk factors for development of chronic superficial keratitis in dogs. *J Am Vet Med Assoc*. 1994 May 15;204:1630-1634.

4. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

OCULAR DISORDERS REPORT
BELGIAN TERVUREN

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 4447 #	%	2000-2009 5570 #	%	2010-2016 2940 #	%
GLOBE							
0.110	microphthalmia	2	0.0%	2	0.0%	0	
10.000	glaucoma	1	0.0%	0		0	
EYELIDS							
21.000	entropion, unspecified	1	0.0%	2	0.0%	0	
25.110	distichiasis	36	0.8%	59	1.1%	20	0.7%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		2	0.0%	0	
NICTITANS							
50.210	pannus of third eyelid	0		0		7	0.2%
51.100	third eyelid cartilage anomaly	1	0.0%	0		17	0.6%
52.110	prolapsed gland of the third eyelid	0		1	0.0%	0	
CORNEA							
70.210	corneal pannus	11	0.2%	41	0.7%	44	1.5%
70.220	pigmentary keratitis	0		2	0.0%	6	0.2%
70.700	corneal dystrophy	25	0.6%	28	0.5%	19	0.6%
70.730	corneal endothelial degeneration	4	0.1%	3	0.1%	0	
UVEA							
93.150	iris coloboma	1	0.0%	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	196	4.4%	485	8.7%	301	10.2%
93.720	persistent pupillary membranes, iris to lens	6	0.1%	6	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.0%	2	0.0%	1	0.0%
93.740	persistent pupillary membranes, iris sheets	5	0.1%	9	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	0.1%	30	1.0%
93.810	uveal melanoma	0		0		1	0.0%
93.999	uveal cysts	5	0.1%	6	0.1%	6	0.2%
LENS							
100.200	cataract, unspecified	66	1.5%	0		0	
100.210	cataract, suspect not inherited	174	3.9%	312	5.6%	197	6.7%
100.301	punctate cataract, anterior cortex	17	0.4%	29	0.5%	19	0.6%
100.302	punctate cataract, posterior cortex	26	0.6%	42	0.8%	23	0.8%
100.303	punctate cataract, equatorial cortex	5	0.1%	9	0.2%	3	0.1%
100.304	punctate cataract, anterior sutures	1	0.0%	1	0.0%	1	0.0%
100.305	punctate cataract, posterior sutures	10	0.2%	11	0.2%	11	0.4%
100.306	punctate cataract, nucleus	2	0.0%	1	0.0%	1	0.0%
100.307	punctate cataract, capsular	2	0.0%	10	0.2%	7	0.2%
100.311	incipient cataract, anterior cortex	22	0.5%	25	0.4%	13	0.4%
100.312	incipient cataract, posterior cortex	36	0.8%	67	1.2%	32	1.1%
100.313	incipient cataract, equatorial cortex	2	0.0%	14	0.3%	3	0.1%
100.314	incipient cataract, anterior sutures	1	0.0%	4	0.1%	1	0.0%
100.315	incipient cataract, posterior sutures	8	0.2%	14	0.3%	6	0.2%
100.316	incipient cataract, nucleus	0		2	0.0%	1	0.0%
100.317	incipient cataract, capsular	1	0.0%	12	0.2%	2	0.1%
100.322	incomplete cataract, posterior cortex	0		0		1	0.0%
100.330	generalized/complete cataract	4	0.1%	8	0.1%	0	

OCULAR DISORDERS REPORT
BELGIAN TERVUREN

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.340	resorbing/hypermature cataract	0		0		1	0.0%
100.375	subluxation/luxation, unspecified	1	0.0%	0		0	
100.999	*significant cataracts (summary)*	*203*	*4.6%*	*249*	*4.5%*	*125*	*4.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	4	0.1%	2	0.0%	5	0.2%
110.135	PHPV/PTVL	0		2	0.0%	1	0.0%
110.320	vitreal degeneration	5	0.1%	18	0.3%	9	0.3%
FUNDUS							
97.110	choroidal hypoplasia	1	0.0%	0		0	
97.120	coloboma	0		2	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	14	0.3%	21	0.4%	7	0.2%
120.180	retinal dysplasia, geographic	5	0.1%	3	0.1%	4	0.1%
120.310	generalized progressive retinal atrophy (PRA)	15	0.3%	6	0.1%	2	0.1%
120.910	retinal detachment without dialysis	1	0.0%	0		0	
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		3	0.1%
OPTIC NERVE							
130.110	micropapilla	8	0.2%	73	1.3%	44	1.5%
130.120	optic nerve hypoplasia	84	1.9%	4	0.1%	6	0.2%
130.150	optic disc coloboma	2	0.0%	2	0.0%	0	
OTHER							
900.000	other, unspecified	0		33	0.6%	74	2.5%
900.100	other, not inherited	27	0.6%	222	4.0%	127	4.3%
900.110	other, suspected as inherited	38	0.9%	9	0.2%	2	0.1%
NORMAL							
0.000	normal globe	3748	84.3%	4708	84.5%	2282	77.6%

BERGER PICARD
(PICARDY SHEPHERD- PICARDIE)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Nictitans cartilage anomaly/eversion	Not defined	2	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- all other forms	Not defined	1	NO
E.	Cataract	Not defined	1	NO
F.	Retinal atrophy - generalized	Not defined	2	NO
G.	Retinal dysplasia - folds	Not defined	3	Breeder option
H.	Retinal dysplasia - geographic/ detached	Autosomal recessive		NO
I.	Retinopathy	Not defined	2	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

OCULAR DISORDERS REPORT

B. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

C. Corneal dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality is also known as progressive retinal atrophy or PRA, and may be detected by electroretinogram (not part of a routine eye screening examination) before there are detectable funduscopic changes seen by ophthalmoscopy. There are multiple genetic types of PRA including the rod cone dysplasias described elsewhere.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

I. Retinopathy

A lesion similar to canine multi-focal retinopathy has been noted in the Berger Picard. The lesions initially appear as multifocal sub-retinal fluid elevations that over time may become hyper-reflective lesions.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Berger Picard breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2010.

4. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 2016.

OCULAR DISORDERS REPORT
BERGER PICARD

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	0		109		840	
Diagnostic Name		#	%	#	%	#	%
EYELIDS							
25.110	distichiasis	0		10	9.2%	62	7.4%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		2	0.2%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		18	2.1%
CORNEA							
70.700	corneal dystrophy	0		1	0.9%	15	1.8%
UVEA							
90.250	pigmentary uveitis	0		0		1	0.1%
93.710	persistent pupillary membranes, iris to iris	0		29	26.6%	196	23.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.1%
93.810	uveal melanoma	0		0		1	0.1%
93.999	uveal cysts	0		0		4	0.5%
LENS							
100.210	cataract, suspect not inherited	0		16	14.7%	90	10.7%
100.301	punctate cataract, anterior cortex	0		0		1	0.1%
100.302	punctate cataract, posterior cortex	0		0		1	0.1%
100.305	punctate cataract, posterior sutures	0		5	4.6%	18	2.1%
100.307	punctate cataract, capsular	0		0		4	0.5%
100.311	incipient cataract, anterior cortex	0		0		2	0.2%
100.312	incipient cataract, posterior cortex	0		0		8	1.0%
100.314	incipient cataract, anterior sutures	0		1	0.9%	0	
100.315	incipient cataract, posterior sutures	0		4	3.7%	3	0.4%
100.322	incomplete cataract, posterior cortex	0		0		3	0.4%
100.326	incomplete cataract, nucleus	0		0		1	0.1%
100.999	*significant cataracts (summary)*	*0*		*10*	*9.2%*	*41*	*4.9%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		0		5	0.6%
110.320	vitreal degeneration	0		1	0.9%	0	
RETINA							
120.170	retinal dysplasia, folds	0		18	16.5%	167	19.9%
120.180	retinal dysplasia, geographic	0		0		8	1.0%
120.190	retinal dysplasia, detached	0		0		1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	0		2	1.8%	16	1.9%
120.960	retinopathy	0		0		41	4.9%
OPTIC NERVE							
130.150	optic disc coloboma	0		0		1	0.1%

OCULAR DISORDERS REPORT
BERGER PICARD

	1991-1999	2000-2009	2010-2016
OTHER			
900.000 other, unspecified	0	15 13.8%	10 1.2%
900.100 other, not inherited	0	4 3.7%	41 4.9%
900.110 other, suspected as inherited	0	1 0.9%	15 1.8%
NORMAL			
0.000 normal globe	0	50 45.9%	377 44.9%

OCULAR DISORDERS REPORT

BERNESE MOUNTAIN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Ectropion	Not defined	2, 3	Breeder option
C.	Distichiasis	Not defined	4	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	3	Breeder option
E.	Cataract	Not defined	3, 4	NO
F.	Retinal atrophy - generalized	Not defined	1, 5	NO
G.	Systemic histiocytosis	Not defined	6-10	NO

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

In the Bernese Mountain Dog, one French report found the early onset retinopathy to be functionally and electroretinographically similar to the congenital stationary night blindness (retinal dystrophy) seen in the Briard.

G. Systemic histiocytosis

An inflammatory, non-neoplastic disease arising from activated dermal Langerhans cells with an absence of infectious agents that responds to immunoregulatory drugs suggesting immune dysregulatory mechanisms. Seen as conjunctivitis, episcleritis, anterior and posterior uveitis, retinal detachments, and glaucoma. Malignant histiocytosis is a malignant histiocytic disease that is familial in the Bernese Mountain Dog with a polygenic mode of inheritance that represents up to 25% of all tumors in the breed.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

5. Chaudieu G and Molon-Noblot S. Early retinopathy in the Bernese Mountain Dog in France: preliminary observations. *Vet Ophthalmol*. 2004 May-Jun;7:175-184.

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OCULAR DISORDERS REPORT
BERNESE MOUNTAIN DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 2881 #	%	2000-2009 8772 #	%	2010-2016 5027 #	%
GLOBE							
0.110	microphthalmia	3	0.1%	2	0.0%	3	0.1%
10.000	glaucoma	0		0		1	0.0%
EYELIDS							
20.160	macropalpebral fissure	8	0.3%	13	0.1%	4	0.1%
21.000	entropion, unspecified	52	1.8%	150	1.7%	47	0.9%
22.000	ectropion, unspecified	24	0.8%	58	0.7%	27	0.5%
25.110	distichiasis	23	0.8%	71	0.8%	61	1.2%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.0%
40.910	keratoconjunctivitis sicca	0		0		1	0.0%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		13	0.1%	29	0.6%
52.110	prolapsed gland of the third eyelid	0		1	0.0%	0	
CORNEA							
70.210	corneal pannus	0		2	0.0%	0	
70.700	corneal dystrophy	10	0.3%	37	0.4%	16	0.3%
70.730	corneal endothelial degeneration	3	0.1%	1	0.0%	0	
UVEA							
90.250	pigmentary uveitis	0		0		1	0.0%
93.110	iris hypoplasia	0		0		2	0.0%
93.150	iris coloboma	0		4	0.0%	5	0.1%
93.710	persistent pupillary membranes, iris to iris	59	2.0%	359	4.1%	205	4.1%
93.720	persistent pupillary membranes, iris to lens	7	0.2%	7	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	2	0.1%	3	0.0%	1	0.0%
93.740	persistent pupillary membranes, iris sheets	0		4	0.0%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.0%	20	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		9	0.2%
93.810	uveal melanoma	0		0		1	0.0%
93.999	uveal cysts	7	0.2%	31	0.4%	16	0.3%
LENS							
100.200	cataract, unspecified	6	0.2%	0		0	
100.210	cataract, suspect not inherited	134	4.7%	587	6.7%	274	5.5%
100.301	punctate cataract, anterior cortex	13	0.5%	42	0.5%	28	0.6%
100.302	punctate cataract, posterior cortex	18	0.6%	50	0.6%	16	0.3%
100.303	punctate cataract, equatorial cortex	9	0.3%	24	0.3%	12	0.2%
100.304	punctate cataract, anterior sutures	2	0.1%	8	0.1%	4	0.1%
100.305	punctate cataract, posterior sutures	4	0.1%	21	0.2%	6	0.1%
100.306	punctate cataract, nucleus	4	0.1%	8	0.1%	10	0.2%
100.307	punctate cataract, capsular	1	0.0%	10	0.1%	5	0.1%
100.311	incipient cataract, anterior cortex	10	0.3%	27	0.3%	19	0.4%
100.312	incipient cataract, posterior cortex	33	1.1%	100	1.1%	43	0.9%
100.313	incipient cataract, equatorial cortex	10	0.3%	71	0.8%	21	0.4%
100.314	incipient cataract, anterior sutures	0		6	0.1%	2	0.0%

OCULAR DISORDERS REPORT
BERNESE MOUNTAIN DOG

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.315	incipient cataract, posterior sutures	7	0.2%	18	0.2%	5	0.1%
100.316	incipient cataract, nucleus	8	0.3%	15	0.2%	6	0.1%
100.317	incipient cataract, capsular	6	0.2%	29	0.3%	12	0.2%
100.322	incomplete cataract, posterior cortex	0		0		3	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.0%
100.326	incomplete cataract, nucleus	0		0		1	0.0%
100.327	incomplete cataract, capsular	0		0		1	0.0%
100.330	generalized/complete cataract	8	0.3%	18	0.2%	2	0.0%
100.340	resorbing/hypermature cataract	0		0		1	0.0%
100.375	subluxation/luxation, unspecified	2	0.1%	5	0.1%	2	0.0%
100.999	*significant cataracts (summary)*	*139*	*4.8%*	*447*	*5.1%*	*198*	*3.9%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	7	0.2%	12	0.1%	8	0.2%
110.135	PHPV/PTVL	2	0.1%	2	0.0%	5	0.1%
110.320	vitreal degeneration	7	0.2%	21	0.2%	1	0.0%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	7	0.2%	14	0.2%	14	0.3%
120.180	retinal dysplasia, geographic	1	0.0%	3	0.0%	4	0.1%
120.190	retinal dysplasia, detached	0		1	0.0%	2	0.0%
120.310	generalized progressive retinal atrophy (PRA)	17	0.6%	29	0.3%	5	0.1%
120.400	retinal hemorrhage	0		2	0.0%	0	
120.910	retinal detachment without dialysis	0		3	0.0%	0	
120.960	retinopathy	0		0		4	0.1%
OPTIC NERVE							
130.110	micropapilla	3	0.1%	10	0.1%	6	0.1%
130.120	optic nerve hypoplasia	4	0.1%	15	0.2%	13	0.3%
130.150	optic disc coloboma	7	0.2%	13	0.1%	2	0.0%
OTHER							
900.000	other, unspecified	0		57	0.6%	136	2.7%
900.100	other, not inherited	38	1.3%	412	4.7%	131	2.6%
900.110	other, suspected as inherited	15	0.5%	32	0.4%	4	0.1%
NORMAL							
0.000	normal globe	2434	84.5%	7574	86.3%	4267	84.9%

OCULAR DISORDERS REPORT

BICHON FRISE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
D.	Cataract	Not defined	1, 3, 4	NO
E.	Vitreous degeneration	Not defined	5	Breeder option
F.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Bichon Frise, many of these strands bridge between the iris and cornea where they may be associated with corneal opacities and vision impairment.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The range in age of animals affected with cataracts in one study was 1-2 years to 9-10 years old, with the peak age of 3 years old. The cataracts involved all regions of the lens, but in age groups of 2-4 years old, the predominant regions affected were the posterior cortex, and the anterior and posterior cortices combined. The earliest abnormalities usually consisted of small punctate opacities in the paracentral posterior cortex, independent of the posterior lens sutures.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. Gelatt KN, Wallace MR, Andrew SE, et al. Cataracts in the Bichon Frise. *Vet Ophthalmol*. 2003 Mar;6:3-9.

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5. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
BICHON FRISE

	TOTAL DOGS EXAMINED	1991-1999 3304		2000-2009 4804		2010-2016 2079	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
GLOBE							
0.110	microphthalmia	1	0.0%	1	0.0%	0	
EYELIDS							
20.140	ectopic cilia	1	0.0%	0		1	0.0%
21.000	entropion, unspecified	3	0.1%	3	0.1%	2	0.1%
22.000	ectropion, unspecified	0		0		1	0.0%
25.110	distichiasis	66	2.0%	181	3.8%	115	5.5%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	1	0.0%	1	0.0%	0	
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		1	0.0%
CORNEA							
70.210	corneal pannus	2	0.1%	0		0	
70.220	pigmentary keratitis	1	0.0%	0		1	0.0%
70.700	corneal dystrophy	80	2.4%	175	3.6%	97	4.7%
70.730	corneal endothelial degeneration	1	0.0%	3	0.1%	2	0.1%
UVEA							
93.110	iris hypoplasia	0		0		2	0.1%
93.140	corneal endothelial pigment without PPM	0		2	0.0%	0	
93.150	iris coloboma	1	0.0%	0		3	0.1%
93.710	persistent pupillary membranes, iris to iris	48	1.5%	127	2.6%	57	2.7%
93.720	persistent pupillary membranes, iris to lens	11	0.3%	2	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea	22	0.7%	6	0.1%	3	0.1%
93.740	persistent pupillary membranes, iris sheets	6	0.2%	2	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		8	0.4%
LENS							
100.200	cataract, unspecified	23	0.7%	0		0	
100.210	cataract, suspect not inherited	144	4.4%	274	5.7%	130	6.3%
100.301	punctate cataract, anterior cortex	35	1.1%	42	0.9%	18	0.9%
100.302	punctate cataract, posterior cortex	26	0.8%	41	0.9%	20	1.0%
100.303	punctate cataract, equatorial cortex	4	0.1%	5	0.1%	2	0.1%
100.304	punctate cataract, anterior sutures	2	0.1%	5	0.1%	1	0.0%
100.305	punctate cataract, posterior sutures	11	0.3%	21	0.4%	5	0.2%
100.306	punctate cataract, nucleus	1	0.0%	5	0.1%	3	0.1%
100.307	punctate cataract, capsular	1	0.0%	5	0.1%	2	0.1%
100.311	incipient cataract, anterior cortex	25	0.8%	49	1.0%	15	0.7%
100.312	incipient cataract, posterior cortex	82	2.5%	100	2.1%	36	1.7%
100.313	incipient cataract, equatorial cortex	9	0.3%	21	0.4%	3	0.1%
100.314	incipient cataract, anterior sutures	1	0.0%	1	0.0%	0	
100.315	incipient cataract, posterior sutures	14	0.4%	26	0.5%	6	0.3%
100.316	incipient cataract, nucleus	3	0.1%	5	0.1%	1	0.0%
100.317	incipient cataract, capsular	2	0.1%	6	0.1%	4	0.2%
100.321	incomplete cataract, anterior cortex	0		0		1	0.0%

OCULAR DISORDERS REPORT
BICHON FRISE

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.322	incomplete cataract, posterior cortex	0		0		3	0.1%
100.330	generalized/complete cataract	89	2.7%	53	1.1%	7	0.3%
100.375	subluxation/luxation, unspecified	1	0.0%	3	0.1%	0	
100.999	*significant cataracts (summary)*	*328*	*9.9%*	*385*	*8.0%*	*127*	*6.1%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	12	0.4%	4	0.1%	7	0.3%
110.135	PHPV/PTVL	0		1	0.0%	2	0.1%
110.320	vitreal degeneration	18	0.5%	40	0.8%	49	2.4%
FUNDUS							
97.120	coloboma	1	0.0%	0		0	
RETINA							
120.170	retinal dysplasia, folds	24	0.7%	34	0.7%	10	0.5%
120.180	retinal dysplasia, geographic	3	0.1%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	24	0.7%	29	0.6%	6	0.3%
120.910	retinal detachment without dialysis	1	0.0%	0		0	
120.960	retinopathy	0		0		3	0.1%
OPTIC NERVE							
130.110	micropapilla	0		1	0.0%	0	
130.120	optic nerve hypoplasia	1	0.0%	0		0	
130.150	optic disc coloboma	8	0.2%	2	0.0%	0	
OTHER							
900.000	other, unspecified	0		15	0.3%	24	1.2%
900.100	other, not inherited	13	0.4%	130	2.7%	48	2.3%
900.110	other, suspected as inherited	19	0.6%	11	0.2%	2	0.1%
NORMAL							
0.000	normal globe	2700	81.7%	4065	84.6%	1613	77.6%

OCULAR DISORDERS REPORT

BIEWER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Biewer. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
BIEWER

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 0 #	%	2000-2009 18 #	%	2010-2016 42 #	%
EYELIDS							
25.110	distichiasis	0		0		1	2.4%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		3	16.7%	5	11.9%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	4.8%
LENS							
100.210	cataract, suspect not inherited	0		0		4	9.5%
100.330	generalized/complete cataract	0		0		1	2.4%
100.340	resorbing/hypermature cataract	0		0		1	2.4%
100.999	*significant cataracts (summary)*	*0*		*0*		*2*	*4.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		0		1	2.4%
FUNDUS							
97.110	choroidal hypoplasia	0		0		1	2.4%
OPTIC NERVE							
130.150	optic disc coloboma	0		0		1	2.4%
OTHER							
900.000	other, unspecified	0		0		1	2.4%
NORMAL							
0.000	normal globe	0		16	88.9%	33	78.6%

OCULAR DISORDERS REPORT

BLACK AND TAN COONHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO
B.	Retinal dysplasia - folds	Not defined	2	Breeder option

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Black and Tan Coonhound breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
BLACK AND TAN COONHOUND

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**174**		**249**		**175**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
GLOBE							
0.110	microphthalmia	0		1	0.4%	0	
EYELIDS							
21.000	entropion, unspecified	3	1.7%	0		0	
22.000	ectropion, unspecified	3	1.7%	0		3	1.7%
25.110	distichiasis	2	1.1%	3	1.2%	1	0.6%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		1	0.4%	1	0.6%
52.110	prolapsed gland of the third eyelid	0		1	0.4%	0	
CORNEA							
70.210	corneal pannus	2	1.1%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	1	0.6%	4	1.6%	0	
93.720	persistent pupillary membranes, iris to lens	1	0.6%	2	0.8%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		8	4.6%
LENS							
100.210	cataract, suspect not inherited	11	6.3%	21	8.4%	13	7.4%
100.301	punctate cataract, anterior cortex	2	1.1%	2	0.8%	0	
100.302	punctate cataract, posterior cortex	1	0.6%	0		0	
100.305	punctate cataract, posterior sutures	0		1	0.4%	0	
100.306	punctate cataract, nucleus	2	1.1%	2	0.8%	2	1.1%
100.307	punctate cataract, capsular	0		1	0.4%	1	0.6%
100.311	incipient cataract, anterior cortex	1	0.6%	0		0	
100.312	incipient cataract, posterior cortex	3	1.7%	2	0.8%	0	
100.314	incipient cataract, anterior sutures	0		1	0.4%	0	
100.316	incipient cataract, nucleus	3	1.7%	0		0	
100.323	incomplete cataract, equatorial cortex	0		0		1	0.6%
100.330	generalized/complete cataract	1	0.6%	2	0.8%	0	
100.999	*significant cataracts (summary)*	*13*	*7.5%*	*11*	*4.4%*	*4*	*2.3%*
VITREOUS							
110.135	PHPV/PTVL	0		1	0.4%	0	
110.320	vitreal degeneration	0		0		1	0.6%
FUNDUS							
97.110	choroidal hypoplasia	1	0.6%	0		0	
RETINA							
120.170	retinal dysplasia, folds	2	1.1%	12	4.8%	21	12.0%
120.180	retinal dysplasia, geographic	0		0		1	0.6%
OTHER							
900.000	other, unspecified	0		0		2	1.1%
900.100	other, not inherited	0		11	4.4%	5	2.9%

OCULAR DISORDERS REPORT
BLACK AND TAN COONHOUND

	1991-1999	2000-2009	2010-2016
NORMAL			
0.000 normal globe	143 82.2%	202 81.1%	126 72.0%

BLACK RUSSIAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	2, 3	NO
C.	POANV (polyneuropathy, ocular abnormalities neuronal vacuolation) - Microphthalmia - Cataracts -PPM (iris to iris) * a DNA test is available	Autosomal recessive	4	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. POANV- Polyneuropathy with ocular abnormalities and neuronal vacuolation

An autosomal recessive condition resulting in juvenile polyneuropathy that presents as laryngeal paralysis and weakness. Patients have concurrent ophthalmic abnormalities including microphthalmia, incomplete cataracts (primarily nuclear) and iris-to-iris PPMs. Neuronal vacuolation was identified on histopathology. Affected dogs were found to be homozygous for the RAB3GAP1: c.743delC mutation. Patients with this variant are not reported to survive past 6 months.

References

1. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

2. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

3. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

4. Mhlanga-Mutangadura T, Johnson GJ, Schnabel RD, et al. A mutation in the Warburg syndrome gene, RAB3GAP1, causes a similar syndrome with polyneuropathy and neuronal vacuolation in Black Russian Terrier dogs. Neurobiology of Disease. 2016;86:75-85.

OCULAR DISORDERS REPORT
BLACK RUSSIAN TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 3 #	%	2000-2009 204 #	%	2010-2016 408 #	%
EYELIDS							
21.000	entropion, unspecified	0		1	0.5%	4	1.0%
22.000	ectropion, unspecified	0		0		4	1.0%
25.110	distichiasis	0		3	1.5%	3	0.7%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		1	0.5%	0	
52.110	prolapsed gland of the third eyelid	0		0		1	0.2%
CORNEA							
70.700	corneal dystrophy	0		0		2	0.5%
UVEA							
93.110	iris hypoplasia	0		0		1	0.2%
93.150	iris coloboma	0		0		1	0.2%
93.710	persistent pupillary membranes, iris to iris	0		3	1.5%	8	2.0%
93.720	persistent pupillary membranes, iris to lens	0		1	0.5%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.2%
93.999	uveal cysts	0		0		3	0.7%
LENS							
100.210	cataract, suspect not inherited	0		8	3.9%	20	4.9%
100.301	punctate cataract, anterior cortex	0		1	0.5%	3	0.7%
100.302	punctate cataract, posterior cortex	0		3	1.5%	4	1.0%
100.304	punctate cataract, anterior sutures	0		1	0.5%	0	
100.305	punctate cataract, posterior sutures	0		1	0.5%	1	0.2%
100.307	punctate cataract, capsular	0		0		1	0.2%
100.311	incipient cataract, anterior cortex	0		0		1	0.2%
100.312	incipient cataract, posterior cortex	0		4	2.0%	5	1.2%
100.315	incipient cataract, posterior sutures	0		0		1	0.2%
100.316	incipient cataract, nucleus	0		0		1	0.2%
100.999	*significant cataracts (summary)*	*0*		*10*	*4.9%*	*17*	*4.2%*
VITREOUS							
110.320	vitreal degeneration	0		0		2	0.5%
RETINA							
120.170	retinal dysplasia, folds	0		0		2	0.5%
OPTIC NERVE							
130.110	micropapilla	0		1	0.5%	0	
OTHER							
900.000	other, unspecified	0		3	1.5%	9	2.2%
900.100	other, not inherited	0		8	3.9%	7	1.7%
900.110	other, suspected as inherited	0		1	0.5%	0	

OCULAR DISORDERS REPORT
BLACK RUSSIAN TERRIER

	1991-1999	2000-2009	2010-2016
NORMAL			
0.000 normal globe	3 100.0%	186 91.2%	348 85.3%

BLOODHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ectropion	Not defined	1, 2	Breeder option
B.	Entropion	Not defined	1-3	Breeder option
C.	Macroblepharon	Not defined	1, 2	Breeder option
D.	Prolapsed gland of the third eyelid	Not defined	1, 2	Breeder option
E.	Persistent pupillary membranes			
	- iris to iris	Not defined	4, 5	Breeder option
	- iris to cornea	Not defined	5	NO
F.	Cataract	Not defined	4	NO
G.	Retinal dysplasia - folds	Not defined	4, 5	Breeder option

Description and Comment

A. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

OCULAR DISORDERS REPORT

C. Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Barnett KC. Comparative aspects of canine hereditary eye disease. *Adv Vet Sci Comp Med*. 1976;20:39-67.

3. ACVO Genetics Committee, 2001 and/or Data from CERF All-Breeds Report, 2001.

4. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

5. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
BLOODHOUND

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**201**		**256**		**130**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
GLOBE							
0.110	microphthalmia	0		0		1	0.8%
EYELIDS							
20.160	macropalpebral fissure	36	17.9%	36	14.1%	3	2.3%
21.000	entropion, unspecified	47	23.4%	62	24.2%	21	16.2%
22.000	ectropion, unspecified	56	27.9%	73	28.5%	20	15.4%
25.110	distichiasis	2	1.0%	4	1.6%	3	2.3%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		1	0.4%	2	1.5%
NICTITANS							
51.100	third eyelid cartilage anomaly	1	0.5%	0		0	
52.110	prolapsed gland of the third eyelid	1	0.5%	4	1.6%	1	0.8%
CORNEA							
70.210	corneal pannus	2	1.0%	3	1.2%	0	
70.220	pigmentary keratitis	0		2	0.8%	1	0.8%
70.730	corneal endothelial degeneration	2	1.0%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	13	6.5%	4	1.6%	0	
93.720	persistent pupillary membranes, iris to lens	2	1.0%	2	0.8%	1	0.8%
93.730	persistent pupillary membranes, iris to cornea	23	11.4%	13	5.1%	2	1.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.4%	2	1.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.8%
93.999	uveal cysts	0		0		1	0.8%
LENS							
100.200	cataract, unspecified	1	0.5%	0		0	
100.210	cataract, suspect not inherited	3	1.5%	5	2.0%	6	4.6%
100.301	punctate cataract, anterior cortex	6	3.0%	4	1.6%	0	
100.302	punctate cataract, posterior cortex	1	0.5%	0		0	
100.306	punctate cataract, nucleus	0		1	0.4%	0	
100.307	punctate cataract, capsular	1	0.5%	1	0.4%	0	
100.311	incipient cataract, anterior cortex	4	2.0%	7	2.7%	4	3.1%
100.312	incipient cataract, posterior cortex	3	1.5%	1	0.4%	2	1.5%
100.314	incipient cataract, anterior sutures	2	1.0%	1	0.4%	0	
100.315	incipient cataract, posterior sutures	0		1	0.4%	0	
100.316	incipient cataract, nucleus	1	0.5%	2	0.8%	1	0.8%
100.317	incipient cataract, capsular	0		4	1.6%	1	0.8%
100.321	incomplete cataract, anterior cortex	0		0		1	0.8%
100.322	incomplete cataract, posterior cortex	0		0		2	1.5%
100.330	generalized/complete cataract	1	0.5%	0		0	
100.340	resorbing/hypermature cataract	0		0		1	0.8%
100.999	*significant cataracts (summary)*	*20*	*10.0%*	*22*	*8.6%*	*12*	*9.2%*

OCULAR DISORDERS REPORT
BLOODHOUND

	1991-1999	2000-2009	2010-2016
VITREOUS			
110.120 persistent hyaloid artery/remnant	0	1 0.4%	0
110.135 PHPV/PTVL	0	1 0.4%	0
110.320 vitreal degeneration	1 0.5%	0	0
RETINA			
120.170 retinal dysplasia, folds	12 6.0%	20 7.8%	1 0.8%
120.310 generalized progressive retinal atrophy (PRA)	1 0.5%	0	0
120.910 retinal detachment without dialysis	1 0.5%	0	0
OPTIC NERVE			
130.150 optic disc coloboma	1 0.5%	0	0
OTHER			
900.000 other, unspecified	0	0	5 3.8%
900.100 other, not inherited	4 2.0%	8 3.1%	3 2.3%
900.110 other, suspected as inherited	3 1.5%	6 2.3%	0
NORMAL			
0.000 normal globe	73 36.3%	117 45.7%	79 60.8%

BOERBOEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Multifocal retinopathy - *cmr1* * a DNA test is available.	Autosomal recessive	1	Breeder option

Description and Comments

A. Multifocal retinopathy

Canine Multi-focal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous sub-retinal fluid or accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multi-focal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

References

1. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis.* 2010;16:2791-2804.

OCULAR DISORDERS REPORT
BOERBOEL

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 0 #	%	2000-2009 2 #	%	2010-2016 34 #	%
EYELIDS							
20.160	macropalpebral fissure	0		0		1	2.9%
22.000	ectropion, unspecified	0		0		1	2.9%
25.110	distichiasis	0		0		3	8.8%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		1	2.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	2.9%
LENS							
100.210	cataract, suspect not inherited	0		0		2	5.9%
RETINA							
120.180	retinal dysplasia, geographic	0		0		1	2.9%
OTHER							
900.100	other, not inherited	0		0		1	2.9%
NORMAL							
0.000	normal globe	0		2	100.0%	26	76.5%

BOLOGNESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
D.	Cataract	Not defined	3	NO
E.	Vitreous Degeneration	Not defined	4	Breeder Option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment. This is a significant problem in the Whippet.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Bolognese breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2013-2014.

4. ACVO Genetics Committee, 2017 and Data from OFA/CERF All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
BOLOGNESE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 60 #	 %	2000-2009 296 #	 %	2010-2016 384 #	 %
EYELIDS							
21.000	entropion, unspecified	0		3	1.0%	0	
25.110	distichiasis	10	16.7%	55	18.6%	42	10.9%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		2	0.5%
40.910	keratoconjunctivitis sicca	0		0		2	0.5%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		2	0.7%	0	
CORNEA							
70.700	corneal dystrophy	0		5	1.7%	9	2.3%
UVEA							
93.710	persistent pupillary membranes, iris to iris	12	20.0%	52	17.6%	43	11.2%
93.730	persistent pupillary membranes, iris to cornea	1	1.7%	3	1.0%	2	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		2	0.7%	2	0.5%
LENS							
100.210	cataract, suspect not inherited	1	1.7%	12	4.1%	5	1.3%
100.305	punctate cataract, posterior sutures	0		0		1	0.3%
100.311	incipient cataract, anterior cortex	1	1.7%	1	0.3%	0	
100.312	incipient cataract, posterior cortex	0		1	0.3%	1	0.3%
100.313	incipient cataract, equatorial cortex	0		1	0.3%	2	0.5%
100.315	incipient cataract, posterior sutures	1	1.7%	6	2.0%	0	
100.317	incipient cataract, capsular	0		1	0.3%	0	
100.330	generalized/complete cataract	2	3.3%	2	0.7%	0	
100.999	*significant cataracts (summary)*	*4*	*6.7%*	*12*	*4.1%*	*4*	*1.0%*
VITREOUS							
110.320	vitreal degeneration	4	6.7%	3	1.0%	7	1.8%
RETINA							
120.170	retinal dysplasia, folds	1	1.7%	5	1.7%	0	
120.190	retinal dysplasia, detached	0		0		1	0.3%
120.310	generalized progressive retinal atrophy (PRA)	0		1	0.3%	0	
120.910	retinal detachment without dialysis	0		0		1	0.3%
OPTIC NERVE							
130.110	micropapilla	0		1	0.3%	0	
OTHER							
900.000	other, unspecified	0		2	0.7%	17	4.4%
900.100	other, not inherited	1	1.7%	19	6.4%	3	0.8%
900.110	other, suspected as inherited	1	1.7%	3	1.0%	0	
NORMAL							
0.000	normal globe	36	60.0%	197	66.6%	306	79.7%

BOLONKA ZWETNA

(Russian Tsvetnaya Bolonka)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - generalized *(prcd)* * a DNA test is available	Not defined	1	NO

Description and Comments

A. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the American Eskimo is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

There are no references or breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Bolonka Zwetna. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

OCULAR DISORDERS REPORT
BOLONKA ZWETNA

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 51 #	%	2010-2016 53 #	%
EYELIDS							
25.110	distichiasis	0		1	2.0%	0	
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		1	1.9%
CORNEA							
70.220	pigmentary keratitis	0		0		2	3.8%
UVEA							
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	1.9%
LENS							
100.210	cataract, suspect not inherited	0		1	2.0%	4	7.5%
100.313	incipient cataract, equatorial cortex	0		1	2.0%	0	
100.315	incipient cataract, posterior sutures	0		0		3	5.7%
100.375	subluxation/luxation, unspecified	0		0		1	1.9%
100.999	*significant cataracts (summary)*	*0*		*1*	*2.0%*	*3*	*5.7%*
VITREOUS							
110.135	PHPV/PTVL	0		1	2.0%	0	
110.320	vitreal degeneration	0		8	15.7%	4	7.5%
OTHER							
900.000	other, unspecified	0		0		1	1.9%
900.100	other, not inherited	0		2	3.9%	1	1.9%
NORMAL							
0.000	normal globe	0		46	90.2%	41	77.4%

OCULAR DISORDERS REPORT

BORDER COLLIE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined		Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined		Breeder option
C.	Persistent pupillary membranes - iris to iris - all other forms	 Not defined Not defined	 2, 3	 Breeder option NO
D.	Cataract	Not defined		NO
E.	Lens luxation * a DNA test is available	Not defined	, 13	NO
F.	Vitreous degeneration	Not defined		Breeder option
G.	Retinal atrophy - generalized	Suggested X-linked	2, 6, 7	NO
H.	Retinal dysplasia - folds	Not defined		Breeder option
I.	Choroidal hypoplasia (Collie Eye Anomaly) - optic Nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma * a DNA test is available	Autosomal recessive		NO
J.	Ceroid lipofuscinosis * a DNA test is available	Not defined	11, 12	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

OCULAR DISORDERS REPORT

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

I. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

J. Ceroid lipofuscinosis

An inherited disease of humans and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease.) A DNA test is available.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

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tion is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
BORDER COLLIE

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 8438 #	%	2000-2009 12641 #	%	2010-2016 5140 #	%
GLOBE								
0.110	microphthalmia		6	0.1%	5	0.0%	2	0.0%
10.000	glaucoma		0		0		1	0.0%
EYELIDS								
21.000	entropion, unspecified		1	0.0%	0		1	0.0%
25.110	distichiasis		35	0.4%	52	0.4%	37	0.7%
NICTITANS								
51.100	third eyelid cartilage anomaly		0		1	0.0%	4	0.1%
CORNEA								
70.210	corneal pannus		2	0.0%	7	0.1%	10	0.2%
70.220	pigmentary keratitis		0		0		1	0.0%
70.700	corneal dystrophy		57	0.7%	89	0.7%	59	1.1%
70.730	corneal endothelial degeneration		0		4	0.0%	0	
UVEA								
90.250	pigmentary uveitis		0		0		1	0.0%
93.110	iris hypoplasia		0		0		1	0.0%
93.140	corneal endothelial pigment without PPM		0		2	0.0%	0	
93.150	iris coloboma		1	0.0%	7	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		305	3.6%	872	6.9%	465	9.0%
93.720	persistent pupillary membranes, iris to lens		12	0.1%	17	0.1%	3	0.1%
93.730	persistent pupillary membranes, iris to cornea		13	0.2%	20	0.2%	1	0.0%
93.740	persistent pupillary membranes, iris sheets		2	0.0%	12	0.1%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		3	0.0%	6	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		2	0.0%	2	0.0%
93.810	uveal melanoma		0		0		1	0.0%
93.999	uveal cysts		1	0.0%	7	0.1%	4	0.1%
97.150	chorioretinal coloboma, congenital		0		0		2	0.0%
LENS								
100.200	cataract, unspecified		57	0.7%	0		0	
100.210	cataract, suspect not inherited		275	3.3%	660	5.2%	306	6.0%
100.301	punctate cataract, anterior cortex		41	0.5%	45	0.4%	26	0.5%
100.302	punctate cataract, posterior cortex		23	0.3%	27	0.2%	14	0.3%
100.303	punctate cataract, equatorial cortex		17	0.2%	17	0.1%	14	0.3%
100.304	punctate cataract, anterior sutures		4	0.0%	1	0.0%	0	
100.305	punctate cataract, posterior sutures		38	0.5%	45	0.4%	40	0.8%
100.306	punctate cataract, nucleus		8	0.1%	9	0.1%	9	0.2%
100.307	punctate cataract, capsular		4	0.0%	11	0.1%	15	0.3%
100.311	incipient cataract, anterior cortex		53	0.6%	57	0.5%	33	0.6%
100.312	incipient cataract, posterior cortex		36	0.4%	43	0.3%	26	0.5%
100.313	incipient cataract, equatorial cortex		32	0.4%	61	0.5%	25	0.5%
100.314	incipient cataract, anterior sutures		3	0.0%	8	0.1%	1	0.0%
100.315	incipient cataract, posterior sutures		10	0.1%	33	0.3%	12	0.2%
100.316	incipient cataract, nucleus		12	0.1%	9	0.1%	6	0.1%
100.317	incipient cataract, capsular		4	0.0%	16	0.1%	7	0.1%
100.321	incomplete cataract, anterior cortex		0		0		5	0.1%

OCULAR DISORDERS REPORT
BORDER COLLIE

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.322	incomplete cataract, posterior cortex	0		0		2	0.0%
100.323	incomplete cataract, equatorial cortex	0		0		3	0.1%
100.327	incomplete cataract, capsular	0		0		1	0.0%
100.330	generalized/complete cataract	12	0.1%	13	0.1%	4	0.1%
100.375	subluxation/luxation, unspecified	6	0.1%	8	0.1%	0	
100.999	*significant cataracts (summary)*	*354*	*4.2%*	*395*	*3.1%*	*243*	*4.7%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	25	0.3%	37	0.3%	5	0.1%
110.135	PHPV/PTVL	5	0.1%	12	0.1%	3	0.1%
110.320	vitreal degeneration	26	0.3%	81	0.6%	63	1.2%
FUNDUS							
97.110	choroidal hypoplasia	166	2.0%	224	1.8%	47	0.9%
97.120	coloboma	11	0.1%	34	0.3%	3	0.1%
RETINA							
120.170	retinal dysplasia, folds	58	0.7%	108	0.9%	31	0.6%
120.180	retinal dysplasia, geographic	7	0.1%	8	0.1%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	97	1.1%	106	0.8%	25	0.5%
120.400	retinal hemorrhage	4	0.0%	2	0.0%	0	
120.910	retinal detachment without dialysis	6	0.1%	11	0.1%	1	0.0%
120.960	retinopathy	0		0		20	0.4%
OPTIC NERVE							
130.110	micropapilla	0		12	0.1%	9	0.2%
130.120	optic nerve hypoplasia	9	0.1%	8	0.1%	1	0.0%
130.150	optic disc coloboma	45	0.5%	36	0.3%	11	0.2%
OTHER							
900.000	other, unspecified	0		70	0.6%	144	2.8%
900.100	other, not inherited	53	0.6%	552	4.4%	162	3.2%
900.110	other, suspected as inherited	59	0.7%	32	0.3%	2	0.0%
NORMAL							
0.000	normal globe	7190	85.2%	10629	84.1%	4025	78.3%

BORDER TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2, 3	Breeder option
C.	Cataract * a DNA test is available	Not defined	4, 5	NO
D.	Vitreous degeneration	Not defined	5	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The condition is inherited as an autosomal recessive mutation in the HSF4 gene (*HSF4-1*). A DNA test is available.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

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OCULAR DISORDERS REPORT
BORDER TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 933 #	%	2000-2009 3021 #	%	2010-2016 2283 #	%
EYELIDS							
21.000	entropion, unspecified	0		3	0.1%	0	
25.110	distichiasis	4	0.4%	22	0.7%	19	0.8%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		1	0.0%	0	
CORNEA							
70.700	corneal dystrophy	2	0.2%	7	0.2%	4	0.2%
UVEA							
93.140	corneal endothelial pigment without PPM	0		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	3	0.3%	64	2.1%	103	4.5%
93.720	persistent pupillary membranes, iris to lens	0		1	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	0		2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.0%
93.999	uveal cysts	0		1	0.0%	0	
LENS							
100.200	cataract, unspecified	9	1.0%	0		0	
100.210	cataract, suspect not inherited	21	2.3%	184	6.1%	194	8.5%
100.301	punctate cataract, anterior cortex	6	0.6%	10	0.3%	20	0.9%
100.302	punctate cataract, posterior cortex	3	0.3%	11	0.4%	6	0.3%
100.303	punctate cataract, equatorial cortex	1	0.1%	11	0.4%	6	0.3%
100.304	punctate cataract, anterior sutures	1	0.1%	1	0.0%	0	
100.305	punctate cataract, posterior sutures	1	0.1%	7	0.2%	9	0.4%
100.306	punctate cataract, nucleus	0		4	0.1%	1	0.0%
100.307	punctate cataract, capsular	0		3	0.1%	5	0.2%
100.311	incipient cataract, anterior cortex	9	1.0%	33	1.1%	18	0.8%
100.312	incipient cataract, posterior cortex	6	0.6%	25	0.8%	20	0.9%
100.313	incipient cataract, equatorial cortex	14	1.5%	35	1.2%	23	1.0%
100.314	incipient cataract, anterior sutures	0		2	0.1%	1	0.0%
100.315	incipient cataract, posterior sutures	1	0.1%	9	0.3%	5	0.2%
100.316	incipient cataract, nucleus	7	0.8%	4	0.1%	2	0.1%
100.317	incipient cataract, capsular	0		4	0.1%	4	0.2%
100.321	incomplete cataract, anterior cortex	0		0		4	0.2%
100.322	incomplete cataract, posterior cortex	0		0		5	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		3	0.1%
100.326	incomplete cataract, nucleus	0		0		1	0.0%
100.327	incomplete cataract, capsular	0		0		1	0.0%
100.330	generalized/complete cataract	4	0.4%	12	0.4%	4	0.2%
100.340	resorbing/hypermature cataract	0		0		2	0.1%
100.375	subluxation/luxation, unspecified	0		1	0.0%	0	
100.999	*significant cataracts (summary)*	*62*	*6.6%*	*171*	*5.7%*	*140*	*6.1%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	2	0.2%	1	0.0%	3	0.1%
110.320	vitreal degeneration	11	1.2%	21	0.7%	35	1.5%

OCULAR DISORDERS REPORT
BORDER TERRIER

		1991-1999		2000-2009		2010-2016	
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.0%	0	
97.120	coloboma	0		1	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	0		10	0.3%	3	0.1%
120.180	retinal dysplasia, geographic	2	0.2%	3	0.1%	3	0.1%
120.310	generalized progressive retinal atrophy (PRA)	4	0.4%	7	0.2%	1	0.0%
120.910	retinal detachment without dialysis	0		1	0.0%	0	
OPTIC NERVE							
130.120	optic nerve hypoplasia	0		0		1	0.0%
OTHER							
900.000	other, unspecified	0		11	0.4%	45	2.0%
900.100	other, not inherited	7	0.8%	117	3.9%	55	2.4%
900.110	other, suspected as inherited	6	0.6%	5	0.2%	3	0.1%
NORMAL							
0.000	normal globe	843	90.4%	2747	90.9%	1898	83.1%

OCULAR DISORDERS REPORT

BORZOI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	2	NO
D.	Optic nerve hypoplasia	Not defined	1	NO
E.	Retinopathy	Not defined	4	Breeder option
F.	Retinal degeneration	Not defined	3	NO
G.	Micropapilla	Not defined	1	Breeder option

Description and Comments

A. Corneal Dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

E. Retinopathy

Patchy focal unilateral or bilateral hyper reflective tapetal lesions most frequently peripheral but occasionally central around a pigmented spot, usually non progressive. Not usually present prior to 3 months of age but usually present by 18 months of age.

F. Retinal degeneration

A unilateral or bilateral retinal disease that affects young and adult Borzoi and which can be progressive. When bilateral, the ophthalmoscopic lesions are often asymmetrical, particularly in the early stages of the disease. Fundus examination shows initially single or multiple focal retinal lesions that appear active (local infiltrative inflammation or granulation) or inactive. The lesions can progress resulting in widespread retinal atrophy. The end-stage ophthalmoscopic lesions vary and may appear indistinguishable from PRA, or may be more characteristic of an inflammatory retinopathy. The asymmetry of the fundus abnormalities and the presence of inflammatory lesions in the retina and choroid help to differentiate this disorder from PRA. The mode of inheritance of this disease is not known; however, studies of different families suggest that it is possibly inherited. An intriguing aspect of the disease has been the preponderance of affected males compared to females. This has been confirmed in a recent unpublished survey.

G. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Repor, 2003-2004.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

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OCULAR DISORDERS REPORT
BORZOI

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 792 #	%	2000-2009 1504 #	%	2010-2016 1197 #	%
GLOBE							
0.110	microphthalmia	2	0.3%	4	0.3%	1	0.1%
EYELIDS							
20.160	macropalpebral fissure	1	0.1%	0		0	
25.110	distichiasis	4	0.5%	3	0.2%	3	0.3%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		1	0.1%
CORNEA							
70.210	corneal pannus	7	0.9%	6	0.4%	4	0.3%
70.700	corneal dystrophy	7	0.9%	6	0.4%	3	0.3%
70.730	corneal endothelial degeneration	0		1	0.1%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	20	2.5%	28	1.9%	27	2.3%
93.720	persistent pupillary membranes, iris to lens	4	0.5%	2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	6	0.8%	5	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	0		0		1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.1%
93.999	uveal cysts	0		4	0.3%	3	0.3%
LENS							
100.200	cataract, unspecified	2	0.3%	0		0	
100.210	cataract, suspect not inherited	8	1.0%	64	4.3%	38	3.2%
100.301	punctate cataract, anterior cortex	0		4	0.3%	2	0.2%
100.302	punctate cataract, posterior cortex	2	0.3%	2	0.1%	6	0.5%
100.304	punctate cataract, anterior sutures	1	0.1%	1	0.1%	0	
100.305	punctate cataract, posterior sutures	3	0.4%	2	0.1%	4	0.3%
100.306	punctate cataract, nucleus	0		1	0.1%	0	
100.307	punctate cataract, capsular	2	0.3%	0		2	0.2%
100.311	incipient cataract, anterior cortex	3	0.4%	5	0.3%	4	0.3%
100.312	incipient cataract, posterior cortex	6	0.8%	7	0.5%	6	0.5%
100.313	incipient cataract, equatorial cortex	0		2	0.1%	1	0.1%
100.314	incipient cataract, anterior sutures	1	0.1%	1	0.1%	0	
100.315	incipient cataract, posterior sutures	0		0		1	0.1%
100.316	incipient cataract, nucleus	1	0.1%	0		0	
100.317	incipient cataract, capsular	0		4	0.3%	3	0.3%
100.324	incomplete cataract, anterior sutures	0		0		1	0.1%
100.330	generalized/complete cataract	3	0.4%	4	0.3%	1	0.1%
100.340	resorbing/hypermature cataract	0		0		1	0.1%
100.375	subluxation/luxation, unspecified	4	0.5%	0		0	
100.999	*significant cataracts (summary)*	*24*	*3.0%*	*33*	*2.2%*	*32*	*2.7%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	0.4%	5	0.3%	5	0.4%
110.135	PHPV/PTVL	4	0.5%	2	0.1%	5	0.4%
110.320	vitreal degeneration	0		7	0.5%	4	0.3%

OCULAR DISORDERS REPORT
BORZOI

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	4	0.5%	3	0.2%	0	
120.180	retinal dysplasia, geographic	3	0.4%	4	0.3%	1	0.1%
120.190	retinal dysplasia, detached	0		0		1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	6	0.8%	14	0.9%	6	0.5%
120.400	retinal hemorrhage	2	0.3%	0		0	
120.910	retinal detachment without dialysis	2	0.3%	0		3	0.3%
120.920	retinal detachment with dialysis	0		0		2	0.2%
120.960	retinopathy	0		0		27	2.3%
OPTIC NERVE							
130.110	micropapilla	0		8	0.5%	4	0.3%
130.120	optic nerve hypoplasia	10	1.3%	3	0.2%	1	0.1%
130.150	optic disc coloboma	2	0.3%	0		2	0.2%
OTHER							
900.000	other, unspecified	0		17	1.1%	27	2.3%
900.100	other, not inherited	10	1.3%	99	6.6%	51	4.3%
900.110	other, suspected as inherited	19	2.4%	9	0.6%	0	
NORMAL							
0.000	normal globe	681	86.0%	1310	87.1%	1033	86.3%

BOSTON TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-3	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Imperforate lacrimal punctum	Not defined	4	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
E.	Corneal dystrophy - endothelial	Not defined	1, 5	NO
F.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
G.	Cataract * a DNA test is available	Autosomal recessive	1, 7-11	NO
H.	Vitreous degeneration	Not defined	6, 12	Breeder option

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine screening exam for certification.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct located at the medial lid margins. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral

E. Corneal dystrophy – endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

In the Boston Terrier, this is a primary degenerative endothelial disease leading to progressive and permanent corneal edema. It is not known if this disease is an inherited disorder. There is no sex predilection. The condition is observed in older dogs, 6 to 13 years of age with a mean of 9.5 years. The corneal edema starts asymptomatically in the dorsal temporal corneal quadrant of one eye and slowly progresses medially, eventually involving the entire cornea. Typically, it becomes bilateral. In the later stages, discomfort, intracorneal bullae with subsequent ulceration and keratoconus may develop.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally during the first three months of life. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The Boston Terrier has at least two distinct forms of inherited cataract. One type has an onset before 6 months of age with rapid progression to complete opacity prior to 2 years old. The early onset cataract is inherited as an autosomal recessive mutation in the HSF4 gene (*HSF4-1*). A DNA test is available. A second type of cataract occurs after 4-5 years of age with variable progression. The genetic mutation responsible for this cataract is not yet known.

H. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

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OCULAR DISORDERS REPORT
BOSTON TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 2723 #	%	2000-2009 6803 #	%	2010-2016 4656 #	%
GLOBE							
0.110	microphthalmia	1	0.0%	1	0.0%	0	
10.000	glaucoma	0		0		1	0.0%
EYELIDS							
20.140	ectopic cilia	3	0.1%	0		2	0.0%
20.160	macropalpebral fissure	3	0.1%	9	0.1%	0	
21.000	entropion, unspecified	2	0.1%	22	0.3%	20	0.4%
22.000	ectropion, unspecified	2	0.1%	0		0	
25.110	distichiasis	80	2.9%	237	3.5%	181	3.9%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	7	0.3%	0		28	0.6%
40.910	keratoconjunctivitis sicca	0		1	0.0%	12	0.3%
NICTITANS							
50.210	pannus of third eyelid	0		0		1	0.0%
51.100	third eyelid cartilage anomaly	0		1	0.0%	0	
52.110	prolapsed gland of the third eyelid	3	0.1%	5	0.1%	1	0.0%
CORNEA							
70.210	corneal pannus	0		0		1	0.0%
70.220	pigmentary keratitis	11	0.4%	4	0.1%	5	0.1%
70.700	corneal dystrophy	61	2.2%	169	2.5%	101	2.2%
70.730	corneal endothelial degeneration	5	0.2%	14	0.2%	8	0.2%
UVEA							
93.110	iris hypoplasia	0		1	0.0%	5	0.1%
93.150	iris coloboma	2	0.1%	4	0.1%	2	0.0%
93.710	persistent pupillary membranes, iris to iris	27	1.0%	271	4.0%	227	4.9%
93.720	persistent pupillary membranes, iris to lens	1	0.0%	8	0.1%	3	0.1%
93.730	persistent pupillary membranes, iris to cornea	4	0.1%	2	0.0%	1	0.0%
93.740	persistent pupillary membranes, iris sheets	3	0.1%	5	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.0%
93.810	uveal melanoma	0		1	0.0%	0	
93.999	uveal cysts	1	0.0%	15	0.2%	16	0.3%
LENS							
100.200	cataract, unspecified	81	3.0%	0		0	
100.210	cataract, suspect not inherited	42	1.5%	167	2.5%	116	2.5%
100.301	punctate cataract, anterior cortex	23	0.8%	78	1.1%	74	1.6%
100.302	punctate cataract, posterior cortex	11	0.4%	18	0.3%	20	0.4%
100.303	punctate cataract, equatorial cortex	9	0.3%	37	0.5%	32	0.7%
100.304	punctate cataract, anterior sutures	5	0.2%	11	0.2%	22	0.5%
100.305	punctate cataract, posterior sutures	8	0.3%	6	0.1%	11	0.2%
100.306	punctate cataract, nucleus	3	0.1%	1	0.0%	5	0.1%
100.307	punctate cataract, capsular	1	0.0%	7	0.1%	17	0.4%
100.311	incipient cataract, anterior cortex	113	4.1%	353	5.2%	182	3.9%
100.312	incipient cataract, posterior cortex	34	1.2%	87	1.3%	35	0.8%
100.313	incipient cataract, equatorial cortex	52	1.9%	170	2.5%	76	1.6%
100.314	incipient cataract, anterior sutures	14	0.5%	42	0.6%	31	0.7%

OCULAR DISORDERS REPORT
BOSTON TERRIER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.315	incipient cataract, posterior sutures	13	0.5%	15	0.2%	8	0.2%
100.316	incipient cataract, nucleus	4	0.1%	9	0.1%	6	0.1%
100.317	incipient cataract, capsular	1	0.0%	12	0.2%	4	0.1%
100.321	incomplete cataract, anterior cortex	0		0		35	0.8%
100.322	incomplete cataract, posterior cortex	0		0		13	0.3%
100.323	incomplete cataract, equatorial cortex	0		0		16	0.3%
100.324	incomplete cataract, anterior sutures	0		0		3	0.1%
100.325	incomplete cataract, posterior sutures	0		0		1	0.0%
100.330	generalized/complete cataract	31	1.1%	50	0.7%	14	0.3%
100.340	resorbing/hypermature cataract	0		0		1	0.0%
100.375	subluxation/luxation, unspecified	5	0.2%	6	0.1%	4	0.1%
100.999	*significant cataracts (summary)*	*403*	*14.8%*	*896*	*13.2%*	*606*	*13.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	11	0.4%	29	0.4%	8	0.2%
110.135	PHPV/PTVL	1	0.0%	3	0.0%	5	0.1%
110.320	vitreal degeneration	16	0.6%	119	1.7%	55	1.2%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.0%	1	0.0%
RETINA							
120.170	retinal dysplasia, folds	5	0.2%	19	0.3%	11	0.2%
120.180	retinal dysplasia, geographic	3	0.1%	6	0.1%	3	0.1%
120.190	retinal dysplasia, detached	2	0.1%	0		2	0.0%
120.310	generalized progressive retinal atrophy (PRA)	3	0.1%	7	0.1%	1	0.0%
120.400	retinal hemorrhage	2	0.1%	0		1	0.0%
120.910	retinal detachment without dialysis	1	0.0%	0		0	
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		3	0.1%
OPTIC NERVE							
130.110	micropapilla	0		0		1	0.0%
130.120	optic nerve hypoplasia	0		2	0.0%	0	
OTHER							
900.000	other, unspecified	0		52	0.8%	113	2.4%
900.100	other, not inherited	13	0.5%	359	5.3%	152	3.3%
900.110	other, suspected as inherited	27	1.0%	35	0.5%	8	0.2%
NORMAL							
0.000	normal globe	2185	80.2%	5637	82.9%	3597	77.3%

BOUVIER DES FLANDRES

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-3	NO
B.	Entropion	Not defined	4	Breeder option
C.	Distichiasis	Not defined	5	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	6	Breeder option
E.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1, 4 8	 Breeder option Passes with no notation
F.	Cataract	Not defined	1	NO
G.	Vitreous degeneration	Not defined	6	Breeder option
H.	Persistent hyperplastic primary vitreous/Persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Not defined	1, 7	NO
I.	Retinal dysplasia - folds	Not defined	5	Breeder option

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine screening exam for certification.

In this breed, primary glaucoma is associated with narrowed iridocorneal angles and various degrees of congenital angle malformations varying from mild to severe. Dysplastic pectinate ligaments and subsequent narrowed angles are similar to those described in the Basset Hound and American and English Cocker Spaniels. The occurrence of glaucoma is related to the most severe abnormalities of the pectinate ligaments. The relationship between glaucoma development and the anomaly of the pectinate ligament is not clear.

A recent study evaluated risk factors for development of glaucoma in the Bouvier des Flandres. A narrow angle with dysplastic pectinate ligaments on gonioscopy and/or presence of a narrow or closed ciliary cleft on high resolution ultrasound were associated with development of primary glaucoma in the breed.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised

D. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

H. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

In the Bouvier des Flandres, the condition is associated with retinal dysplasia and detachment, optic nerve hypoplasia, lenticonus, cataract and congenital blindness.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
BOUVIER DES FLANDRES

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1365 #	 %	2000-2009 2541 #	 %	2010-2016 1301 #	 %
GLOBE							
10.000	glaucoma	0		1	0.0%	0	
EYELIDS							
20.160	macropalpebral fissure	1	0.1%	0		0	
21.000	entropion, unspecified	7	0.5%	15	0.6%	7	0.5%
22.000	ectropion, unspecified	0		4	0.2%	2	0.2%
25.110	distichiasis	20	1.5%	14	0.6%	11	0.8%
CORNEA							
70.210	corneal pannus	0		1	0.0%	0	
70.220	pigmentary keratitis	0		0		2	0.2%
70.700	corneal dystrophy	9	0.7%	12	0.5%	12	0.9%
70.730	corneal endothelial degeneration	2	0.1%	2	0.1%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	85	6.2%	236	9.3%	112	8.6%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	10	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	5	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	5	0.4%	1	0.0%	2	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.0%	17	1.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		3	0.2%
93.810	uveal melanoma	0		0		1	0.1%
93.999	uveal cysts	2	0.1%	6	0.2%	8	0.6%
LENS							
100.200	cataract, unspecified	5	0.4%	0		0	
100.210	cataract, suspect not inherited	84	6.2%	212	8.3%	143	11.0%
100.301	punctate cataract, anterior cortex	6	0.4%	20	0.8%	4	0.3%
100.302	punctate cataract, posterior cortex	14	1.0%	16	0.6%	10	0.8%
100.303	punctate cataract, equatorial cortex	0		4	0.2%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	1	0.0%	4	0.3%
100.305	punctate cataract, posterior sutures	5	0.4%	15	0.6%	14	1.1%
100.306	punctate cataract, nucleus	3	0.2%	5	0.2%	2	0.2%
100.307	punctate cataract, capsular	0		18	0.7%	3	0.2%
100.311	incipient cataract, anterior cortex	4	0.3%	9	0.4%	5	0.4%
100.312	incipient cataract, posterior cortex	33	2.4%	54	2.1%	13	1.0%
100.313	incipient cataract, equatorial cortex	8	0.6%	11	0.4%	2	0.2%
100.315	incipient cataract, posterior sutures	7	0.5%	11	0.4%	5	0.4%
100.316	incipient cataract, nucleus	21	1.5%	8	0.3%	4	0.3%
100.317	incipient cataract, capsular	2	0.1%	6	0.2%	2	0.2%
100.321	incomplete cataract, anterior cortex	0		0		1	0.1%
100.322	incomplete cataract, posterior cortex	0		0		2	0.2%
100.326	incomplete cataract, nucleus	0		0		1	0.1%
100.330	generalized/complete cataract	18	1.3%	11	0.4%	2	0.2%
100.375	subluxation/luxation, unspecified	1	0.1%	1	0.0%	0	
100.999	*significant cataracts (summary)*	*127*	*9.3%*	*189*	*7.4%*	*74*	*5.7%*

OCULAR DISORDERS REPORT
BOUVIER DES FLANDRES

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	2	0.1%	4	0.2%	2	0.2%
110.135	PHPV/PTVL	1	0.1%	5	0.2%	0	
110.320	vitreal degeneration	1	0.1%	8	0.3%	2	0.2%
RETINA							
120.170	retinal dysplasia, folds	12	0.9%	19	0.7%	5	0.4%
120.180	retinal dysplasia, geographic	0		1	0.0%	2	0.2%
120.310	generalized progressive retinal atrophy (PRA)	0		9	0.4%	5	0.4%
OPTIC NERVE							
130.110	micropapilla	0		1	0.0%	1	0.1%
130.120	optic nerve hypoplasia	1	0.1%	0		0	
130.150	optic disc coloboma	1	0.1%	2	0.1%	0	
OTHER							
900.000	other, unspecified	0		21	0.8%	43	3.3%
900.100	other, not inherited	10	0.7%	120	4.7%	54	4.2%
900.110	other, suspected as inherited	36	2.6%	64	2.5%	6	0.5%
NORMAL							
0.000	normal globe	1055	77.3%	2020	79.5%	958	73.6%

OCULAR DISORDERS REPORT

BOXER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Ectopic cilia	Not defined	2	Breeder option
C.	Ectropion	Not defined	1	Breeder option
D.	Eury/Macroblepharon	Not defined	3, 4	Breeder option
E.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
F.	Corneal dystrophy - epithelial erosion	Not defined	1, 5-7	Breeder option
G.	Persistent pupillary membranes			
	- iris to iris	Not defined	2	Breeder option
	- iris to cornea	Not defined	8	NO
H.	Cataract	Not defined	1	NO
I.	Vitreous degeneration	Not defined	9	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

In the Boxer, because there is significant clinical disease associated with the abnormal hairs, breeding affected animals should be discouraged.

B. Ectopic cilia

Hair emerging through the eyelid conjunctiva. Ectopic cilia occur more frequently in younger dogs and cause discomfort and corneal disease.

C. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

F. Corneal dystrophy - epithelial erosion

A general group of corneal ulcerative conditions (e.g. erosions, indolent or persistent ulcers, epithelial bonding defects) is recognized as a common problem in older Boxers (as well as other older animals). It has been commonly referred to as Boxer corneal ulceration. Animals that are affected are usually 7-8 years of age or older. The ulceration can be a very difficult lesion to heal, and it is often recurrent. The chronic form stimulates eventual scarring, with vascularization, fibrosis and pigmentation of the lesion site. The lesion can cause vision impairment.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

I. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

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OCULAR DISORDERS REPORT
BOXER

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	689		702		386	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	4	0.6%	1	0.1%	0	
EYELIDS							
20.140	ectopic cilia	0		3	0.4%	0	
20.160	macropalpebral fissure	6	0.9%	2	0.3%	1	0.3%
21.000	entropion, unspecified	0		1	0.1%	6	1.6%
22.000	ectropion, unspecified	24	3.5%	30	4.3%	14	3.6%
25.110	distichiasis	60	8.7%	97	13.8%	52	13.5%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.3%
CORNEA							
70.210	corneal pannus	0		1	0.1%	0	
70.220	pigmentary keratitis	1	0.1%	0		0	
70.700	corneal dystrophy	54	7.8%	62	8.8%	31	8.0%
70.730	corneal endothelial degeneration	2	0.3%	0		1	0.3%
UVEA							
93.150	iris coloboma	1	0.1%	0		0	
93.710	persistent pupillary membranes, iris to iris	0		3	0.4%	1	0.3%
93.720	persistent pupillary membranes, iris to lens	2	0.3%	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	4	0.6%	2	0.3%	5	1.3%
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0		0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		3	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		4	1.0%
93.999	uveal cysts	1	0.1%	0		0	
LENS							
100.200	cataract, unspecified	4	0.6%	0		0	
100.210	cataract, suspect not inherited	15	2.2%	21	3.0%	8	2.1%
100.301	punctate cataract, anterior cortex	1	0.1%	1	0.1%	0	
100.303	punctate cataract, equatorial cortex	1	0.1%	1	0.1%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	2	0.3%	0	
100.305	punctate cataract, posterior sutures	0		0		2	0.5%
100.306	punctate cataract, nucleus	1	0.1%	0		0	
100.307	punctate cataract, capsular	0		2	0.3%	0	
100.311	incipient cataract, anterior cortex	5	0.7%	8	1.1%	3	0.8%
100.312	incipient cataract, posterior cortex	1	0.1%	1	0.1%	0	
100.313	incipient cataract, equatorial cortex	3	0.4%	4	0.6%	0	
100.314	incipient cataract, anterior sutures	1	0.1%	1	0.1%	0	
100.315	incipient cataract, posterior sutures	2	0.3%	0		0	
100.316	incipient cataract, nucleus	1	0.1%	0		1	0.3%
100.317	incipient cataract, capsular	0		0		2	0.5%
100.321	incomplete cataract, anterior cortex	0		0		2	0.5%
100.326	incomplete cataract, nucleus	0		0		1	0.3%
100.330	generalized/complete cataract	3	0.4%	4	0.6%	0	
100.375	subluxation/luxation, unspecified	1	0.1%	1	0.1%	0	
100.999	*significant cataracts (summary)*	*24*	*3.5%*	*24*	*3.4%*	*11*	*2.8%*

OCULAR DISORDERS REPORT
BOXER

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.1%	1	0.1%	1	0.3%
110.135	PHPV/PTVL	0		1	0.1%	0	
110.320	vitreal degeneration	1	0.1%	5	0.7%	5	1.3%
RETINA							
120.170	retinal dysplasia, folds	2	0.3%	2	0.3%	1	0.3%
120.310	generalized progressive retinal atrophy (PRA)	1	0.1%	2	0.3%	0	
120.400	retinal hemorrhage	1	0.1%	0		0	
120.910	retinal detachment without dialysis	1	0.1%	0		0	
OPTIC NERVE							
130.110	micropapilla	0		1	0.1%	0	
130.120	optic nerve hypoplasia	1	0.1%	0		0	
130.150	optic disc coloboma	2	0.3%	0		1	0.3%
OTHER							
900.000	other, unspecified	0		2	0.3%	11	2.8%
900.100	other, not inherited	4	0.6%	39	5.6%	14	3.6%
900.110	other, suspected as inherited	6	0.9%	4	0.6%	1	0.3%
NORMAL							
0.000	normal globe	522	75.8%	506	72.1%	272	70.5%

BOYKIN SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
D.	Cataract	Not defined	1	NO
E.	Persistent hyaloid artery	Not defined	2	Breeder option
F.	Retinal atrophy - generalized	Not defined	1	NO
G.	Retinal dysplasia - folds	Not defined	1	Breeder option
H.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma * a DNA test is available	Autosomal recessive	3-5	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

OCULAR DISORDERS REPORT

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram before it is apparent clinically. In most breeds studied to date, retinal atrophy is recessively inherited.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

4. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

5. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Genome Res*. 2007 Nov;17:1562-1571.

OCULAR DISORDERS REPORT
BOYKIN SPANIEL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 388 #	 %	2000-2009 1581 #	 %	2010-2016 1786 #	 %
GLOBE							
0.110	microphthalmia	0		1	0.1%	0	
EYELIDS							
20.160	macropalpebral fissure	1	0.3%	1	0.1%	0	
21.000	entropion, unspecified	0		1	0.1%	0	
25.110	distichiasis	51	13.1%	203	12.8%	230	12.9%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.1%
NICTITANS							
51.100	third eyelid cartilage anomaly	1	0.3%	0		0	
52.110	prolapsed gland of the third eyelid	1	0.3%	0		0	
CORNEA							
70.210	corneal pannus	1	0.3%	0		0	
70.220	pigmentary keratitis	1	0.3%	0		3	0.2%
70.700	corneal dystrophy	13	3.4%	31	2.0%	9	0.5%
70.730	corneal endothelial degeneration	1	0.3%	0		0	
UVEA							
93.110	iris hypoplasia	0		0		3	0.2%
93.150	iris coloboma	1	0.3%	0		0	
93.710	persistent pupillary membranes, iris to iris	5	1.3%	21	1.3%	77	4.3%
93.720	persistent pupillary membranes, iris to lens	1	0.3%	0		1	0.1%
93.730	persistent pupillary membranes, iris to cornea	1	0.3%	3	0.2%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	2	0.5%	0		0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		12	0.7%
93.999	uveal cysts	1	0.3%	0		0	
97.150	chorioretinal coloboma, congenital	0		0		2	0.1%
LENS							
100.200	cataract, unspecified	7	1.8%	0		0	
100.210	cataract, suspect not inherited	17	4.4%	99	6.3%	85	4.8%
100.301	punctate cataract, anterior cortex	5	1.3%	5	0.3%	7	0.4%
100.302	punctate cataract, posterior cortex	11	2.8%	16	1.0%	17	1.0%
100.303	punctate cataract, equatorial cortex	3	0.8%	1	0.1%	3	0.2%
100.304	punctate cataract, anterior sutures	0		3	0.2%	3	0.2%
100.305	punctate cataract, posterior sutures	4	1.0%	7	0.4%	9	0.5%
100.306	punctate cataract, nucleus	5	1.3%	3	0.2%	2	0.1%
100.307	punctate cataract, capsular	0		3	0.2%	8	0.4%
100.311	incipient cataract, anterior cortex	3	0.8%	8	0.5%	6	0.3%
100.312	incipient cataract, posterior cortex	4	1.0%	22	1.4%	18	1.0%
100.313	incipient cataract, equatorial cortex	2	0.5%	2	0.1%	3	0.2%
100.314	incipient cataract, anterior sutures	0		0		1	0.1%
100.315	incipient cataract, posterior sutures	1	0.3%	2	0.1%	3	0.2%
100.316	incipient cataract, nucleus	1	0.3%	7	0.4%	2	0.1%
100.317	incipient cataract, capsular	0		2	0.1%	7	0.4%
100.323	incomplete cataract, equatorial cortex	0		0		2	0.1%
100.330	generalized/complete cataract	3	0.8%	7	0.4%	0	

OCULAR DISORDERS REPORT
BOYKIN SPANIEL

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.999	*significant cataracts (summary)*	*49*	*12.6%*	*88*	*5.6%*	*91*	*5.1%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.3%	8	0.5%	30	1.7%
110.135	PHPV/PTVL	0		3	0.2%	0	
110.320	vitreal degeneration	0		2	0.1%	5	0.3%
FUNDUS							
97.110	choroidal hypoplasia	0		24	1.5%	28	1.6%
97.120	coloboma	0		0		1	0.1%
RETINA							
120.170	retinal dysplasia, folds	16	4.1%	30	1.9%	21	1.2%
120.180	retinal dysplasia, geographic	0		7	0.4%	2	0.1%
120.190	retinal dysplasia, detached	0		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	1.3%	18	1.1%	7	0.4%
120.400	retinal hemorrhage	1	0.3%	1	0.1%	0	
120.910	retinal detachment without dialysis	1	0.3%	1	0.1%	0	
120.920	retinal detachment with dialysis	0		0		1	0.1%
120.960	retinopathy	0		0		14	0.8%
OPTIC NERVE							
130.110	micropapilla	1	0.3%	0		0	
130.120	optic nerve hypoplasia	3	0.8%	1	0.1%	0	
130.150	optic disc coloboma	5	1.3%	4	0.3%	20	1.1%
OTHER							
900.000	other, unspecified	0		26	1.6%	47	2.6%
900.100	other, not inherited	4	1.0%	75	4.7%	51	2.9%
900.110	other, suspected as inherited	2	0.5%	6	0.4%	3	0.2%
NORMAL							
0.000	normal globe	271	69.8%	1250	79.1%	1303	73.0%

OCULAR DISORDERS REPORT

BRACCO ITALIANO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Cataract	Not defined	2	NO
C.	Retinal dysplasia - folds	Not defined	3	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary conditions of the Bracco Italiano breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

2. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

3. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

OCULAR DISORDERS REPORT
BRACCO ITALIANO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 48 #	%	2010-2016 83 #	%
EYELIDS							
20.160	macropalpebral fissure	0		1	2.1%	0	
21.000	entropion, unspecified	0		2	4.2%	4	4.8%
25.110	distichiasis	0		2	4.2%	8	9.6%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		2	2.4%
52.110	prolapsed gland of the third eyelid	0		1	2.1%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		2	2.4%
LENS							
100.210	cataract, suspect not inherited	0		3	6.2%	7	8.4%
100.301	punctate cataract, anterior cortex	0		2	4.2%	0	
100.302	punctate cataract, posterior cortex	0		2	4.2%	1	1.2%
100.311	incipient cataract, anterior cortex	0		1	2.1%	0	
100.312	incipient cataract, posterior cortex	0		2	4.2%	6	7.2%
100.313	incipient cataract, equatorial cortex	0		1	2.1%	3	3.6%
100.316	incipient cataract, nucleus	0		2	4.2%	0	
100.317	incipient cataract, capsular	0		0		2	2.4%
100.999	*significant cataracts (summary)*	*0*		*10*	*20.8%*	*12*	*14.5%*
VITREOUS							
110.135	PHPV/PTVL	0		0		2	2.4%
RETINA							
120.170	retinal dysplasia, folds	0		5	10.4%	3	3.6%
120.960	retinopathy	0		0		2	2.4%
OTHER							
900.000	other, unspecified	0		1	2.1%	1	1.2%
900.100	other, not inherited	0		3	6.2%	2	2.4%
NORMAL							
0.000	normal globe	0		32	66.7%	52	62.7%

BRAQUE FRANCAIS

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Braque Francais breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
BRAQUE FRANCAIS

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 0 #	%	2010-2016 43 #	%
EYELIDS								
25.110	distichiasis		0		0		2	4.7%
LENS								
100.210	cataract, suspect not inherited		0		0		5	11.6%
100.312	incipient cataract, posterior cortex		0		0		1	2.3%
100.999	*significant cataracts (summary)*		*0*		*0*		*1*	*2.3%*
OTHER								
900.100	other, not inherited		0		0		4	9.3%
NORMAL								
0.000	normal globe		0		0		34	79.1%

BRAZILIAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Multifocal retinopathy - *cmr1* * a DNA test is available.	Autosomal recessive	1	Breeder option

Description and Comments

A. Multifocal retinopathy

Canine Multi-focal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multi-focal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Brazilian Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis*. 2010;16:2791-2804.

OCULAR DISORDERS REPORT

BRIARD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	2	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
C.	Cataract	Not defined	4	NO
D.	Retinal atrophy - generalized	Not defined	1	NO
E.	Retinal dystrophy formerly Congenital stationary night blindness (CSNB) * a DNA test is available	Autosomal recessive	1, 5-10	NO

Description and Comments

A. Corneal dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

In the Briard, early fundus abnormalities usually appear after 4 years of age. The electroretinogram (ERG) shows marked functional abnormalities indicative of a progressive rod-cone degeneration. The age for early diagnosis by ERG has not been established but should be possible in dogs over 2 years of age.

E. Retinal dystrophy formerly Congenital stationary night blindness (*CSNB*)

A non-progressive retinal function defect characterized primarily by night blindness; day vision is normal to severely compromised. CSNB is an autosomal recessive trait caused by a mutation in the RPE65 gene. The condition is detected by 5-6 weeks of age, after the postnatal maturation of the retina is completed. Nystagmus is present in some dogs, particularly in those having night blindness and severely compromised day vision. Ophthalmoscopic examination shows no abnormalities. Abnormalities in serum lipids (mild hypercholesterolemia) and elevated arachidonic acid have been noted in some animals. The ERG results are specific and diagnostic for the disorder. ERG testing is essential to distinguish this disorder from more central visual pathway defects which may appear clinically similar.

The gene mutation RPE65 has been identified. This is the same mutation as causes Leber's congenital amaurosis, also sometimes called juvenile retinitis pigmentosa (RP), in humans. A DNA test is available.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

3. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2015-2016.

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5. Narfstrom K. Retinal dystrophy or 'congenital stationary night blindness' in the Briard dog. *Vet Ophthalmol*. 1999;2:75-76.

6. Narfstrom K, Wrigstad A, Nilsson SE. The Briard dog: a new animal model of congenital stationary night blindness. *Br J Ophthalmol*. 1989;73:750-756.

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8. Wrigstad A, Narfstrom K, Nilsson SE. Slowly progressive changes of the retina and retinal pigment epithelium in Briard dogs with hereditary retinal dystrophy. A morphological study. *Doc Ophthalmol.* 1994;87:337-354.

9. Lightfoot RM, Cabral L, Gooch L, et al. Retinal pigment epithelial dystrophy in Briard dogs. *Res Vet Sci*. 1996;60:17-23.

10. Aguirre GD, Baldwin V, Pearce-Kelling S, et al. Congenital stationary night blindness in the dog: common mutation in the RPE65 gene indicates founder effect. *Mol Vis*. 1998;4:23.

OCULAR DISORDERS REPORT
BRIARD

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 829 #	 %	2000-2009 933 #	 %	2010-2016 513 #	 %
GLOBE							
10.000	glaucoma	1	0.1%	0		0	
EYELIDS							
20.140	ectopic cilia	1	0.1%	0		0	
21.000	entropion, unspecified	1	0.1%	0		0	
25.110	distichiasis	0		7	0.8%	2	0.4%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	2	0.2%	0		0	
NICTITANS							
51.100	third eyelid cartilage anomaly	0		1	0.1%	1	0.2%
52.110	prolapsed gland of the third eyelid	1	0.1%	0		1	0.2%
CORNEA							
70.210	corneal pannus	1	0.1%	0		0	
70.700	corneal dystrophy	7	0.8%	14	1.5%	10	1.9%
UVEA							
93.710	persistent pupillary membranes, iris to iris	6	0.7%	11	1.2%	6	1.2%
93.720	persistent pupillary membranes, iris to lens	0		1	0.1%	1	0.2%
93.730	persistent pupillary membranes, iris to cornea	0		2	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	0		2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		9	1.8%
93.999	uveal cysts	2	0.2%	4	0.4%	4	0.8%
LENS							
100.200	cataract, unspecified	9	1.1%	0		0	
100.210	cataract, suspect not inherited	16	1.9%	29	3.1%	28	5.5%
100.301	punctate cataract, anterior cortex	1	0.1%	4	0.4%	1	0.2%
100.302	punctate cataract, posterior cortex	0		1	0.1%	0	
100.305	punctate cataract, posterior sutures	0		2	0.2%	1	0.2%
100.306	punctate cataract, nucleus	1	0.1%	4	0.4%	0	
100.307	punctate cataract, capsular	0		3	0.3%	1	0.2%
100.311	incipient cataract, anterior cortex	2	0.2%	3	0.3%	1	0.2%
100.312	incipient cataract, posterior cortex	1	0.1%	7	0.8%	1	0.2%
100.313	incipient cataract, equatorial cortex	0		1	0.1%	1	0.2%
100.315	incipient cataract, posterior sutures	0		1	0.1%	0	
100.316	incipient cataract, nucleus	0		2	0.2%	1	0.2%
100.317	incipient cataract, capsular	0		2	0.2%	0	
100.323	incomplete cataract, equatorial cortex	0		0		1	0.2%
100.330	generalized/complete cataract	2	0.2%	1	0.1%	0	
100.999	*significant cataracts (summary)*	*16*	*1.9%*	*31*	*3.3%*	*8*	*1.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.1%	0	
110.135	PHPV/PTVL	0		3	0.3%	0	
110.320	vitreal degeneration	1	0.1%	1	0.1%	0	

OCULAR DISORDERS REPORT
BRIARD

	1991-1999	2000-2009	2010-2016
FUNDUS			
97.120 coloboma	1 0.1%	0	0
RETINA			
120.170 retinal dysplasia, folds	3 0.4%	2 0.2%	2 0.4%
120.180 retinal dysplasia, geographic	0	1 0.1%	0
120.310 generalized progressive retinal atrophy (PRA)	1 0.1%	0	0
120.400 retinal hemorrhage	1 0.1%	0	0
120.910 retinal detachment without dialysis	0	0	2 0.4%
OPTIC NERVE			
130.120 optic nerve hypoplasia	1 0.1%	0	0
130.150 optic disc coloboma	2 0.2%	1 0.1%	0
OTHER			
900.000 other, unspecified	0	12 1.3%	25 4.9%
900.100 other, not inherited	6 0.7%	52 5.6%	17 3.3%
900.110 other, suspected as inherited	14 1.7%	2 0.2%	0
NORMAL			
0.000 normal globe	764 92.2%	869 93.1%	448 87.3%

BRITTANY

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membrane			
	- iris to iris	Not defined	2	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
C.	Cataract	Not defined	4	NO
D.	Lens luxation	Not defined	4	NO
E.	Vitreous degeneration	Not defined	5	Breeder option
F.	Retinal dysplasia - folds	Not defined	5	Breeder option
G.	Retinal dysplasia - geographic	Not defined	6	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membrane (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

OCULAR DISORDERS REPORT

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The exact frequency and significance of cataracts in the Brittany is not known, although it is probably low.

D. Lens luxation

Partial (subluxated) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Retinal dysplasia - geographic

Abnormal development of the retina present at birth. Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

References

There are no references providing detailed descriptions of hereditary conditions of the Brittany breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2015-2016.

4. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

5. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

6. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
BRITTANY

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 676 #	1991-1999 676 %	2000-2009 1002 #	2000-2009 1002 %	2010-2016 731 #	2010-2016 731 %
EYELIDS							
25.110	distichiasis	22	3.3%	22	2.2%	13	1.8%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		1	0.1%	0	
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		2	0.3%
CORNEA							
70.700	corneal dystrophy	1	0.1%	3	0.3%	1	0.1%
70.730	corneal endothelial degeneration	2	0.3%	1	0.1%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	4	0.6%	21	2.1%	13	1.8%
93.720	persistent pupillary membranes, iris to lens	0		2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		10	1.4%
93.999	uveal cysts	0		1	0.1%	0	
LENS							
100.200	cataract, unspecified	10	1.5%	0		0	
100.210	cataract, suspect not inherited	17	2.5%	57	5.7%	34	4.7%
100.301	punctate cataract, anterior cortex	5	0.7%	3	0.3%	6	0.8%
100.302	punctate cataract, posterior cortex	3	0.4%	16	1.6%	9	1.2%
100.303	punctate cataract, equatorial cortex	1	0.1%	0		1	0.1%
100.304	punctate cataract, anterior sutures	1	0.1%	0		0	
100.305	punctate cataract, posterior sutures	1	0.1%	3	0.3%	2	0.3%
100.306	punctate cataract, nucleus	1	0.1%	0		0	
100.307	punctate cataract, capsular	0		8	0.8%	2	0.3%
100.311	incipient cataract, anterior cortex	4	0.6%	5	0.5%	1	0.1%
100.312	incipient cataract, posterior cortex	9	1.3%	18	1.8%	12	1.6%
100.313	incipient cataract, equatorial cortex	4	0.6%	3	0.3%	6	0.8%
100.314	incipient cataract, anterior sutures	0		1	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures	2	0.3%	6	0.6%	1	0.1%
100.316	incipient cataract, nucleus	1	0.1%	5	0.5%	1	0.1%
100.317	incipient cataract, capsular	0		4	0.4%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		0		1	0.1%
100.322	incomplete cataract, posterior cortex	0		0		1	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.1%
100.327	incomplete cataract, capsular	0		0		1	0.1%
100.330	generalized/complete cataract	4	0.6%	0		0	
100.340	resorbing/hypermature cataract	0		0		1	0.1%
100.375	subluxation/luxation, unspecified	0		3	0.3%	0	
100.999	*significant cataracts (summary)*	*46*	*6.8%*	*72*	*7.2%*	*48*	*6.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.1%	0		4	0.5%
110.135	PHPV/PTVL	0		1	0.1%	0	
110.320	vitreal degeneration	0		8	0.8%	7	1.0%

OCULAR DISORDERS REPORT
BRITTANY

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	1	0.1%	5	0.5%	1	0.1%
120.180	retinal dysplasia, geographic	0		6	0.6%	0	
120.310	generalized progressive retinal atrophy (PRA)	6	0.9%	12	1.2%	3	0.4%
120.910	retinal detachment without dialysis	1	0.1%	0		0	
120.920	retinal detachment with dialysis	0		0		1	0.1%
120.960	retinopathy	0		0		2	0.3%
OPTIC NERVE							
130.110	micropapilla	0		1	0.1%	0	
130.120	optic nerve hypoplasia	0		1	0.1%	0	
130.150	optic disc coloboma	0		1	0.1%	0	
OTHER							
900.000	other, unspecified	0		4	0.4%	13	1.8%
900.100	other, not inherited	4	0.6%	57	5.7%	16	2.2%
900.110	other, suspected as inherited	5	0.7%	3	0.3%	0	
NORMAL							
0.000	normal globe	592	87.6%	871	86.9%	614	84.0%

BRUSSELS GRIFFON

	DISORDER	INHERITANCE	REFERENCES	BREEDING ADVICE
A.	Exposure keratopathy syndrome/ Macroblepharon	Not defined	1	Breeder option
B.	Distichiasis	Not defined	2, 3	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 3	Breeder option
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Lens luxation	Not defined	2, 3	NO
F.	Persistent hyaloid artery	Not defined	3	Breeder option
G.	Vitreous degeneration	Not defined	1,5-6	Breeder option
H.	Retinal atrophy - generalized	Not defined	2, 3	NO
I.	Retinal dysplasia	Not defined	4	Breeder option
	- folds			
	- geographic	Not defined	6	NO
J.	Optic nerve coloboma	Not defined	1	NO

Description and Comments

A. Exposure keratopathy syndrome/macroblepharon

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

I. Retinal dysplasia - geographic

Abnormal development of the retina present at birth. Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

J. Optic nerve coloboma

A congenital cavity in the optic nerve which, if large, may cause blindness or vision impairment.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Brussels Griffon breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2017 and/or Data from OFA All-Breeds Report, 2015-2016.

5. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

6. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
BRUSSELS GRIFFON

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 362 #	 %	2000-2009 597 #	 %	2010-2016 467 #	 %
EYELIDS							
20.140	ectopic cilia	1	0.3%	6	1.0%	1	0.2%
21.000	entropion, unspecified	2	0.6%	1	0.2%	3	0.6%
25.110	distichiasis	6	1.7%	16	2.7%	10	2.1%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		1	0.2%	2	0.4%
CORNEA							
70.210	corneal pannus	0		1	0.2%	0	
70.220	pigmentary keratitis	8	2.2%	7	1.2%	9	1.9%
70.700	corneal dystrophy	1	0.3%	7	1.2%	2	0.4%
UVEA							
93.110	iris hypoplasia	0		0		2	0.4%
93.710	persistent pupillary membranes, iris to iris	10	2.8%	48	8.0%	70	15.0%
93.720	persistent pupillary membranes, iris to lens	0		1	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	0		2	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	0		1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		10	2.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		4	0.9%
93.999	uveal cysts	0		0		2	0.4%
97.150	chorioretinal coloboma, congenital	0		0		1	0.2%
LENS							
100.200	cataract, unspecified	8	2.2%	0		0	
100.210	cataract, suspect not inherited	18	5.0%	19	3.2%	19	4.1%
100.301	punctate cataract, anterior cortex	5	1.4%	12	2.0%	6	1.3%
100.302	punctate cataract, posterior cortex	6	1.7%	2	0.3%	3	0.6%
100.303	punctate cataract, equatorial cortex	1	0.3%	2	0.3%	2	0.4%
100.304	punctate cataract, anterior sutures	0		2	0.3%	1	0.2%
100.305	punctate cataract, posterior sutures	0		0		1	0.2%
100.307	punctate cataract, capsular	0		4	0.7%	0	
100.311	incipient cataract, anterior cortex	27	7.5%	39	6.5%	15	3.2%
100.312	incipient cataract, posterior cortex	7	1.9%	16	2.7%	12	2.6%
100.313	incipient cataract, equatorial cortex	10	2.8%	31	5.2%	2	0.4%
100.314	incipient cataract, anterior sutures	1	0.3%	6	1.0%	0	
100.315	incipient cataract, posterior sutures	0		3	0.5%	2	0.4%
100.316	incipient cataract, nucleus	0		3	0.5%	2	0.4%
100.317	incipient cataract, capsular	0		2	0.3%	0	
100.321	incomplete cataract, anterior cortex	0		0		2	0.4%
100.330	generalized/complete cataract	16	4.4%	10	1.7%	3	0.6%
100.375	subluxation/luxation, unspecified	3	0.8%	4	0.7%	1	0.2%
100.999	*significant cataracts (summary)*	*81*	*22.4%*	*132*	*22.1%*	*51*	*10.9%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		8	1.3%	2	0.4%
110.135	PHPV/PTVL	0		0		2	0.4%
110.320	vitreal degeneration	53	14.6%	171	28.6%	118	25.3%

OCULAR DISORDERS REPORT
BRUSSELS GRIFFON

		1991-1999		2000-2009		2010-2016	
FUNDUS							
97.110	choroidal hypoplasia	0		0		2	0.4%
97.120	coloboma	0		2	0.3%	0	
RETINA							
120.170	retinal dysplasia, folds	2	0.6%	3	0.5%	21	4.5%
120.180	retinal dysplasia, geographic	3	0.8%	5	0.8%	5	1.1%
120.190	retinal dysplasia, detached	0		0		2	0.4%
120.310	generalized progressive retinal atrophy (PRA)	6	1.7%	16	2.7%	1	0.2%
120.400	retinal hemorrhage	0		0		2	0.4%
120.910	retinal detachment without dialysis	1	0.3%	1	0.2%	0	
OPTIC NERVE							
130.120	optic nerve hypoplasia	0		0		3	0.6%
130.150	optic disc coloboma	9	2.5%	6	1.0%	4	0.9%
OTHER							
900.000	other, unspecified	0		6	1.0%	20	4.3%
900.100	other, not inherited	1	0.3%	24	4.0%	10	2.1%
900.110	other, suspected as inherited	7	1.9%	5	0.8%	4	0.9%
NORMAL							
0.000	normal globe	229	63.3%	370	62.0%	254	54.4%

OCULAR DISORDERS REPORT

BULL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder Option
	- iris to cornea	Not defined	2	NO
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary conditions of the Bull Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
BULL TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 94 #	1991-1999 94 %	2000-2009 95 #	2000-2009 95 %	2010-2016 58 #	2010-2016 58 %
GLOBE							
0.110	microphthalmia	1	1.1%	2	2.1%	0	
EYELIDS							
21.000	entropion, unspecified	0		2	2.1%	0	
22.000	ectropion, unspecified	0		0		1	1.7%
25.110	distichiasis	1	1.1%	0		4	6.9%
CORNEA							
70.700	corneal dystrophy	0		1	1.1%	0	
70.730	corneal endothelial degeneration	5	5.3%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	5	5.3%	3	3.2%	0	
93.720	persistent pupillary membranes, iris to lens	2	2.1%	2	2.1%	0	
93.730	persistent pupillary membranes, iris to cornea	6	6.4%	4	4.2%	2	3.4%
93.740	persistent pupillary membranes, iris sheets	1	1.1%	0		0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	1.7%
LENS							
100.210	cataract, suspect not inherited	0		4	4.2%	2	3.4%
100.301	punctate cataract, anterior cortex	2	2.1%	0		1	1.7%
100.302	punctate cataract, posterior cortex	1	1.1%	0		1	1.7%
100.303	punctate cataract, equatorial cortex	2	2.1%	0		0	
100.304	punctate cataract, anterior sutures	0		1	1.1%	0	
100.306	punctate cataract, nucleus	1	1.1%	0		0	
100.307	punctate cataract, capsular	0		1	1.1%	0	
100.311	incipient cataract, anterior cortex	0		1	1.1%	0	
100.312	incipient cataract, posterior cortex	1	1.1%	0		0	
100.313	incipient cataract, equatorial cortex	1	1.1%	1	1.1%	1	1.7%
100.314	incipient cataract, anterior sutures	1	1.1%	0		0	
100.315	incipient cataract, posterior sutures	1	1.1%	0		0	
100.330	generalized/complete cataract	0		2	2.1%	1	1.7%
100.375	subluxation/luxation, unspecified	3	3.2%	4	4.2%	0	
100.999	*significant cataracts (summary)*	*10*	*10.6%*	*6*	*6.3%*	*4*	*6.9%*
VITREOUS							
110.320	vitreal degeneration	1	1.1%	2	2.1%	2	3.4%
RETINA							
120.170	retinal dysplasia, folds	0		1	1.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		1	1.1%	0	
120.910	retinal detachment without dialysis	1	1.1%	1	1.1%	0	
OPTIC NERVE							
130.110	micropapilla	1	1.1%	1	1.1%	1	1.7%
130.120	optic nerve hypoplasia	3	3.2%	0		0	

OCULAR DISORDERS REPORT
BULL TERRIER

	1991-1999	2000-2009	2010-2016
OTHER			
900.000 other, unspecified	0	0	5 8.6%
900.100 other, not inherited	0	8 8.4%	0
900.110 other, suspected as inherited	3 3.2%	0	0
NORMAL			
0.000 normal globe	73 77.7%	76 80.0%	45 77.6%

BULLDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Keratoconjunctivitis sicca	Not defined	1, 7, 8	NO
B.	Entropion	Not defined	1, 3	Breeder option
C.	Ectropion	Not defined	1	Breeder option
D.	Distichiasis	Not defined	1	Breeder option
E.	Ectopic cilia	Not defined	1	Breeder option
F.	Eury/Macroblepharon	Not defined	1	Breeder option
G.	Prolapsed gland of third eyelid	Not defined	1, 4-6	Breeder option
H.	Exposure/Pigmentary Keratitis	Not defined	2	Breeder option
I.	Corneal dystrophy – epithelial/stromal	Not defined	9	Breeder option
J.	Secondary keratitis - chronic	Not defined	2	Breeder option
	Uveal cysts	Not defined	2	Breeder option
L.	Cataract	Not defined	1	NO
M.	Retinal dysplasia - folds	Not defined	1	Breeder option
N.	Multifocal retinopathy - *cmr1* * a DNA test is available.	Autosomal recessive	10, 11	Breeder option

OCULAR DISORDERS REPORT

Description and Comments

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

In the Bulldog, ectropion is associated with an exceptionally large palpebral fissure and laxity of the canthal structures. Central lower lid ectropion is often associated with entropion of the adjacent lid. This causes severe ocular irritation.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

In the Bulldog, these abnormal eyelashes may be associated with significant clinical disease and breeding of affected animals should be discouraged.

E. Ectopic cilia

Hair emerging through the eyelid conjunctiva. Ectopic cilia occur more frequently in younger dogs and cause discomfort and corneal disease.

F. Eury/Macroblepharon

Macroblepharon is defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion.

G. Prolapse of the gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated and severe chronic inflammation or keratoconjunctivitis sicca/dry eye syndrome may ensue. Commonly referred to as "cherry eye."

Bulldogs were overrepresented in a study of prolapsed gland of the third eyelid. In the study, 100% of the prolapsed glands in Bulldogs occurred before 1 year of age. Bulldogs were also more likely to develop bilateral prolapsed glands that occurred either simultaneously with the first prolapse or with a short time interval between prolapses.

H. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

I. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

J. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis – chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion.

K. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

This disorder may be observed in any breed but retriever breeds tend to be predisposed. There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

OCULAR DISORDERS REPORT

L. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

M. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

N. Multifocal Retinopathy

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write multifocal retinopathy.

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog. The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas. Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

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OCULAR DISORDERS REPORT
BULLDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 209 #	 %	2000-2009 531 #	 %	2010-2016 514 #	 %
GLOBE							
0.110	microphthalmia	1	0.5%	0		0	
EYELIDS							
20.140	ectopic cilia	3	1.4%	3	0.6%	3	0.6%
20.160	macropalpebral fissure	3	1.4%	12	2.3%	1	0.2%
21.000	entropion, unspecified	36	17.2%	74	13.9%	72	14.0%
22.000	ectropion, unspecified	11	5.3%	31	5.8%	25	4.9%
25.110	distichiasis	47	22.5%	96	18.1%	143	27.8%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.5%	0		3	0.6%
40.910	keratoconjunctivitis sicca	1	0.5%	0		7	1.4%
NICTITANS							
52.110	prolapsed gland of the third eyelid	3	1.4%	9	1.7%	8	1.6%
CORNEA							
70.210	corneal pannus	3	1.4%	6	1.1%	0	
70.220	pigmentary keratitis	4	1.9%	13	2.4%	8	1.6%
70.700	corneal dystrophy	3	1.4%	3	0.6%	5	1.0%
UVEA							
93.710	persistent pupillary membranes, iris to iris	1	0.5%	4	0.8%	3	0.6%
93.730	persistent pupillary membranes, iris to cornea	0		1	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	0		2	0.4%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.2%
93.999	uveal cysts	0		2	0.4%	9	1.8%
LENS							
100.200	cataract, unspecified	1	0.5%	0		0	
100.210	cataract, suspect not inherited	6	2.9%	10	1.9%	18	3.5%
100.301	punctate cataract, anterior cortex	1	0.5%	1	0.2%	2	0.4%
100.302	punctate cataract, posterior cortex	1	0.5%	1	0.2%	0	
100.305	punctate cataract, posterior sutures	0		0		1	0.2%
100.311	incipient cataract, anterior cortex	0		4	0.8%	1	0.2%
100.312	incipient cataract, posterior cortex	1	0.5%	1	0.2%	0	
100.313	incipient cataract, equatorial cortex	1	0.5%	2	0.4%	0	
100.314	incipient cataract, anterior sutures	1	0.5%	0		0	
100.316	incipient cataract, nucleus	1	0.5%	1	0.2%	2	0.4%
100.317	incipient cataract, capsular	0		1	0.2%	0	
100.330	generalized/complete cataract	4	1.9%	1	0.2%	0	
100.375	subluxation/luxation, unspecified	0		1	0.2%	2	0.4%
100.999	*significant cataracts (summary)*	*11*	*5.3%*	*12*	*2.3%*	*6*	*1.2%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.2%	0	
110.320	vitreal degeneration	0		2	0.4%	0	

OCULAR DISORDERS REPORT
BULLDOG

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	15	7.2%	38	7.2%	21	4.1%
120.180	retinal dysplasia, geographic	1	0.5%	2	0.4%	0	
120.190	retinal dysplasia, detached	0		2	0.4%	0	
120.960	retinopathy	0		0		1	0.2%
OTHER							
900.000	other, unspecified	0		3	0.6%	4	0.8%
900.100	other, not inherited	3	1.4%	33	6.2%	35	6.8%
900.110	other, suspected as inherited	7	3.3%	3	0.6%	4	0.8%
NORMAL							
0.000	normal globe	108	51.7%	347	65.3%	265	51.6%

OCULAR DISORDERS REPORT

BULLMASTIFF

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1	NO
B.	Entropion	Not defined	1	Breeder option
C.	Ectropion	Not defined	2	Breeder option
D.	Eury/Macroblepharon	Not defined	2	Breeder option
E.	Distichiasis	Not defined	1	Breeder option
F.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1 5	 Breeder option Passes with no notation
G.	Cataract	Not defined	1	NO
H.	Retinal atrophy - generalized * a DNA test is available	Autosomal dominant	3	NO
I.	Retinal dysplasia - folds	Not defined	1	Breeder option
J.	Multifocal retinopathy - *cmr1* * a DNA test is available	Autosomal recessive	4	Breeder option
K.	Optic nerve hypoplasia	Not defined	2	NO
L.	Micropapilla	Not defined	2	Breeder option

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine screening exam for certification.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

In the Bullmastiff, the palpebral fissures may become vertical and/or shaped like a "pagoda." Entropion in the Bullmastiff is severe and may require multiple surgical corrections.

C. Ectropion

A conformational defect resulting in eversion (rolling-out) of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and is therefore not noted on the certificate.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

H Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA in the Bullmastiff is inherited as an autosomal dominant trait. A DNA test is available.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

J. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous sub-retinal fluid, or accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal

thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

K. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

L. Micropapilla

Micropapilla refers to a small optic disc, which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve, which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

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OCULAR DISORDERS REPORT
BULLMASTIFF

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 397 #	%	2000-2009 644 #	%	2010-2016 716 #	%
GLOBE								
0.110	microphthalmia		2	0.5%	2	0.3%	1	0.1%
EYELIDS								
20.160	macropalpebral fissure		0		13	2.0%	3	0.4%
21.000	entropion, unspecified		28	7.1%	46	7.1%	27	3.8%
22.000	ectropion, unspecified		3	0.8%	15	2.3%	10	1.4%
25.110	distichiasis		11	2.8%	19	3.0%	19	2.7%
NICTITANS								
51.100	third eyelid cartilage anomaly		0		1	0.2%	0	
52.110	prolapsed gland of the third eyelid		1	0.3%	0		0	
CORNEA								
70.210	corneal pannus		0		2	0.3%	0	
70.220	pigmentary keratitis		0		1	0.2%	3	0.4%
70.700	corneal dystrophy		1	0.3%	0		1	0.1%
70.730	corneal endothelial degeneration		1	0.3%	0		0	
UVEA								
93.140	corneal endothelial pigment without PPM		0		0		1	0.1%
93.150	iris coloboma		0		2	0.3%	1	0.1%
93.710	persistent pupillary membranes, iris to iris		17	4.3%	11	1.7%	38	5.3%
93.720	persistent pupillary membranes, iris to lens		7	1.8%	2	0.3%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea		12	3.0%	6	0.9%	5	0.7%
93.740	persistent pupillary membranes, iris sheets		0		1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		7	1.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		1	0.2%	2	0.3%
93.999	uveal cysts		1	0.3%	3	0.5%	6	0.8%
97.150	chorioretinal coloboma, congenital		0		0		1	0.1%
LENS								
100.200	cataract, unspecified		1	0.3%	0		0	
100.210	cataract, suspect not inherited		8	2.0%	24	3.7%	24	3.4%
100.301	punctate cataract, anterior cortex		2	0.5%	3	0.5%	0	
100.302	punctate cataract, posterior cortex		0		2	0.3%	2	0.3%
100.303	punctate cataract, equatorial cortex		0		1	0.2%	0	
100.305	punctate cataract, posterior sutures		0		0		1	0.1%
100.307	punctate cataract, capsular		0		2	0.3%	0	
100.311	incipient cataract, anterior cortex		3	0.8%	5	0.8%	3	0.4%
100.312	incipient cataract, posterior cortex		4	1.0%	7	1.1%	2	0.3%
100.313	incipient cataract, equatorial cortex		3	0.8%	3	0.5%	3	0.4%
100.315	incipient cataract, posterior sutures		0		1	0.2%	1	0.1%
100.316	incipient cataract, nucleus		1	0.3%	3	0.5%	0	
100.321	incomplete cataract, anterior cortex		0		0		1	0.1%
100.322	incomplete cataract, posterior cortex		0		0		4	0.6%
100.323	incomplete cataract, equatorial cortex		0		0		1	0.1%
100.326	incomplete cataract, nucleus		0		0		1	0.1%
100.330	generalized/complete cataract		3	0.8%	4	0.6%	0	
100.999	*significant cataracts (summary)*		*17*	*4.3%*	*31*	*4.8%*	*19*	*2.7%*

OCULAR DISORDERS REPORT
BULLMASTIFF

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.135	PHPV/PTVL	0		0		1	0.1%
110.320	vitreal degeneration	1	0.3%	1	0.2%	1	0.1%
RETINA							
120.170	retinal dysplasia, folds	27	6.8%	27	4.2%	24	3.4%
120.180	retinal dysplasia, geographic	1	0.3%	2	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		2	0.3%	1	0.1%
120.960	retinopathy	0		0		6	0.8%
OPTIC NERVE							
130.110	micropapilla	0		2	0.3%	5	0.7%
130.120	optic nerve hypoplasia	6	1.5%	0		0	
130.150	optic disc coloboma	1	0.3%	0		1	0.1%
OTHER							
900.000	other, unspecified	0		10	1.6%	15	2.1%
900.100	other, not inherited	2	0.5%	40	6.2%	10	1.4%
900.110	other, suspected as inherited	4	1.0%	9	1.4%	0	
NORMAL							
0.000	normal globe	288	72.5%	502	78.0%	551	77.0%

OCULAR DISORDERS REPORT

CAIRN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ocular melanosis with and without glaucoma	Presumed autosomal dominant	1-3	NO
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	4, 5	Breeder option
	- lens pigment foci/no strands	Not defined	6	Passes with no notation
C.	Cataract	Not defined	1	NO
	Vitreous degeneration	Not defined	6	Breeder option
E.	Persistent hyaloid artery	Not defined	6	Breeder option

Description and Comments

A. Ocular melanosis with and without glaucoma
(Previously ocular melanosis with secondary glaucoma, previously pigmentary glaucoma)

A proliferation of melanocytes within the uveal tract associated with an elevation in intraocular pressure. Obstruction of the aqueous outflow pathways occurs resulting in glaucoma. This condition has been identified most commonly in the Cairn Terrier. The condition is familial but the exact mode of inheritance is unknown (pedigree anaylsis has ruled out a sex-linked disorder). In the Cairn Terrier, the disease is very slowly progressive and blindness ultimately results. Some dogs develop episodes of anterior uveitis associated with the shedding of large amounts of pigment from the iris surface. There is a long pre-glaucomatous phase of the disease in which diagnosis of the condition is possible. Age of onset varies from 2-14 years.

B. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. Petersen-Jones SM, Forcier J, Mentzer AL. Ocular melanosis in the Cairn Terrier: clinical description and investigation of mode of inheritance. *Vet Ophthalmol*. 2007;10 Suppl 1:63-69.

4. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

5. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

6. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
CAIRN TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 629 #	%	2000-2009 2129 #	%	2010-2016 1278 #	%
GLOBE							
0.110	microphthalmia	0		0		2	0.2%
10.000	glaucoma	2	0.3%	0		1	0.1%
EYELIDS							
25.110	distichiasis	3	0.5%	5	0.2%	7	0.5%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.1%
40.910	keratoconjunctivitis sicca	0		1	0.0%	7	0.5%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		1	0.0%	0	
52.110	prolapsed gland of the third eyelid	0		0		1	0.1%
CORNEA							
70.210	corneal pannus	0		1	0.0%	0	
70.220	pigmentary keratitis	1	0.2%	5	0.2%	1	0.1%
70.700	corneal dystrophy	2	0.3%	15	0.7%	8	0.6%
70.730	corneal endothelial degeneration	3	0.5%	0		0	
UVEA							
93.140	corneal endothelial pigment without PPM	0		0		1	0.1%
93.150	iris coloboma	0		0		1	0.1%
93.710	persistent pupillary membranes, iris to iris	12	1.9%	174	8.2%	156	12.2%
93.720	persistent pupillary membranes, iris to lens	0		5	0.2%	5	0.4%
93.730	persistent pupillary membranes, iris to cornea	3	0.5%	2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.2%	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.1%	30	2.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		3	0.1%	6	0.5%
93.930	ocular melanocytosis	0		9	0.4%	0	
93.999	uveal cysts	0		0		1	0.1%
LENS							
100.200	cataract, unspecified	10	1.6%	0		1	0.1%
100.210	cataract, suspect not inherited	11	1.7%	102	4.8%	125	9.8%
100.301	punctate cataract, anterior cortex	2	0.3%	14	0.7%	13	1.0%
100.302	punctate cataract, posterior cortex	2	0.3%	13	0.6%	11	0.9%
100.303	punctate cataract, equatorial cortex	2	0.3%	7	0.3%	5	0.4%
100.305	punctate cataract, posterior sutures	1	0.2%	3	0.1%	1	0.1%
100.306	punctate cataract, nucleus	1	0.2%	0		0	
100.307	punctate cataract, capsular	0		4	0.2%	3	0.2%
100.311	incipient cataract, anterior cortex	3	0.5%	18	0.8%	15	1.2%
100.312	incipient cataract, posterior cortex	9	1.4%	34	1.6%	16	1.3%
100.313	incipient cataract, equatorial cortex	2	0.3%	18	0.8%	10	0.8%
100.315	incipient cataract, posterior sutures	5	0.8%	2	0.1%	3	0.2%
100.316	incipient cataract, nucleus	0		2	0.1%	3	0.2%
100.317	incipient cataract, capsular	0		4	0.2%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		0		12	0.9%
100.322	incomplete cataract, posterior cortex	0		0		10	0.8%

OCULAR DISORDERS REPORT
CAIRN TERRIER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.323	incomplete cataract, equatorial cortex	0		0		3	0.2%
100.326	incomplete cataract, nucleus	0		0		2	0.2%
100.330	generalized/complete cataract	8	1.3%	17	0.8%	8	0.6%
100.340	resorbing/hypermature cataract	0		0		2	0.2%
100.375	subluxation/luxation, unspecified	0		1	0.0%	0	
100.999	*significant cataracts (summary)*	*45*	*7.2%*	*136*	*6.4%*	*119*	*9.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	5	0.8%	17	0.8%	18	1.4%
110.135	PHPV/PTVL	2	0.3%	4	0.2%	0	
110.320	vitreal degeneration	2	0.3%	24	1.1%	23	1.8%
FUNDUS							
97.110	choroidal hypoplasia	2	0.3%	0		0	
97.120	coloboma	0		0		1	0.1%
RETINA							
120.170	retinal dysplasia, folds	1	0.2%	13	0.6%	7	0.5%
120.180	retinal dysplasia, geographic	2	0.3%	3	0.1%	3	0.2%
120.310	generalized progressive retinal atrophy (PRA)	9	1.4%	11	0.5%	2	0.2%
120.960	retinopathy	0		0		1	0.1%
OPTIC NERVE							
130.110	micropapilla	0		1	0.0%	2	0.2%
130.120	optic nerve hypoplasia	1	0.2%	6	0.3%	1	0.1%
130.150	optic disc coloboma	6	1.0%	5	0.2%	0	
OTHER							
900.000	other, unspecified	0		29	1.4%	47	3.7%
900.100	other, not inherited	3	0.5%	110	5.2%	41	3.2%
900.110	other, suspected as inherited	39	6.2%	44	2.1%	14	1.1%
NORMAL							
0.000	normal globe	502	79.8%	1726	81.1%	883	69.1%

OCULAR DISORDERS REPORT

CANAAN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	2, 3	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary conditions of the Canaan Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

OCULAR DISORDERS REPORT
CANAAN DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 50 #	 %	2000-2009 335 #	 %	2010-2016 150 #	 %
EYELIDS							
25.110	distichiasis	2	4.0%	7	2.1%	6	4.0%
CORNEA							
70.700	corneal dystrophy	1	2.0%	1	0.3%	3	2.0%
UVEA							
93.710	persistent pupillary membranes, iris to iris	3	6.0%	13	3.9%	5	3.3%
93.740	persistent pupillary membranes, iris sheets	0		1	0.3%	0	
93.999	uveal cysts	0		0		2	1.3%
LENS							
100.210	cataract, suspect not inherited	3	6.0%	12	3.6%	5	3.3%
100.302	punctate cataract, posterior cortex	0		2	0.6%	0	
100.303	punctate cataract, equatorial cortex	0		1	0.3%	0	
100.304	punctate cataract, anterior sutures	0		1	0.3%	0	
100.306	punctate cataract, nucleus	1	2.0%	2	0.6%	0	
100.307	punctate cataract, capsular	0		0		1	0.7%
100.311	incipient cataract, anterior cortex	0		0		3	2.0%
100.312	incipient cataract, posterior cortex	0		4	1.2%	3	2.0%
100.314	incipient cataract, anterior sutures	1	2.0%	0		0	
100.315	incipient cataract, posterior sutures	1	2.0%	0		0	
100.316	incipient cataract, nucleus	3	6.0%	9	2.7%	0	
100.322	incomplete cataract, posterior cortex	0		0		1	0.7%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.7%
100.330	generalized/complete cataract	12	24.0%	1	0.3%	0	
100.999	*significant cataracts (summary)*	*18*	*36.0%*	*20*	*6.0%*	*9*	*6.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		0		1	0.7%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.3%	0	
RETINA							
120.170	retinal dysplasia, folds	0		2	0.6%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		9	2.7%	0	
OTHER							
900.000	other, unspecified	0		3	0.9%	3	2.0%
900.100	other, not inherited	0		18	5.4%	5	3.3%
NORMAL							
0.000	normal globe	38	76.0%	274	81.8%	123	82.0%

CANADIAN ESKIMO DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Canadian Eskimo Dog breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
CANADIAN ESKIMO DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 0 #	%	2010-2016 26 #	%
CORNEA							
70.700	corneal dystrophy	0		0		1	3.8%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		6	23.1%
LENS							
100.307	punctate cataract, capsular	0		0		1	3.8%
100.999	*significant cataracts (summary)*	*0*		*0*		*1*	*3.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		0		1	3.8%
RETINA							
120.180	retinal dysplasia, geographic	0		0		1	3.8%
OTHER							
900.100	other, not inherited	0		0		2	7.7%
NORMAL							
0.000	normal globe	0		0		19	73.1%

OCULAR DISORDERS REPORT

CANE CORSO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	3,4	Breeder option
B.	Ectropion	Not defined	3,4	Breeder option
C.	Eury/Macroblepharon	Not defined	3	Breeder option
D.	Distichiasis	Not defined	4	Breeder option
E.	Prolapsed gland of the third eyelid	Not defined	3	Breeder option
F.	Nictitans cartilage anomaly/eversion	Not defined	3	Breeder option
G.	Cataract	Not defined	3,4	NO
H.	Multifocal retinopathy - *cmr1* * a DNA test is available	Autosomal recessive	1, 2	Breeder option
I.	Neuronal ceroid lipofuscinosis	Autosomal recessive	5	NO

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion in the Mastiff is severe and may require multiple surgical corrections.

B. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

F. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

H. Multifocal retinopathy

Canine Multi-focal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their

abnormal appearing retinas.

Canine Multi-focal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

I. Neuronal ceroid lipofuscinosis

An inherited disease of man and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease.)

References

1. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vi*s. 2010;16:2791-2804.

2. Guziewicz KE, Slavik J, Lindauer SP et al. Molecular consequences of BEST1 gene mutations in canine multifocal retinopathy predict functional implications for human bestrophinopathies. IOVS 52(7) 2011; 4497-505.

3. Guandilini A, Girolamo ND, Santillo D, et al. Epidemiology of ocular disorders presumed to be inherited in three large Italian dog breeds. Veterinary Ophthalmology 20(5) 2017; 420-426.

4. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breed Report, 2010-2016.

5. Kolicheski A, Barnes Heller HL, Arnold S, et al. Homozygous PPT1 splice donor mutation in a Cane Corso dog with neuronal ceroid lipofuscinosis. J Vet Intern Med. 31(1) 2017; 149-157.

OCULAR DISORDERS REPORT
CANE CORSO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 2 #	%	2010-2016 148 #	%
EYELIDS							
21.000	entropion, unspecified	0		0		4	2.7%
22.000	ectropion, unspecified	0		0		10	6.8%
25.110	distichiasis	0		0		6	4.1%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		1	50.0%	0	
52.110	prolapsed gland of the third eyelid	0		1	50.0%	1	0.7%
CORNEA							
70.700	corneal dystrophy	0		0		1	0.7%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		3	2.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	1.4%
93.999	uveal cysts	0		0		2	1.4%
LENS							
100.210	cataract, suspect not inherited	0		0		4	2.7%
100.301	punctate cataract, anterior cortex	0		0		1	0.7%
100.302	punctate cataract, posterior cortex	0		0		2	1.4%
100.305	punctate cataract, posterior sutures	0		0		1	0.7%
100.330	generalized/complete cataract	0		0		1	0.7%
100.999	*significant cataracts (summary)*	*0*		*0*		*5*	*3.4%*
VITREOUS							
110.135	PHPV/PTVL	0		0		1	0.7%
RETINA							
120.960	retinopathy	0		0		1	0.7%
OTHER							
900.000	other, unspecified	0		0		1	0.7%
900.100	other, not inherited	0		0		1	0.7%
NORMAL							
0.000	normal globe	0		2	100.0%	119	80.4%

OCULAR DISORDERS REPORT

CARDIGAN WELSH CORGI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	1	NO
D.	Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*) * a DNA test is available	Presumed autosomal recessive	1, 4-6	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin that may cause ocular irritation. Distichiasis may occur any time in the life of the dog. It is difficult to make a strong recommendation about breeding dogs with this entity. The hereditary basis is not known although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

D. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA in the Cardigan Welsh Corgi is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the PDE6A gene. A DNA test is available.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

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5. Petersen-Jones SM, Entz DD. An improved DNA-based test for detection of the codon 616 mutation in the alpha cyclic GMP phosphodiesterase gene that causes progressive retinal atrophy in the Cardigan Welsh Corgi. *Vet Ophthalmol*. 2002;5:103-106.

6. Keep JM. Clinical aspects of progressive retinal atrophy in the Cardigan Welsh Corgi. *Aust Vet J*. 1972;48:197-199.

OCULAR DISORDERS REPORT
CARDIGAN WELSH CORGI

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1571 #	%	2000-2009 1370 #	%	2010-2016 850 #	%
GLOBE							
0.110	microphthalmia	1	0.1%	1	0.1%	0	
EYELIDS							
25.110	distichiasis	51	3.2%	60	4.4%	32	3.8%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.1%
CORNEA							
70.700	corneal dystrophy	8	0.5%	5	0.4%	3	0.4%
70.730	corneal endothelial degeneration	0		1	0.1%	1	0.1%
UVEA							
93.110	iris hypoplasia	0		0		1	0.1%
93.150	iris coloboma	0		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	38	2.4%	49	3.6%	21	2.5%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	2	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.2%	5	0.4%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	0		1	0.1%	0	
93.810	uveal melanoma	0		0		1	0.1%
LENS							
100.200	cataract, unspecified	15	1.0%	0		0	
100.210	cataract, suspect not inherited	47	3.0%	45	3.3%	20	2.4%
100.301	punctate cataract, anterior cortex	5	0.3%	4	0.3%	1	0.1%
100.302	punctate cataract, posterior cortex	7	0.4%	2	0.1%	2	0.2%
100.303	punctate cataract, equatorial cortex	4	0.3%	4	0.3%	5	0.6%
100.304	punctate cataract, anterior sutures	2	0.1%	0		0	
100.305	punctate cataract, posterior sutures	0		1	0.1%	3	0.4%
100.306	punctate cataract, nucleus	1	0.1%	1	0.1%	0	
100.311	incipient cataract, anterior cortex	19	1.2%	10	0.7%	4	0.5%
100.312	incipient cataract, posterior cortex	8	0.5%	8	0.6%	2	0.2%
100.313	incipient cataract, equatorial cortex	7	0.4%	5	0.4%	3	0.4%
100.314	incipient cataract, anterior sutures	1	0.1%	1	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures	1	0.1%	0		1	0.1%
100.316	incipient cataract, nucleus	3	0.2%	4	0.3%	0	
100.317	incipient cataract, capsular	0		2	0.1%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		0		1	0.1%
100.322	incomplete cataract, posterior cortex	0		0		1	0.1%
100.330	generalized/complete cataract	6	0.4%	1	0.1%	1	0.1%
100.340	resorbing/hypermature cataract	0		0		1	0.1%
100.999	*significant cataracts (summary)*	*79*	*5.0%*	*43*	*3.1%*	*27*	*3.2%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	4	0.3%	0		0	
110.320	vitreal degeneration	3	0.2%	2	0.1%	3	0.4%
FUNDUS							
97.110	choroidal hypoplasia	0		2	0.1%	1	0.1%
97.120	coloboma	0		2	0.1%	0	

OCULAR DISORDERS REPORT
CARDIGAN WELSH CORGI

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	13	0.8%	10	0.7%	1	0.1%
120.180	retinal dysplasia, geographic	4	0.3%	1	0.1%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	8	0.5%	1	0.1%	0	
120.400	retinal hemorrhage	1	0.1%	0		0	
120.910	retinal detachment without dialysis	2	0.1%	0		0	
OPTIC NERVE							
130.120	optic nerve hypoplasia	3	0.2%	0		0	
OTHER							
900.000	other, unspecified	0		8	0.6%	8	0.9%
900.100	other, not inherited	3	0.2%	35	2.6%	14	1.6%
900.110	other, suspected as inherited	4	0.3%	4	0.3%	1	0.1%
NORMAL							
0.000	normal globe	1357	86.4%	1236	90.2%	739	86.9%

OCULAR DISORDERS REPORT

CAVALIER KING CHARLES SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1, 2	NO
B.	Keratoconjunctivitis sicca	Not defined	3	NO
C.	Congenital KCS and ichthyosiform dermatosis	Autosomal recessive	4, 5	NO
D.	Entropion	Not defined	6	Breeder option
E.	Distichiasis	Not defined	1	Breeder option
F.	Corneal dystrophy - epithelial/stromal	Not defined	1, 7	Breeder option
G.	Exposure/pigmentary keratitis	Not defined	1	Breeder option
H.	Persistent pupillary membranes - iris to iris	Not defined	8	Breeder option
I.	Cataract	Not defined	1, 9	NO
J.	Vitreous degeneration	Not defined	6	Breeder option
K.	Retinal dysplasia - folds	Not defined	1	Breeder option
L.	Retinal dysplasia - geographic/detached	Not defined	1	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye often associated with other ocular malformations, including defects of the cornea, anterior chamber, lens and/or retina

B. Keratoconjunctivitis sicca (KCS)

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

C. Congenital KCS and ichthyosiform dermatosis

A syndrome in which dogs are born with severe to absolute keratoconjunctivitis sicca (KCS) which is poorly responsive to lacrimostimulant treatment. Co-morbid congenital dermatopathy affecting haircoat, skin and footpads is severe and requires intensive life-long care. Clinical signs are so devastating that affected dogs are often euthanized.

D. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Cavalier King Charles Spaniel, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

G. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

H. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

I. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Cavalier King Charles Spaniel, onset is at an early age (less than 6 months), affecting the cortex and nucleus with rapid progression to complete cataract, resulting in blindness.

J. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

K. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

L. Retinal dysplasia – geographic/detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Narfstrom K, Dubielzig R. Posterior lenticonus, cataracts and microphthalmia: Congenital defects in the Cavalier King Charles spaniel. *J Small Anim Pract*. 1984;25.

3. Sanchez RF, Innocent G, Mould J, et al. Canine keratoconjunctivitis sicca: disease trends in a review of 229 cases. *J Small Anim Pract*. 2007;48:211-217.

4. Hartley C, Donaldson D, Smith KC, et al. Congenital keratoconjunctivitis sicca and ichthyosiform dermatosis in 25 Cavalier King Charles spaniel dogs – part I: clinical signs, histopathology, and inheritance. *Vet Ophthalmol*. 2012;15:315-326.

5. Barnett KC. Congenital keratoconjunctivitis sicca and ichthyosiform dermatosis in the Cavalier King Charles Spaniel. *J Small Anim Pract*. 2006;47:524-528.

6. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

7. Crispin SM, Barnett KC. Dystrophy, degeneration and infiltration of the canine cornea. *J Small Anim Pract*. 1983;24:63-83.

8. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

9. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985;26:305-316.

OCULAR DISORDERS REPORT
CAVALIER KING CHARLES SPANIEL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 6383 #	%	2000-2009 26222 #	%	2010-2016 20439 #	%
GLOBE							
0.110	microphthalmia	8	0.1%	38	0.1%	31	0.2%
10.000	glaucoma	2	0.0%	1	0.0%	0	
EYELIDS							
20.140	ectopic cilia	0		3	0.0%	0	
20.160	macropalpebral fissure	14	0.2%	96	0.4%	16	0.1%
21.000	entropion, unspecified	21	0.3%	120	0.5%	68	0.3%
22.000	ectropion, unspecified	1	0.0%	6	0.0%	3	0.0%
25.110	distichiasis	498	7.8%	2465	9.4%	1875	9.2%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	3	0.0%	0		37	0.2%
40.910	keratoconjunctivitis sicca	2	0.0%	29	0.1%	63	0.3%
NICTITANS							
50.210	pannus of third eyelid	0		0		1	0.0%
51.100	third eyelid cartilage anomaly	0		5	0.0%	1	0.0%
52.110	prolapsed gland of the third eyelid	4	0.1%	7	0.0%	8	0.0%
CORNEA							
70.210	corneal pannus	2	0.0%	9	0.0%	3	0.0%
70.220	pigmentary keratitis	11	0.2%	92	0.4%	172	0.8%
70.700	corneal dystrophy	494	7.7%	2313	8.8%	1893	9.3%
70.730	corneal endothelial degeneration	6	0.1%	33	0.1%	14	0.1%
UVEA							
93.110	iris hypoplasia	0		0		4	0.0%
93.140	corneal endothelial pigment without PPM	0		7	0.0%	0	
93.150	iris coloboma	2	0.0%	2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	19	0.3%	307	1.2%	242	1.2%
93.720	persistent pupillary membranes, iris to lens	3	0.0%	23	0.1%	11	0.1%
93.730	persistent pupillary membranes, iris to cornea	5	0.1%	23	0.1%	7	0.0%
93.740	persistent pupillary membranes, iris sheets	4	0.1%	40	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	0.0%	34	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.0%	10	0.0%
93.999	uveal cysts	2	0.0%	11	0.0%	10	0.0%
97.150	chorioretinal coloboma, congenital	0		0		2	0.0%
LENS							
100.200	cataract, unspecified	57	0.9%	0		0	
100.210	cataract, suspect not inherited	243	3.8%	945	3.6%	751	3.7%
100.301	punctate cataract, anterior cortex	37	0.6%	123	0.5%	128	0.6%
100.302	punctate cataract, posterior cortex	13	0.2%	59	0.2%	47	0.2%
100.303	punctate cataract, equatorial cortex	15	0.2%	43	0.2%	33	0.2%
100.304	punctate cataract, anterior sutures	3	0.0%	25	0.1%	18	0.1%
100.305	punctate cataract, posterior sutures	26	0.4%	39	0.1%	52	0.3%
100.306	punctate cataract, nucleus	10	0.2%	64	0.2%	48	0.2%
100.307	punctate cataract, capsular	5	0.1%	23	0.1%	20	0.1%
100.311	incipient cataract, anterior cortex	56	0.9%	176	0.7%	145	0.7%

OCULAR DISORDERS REPORT
CAVALIER KING CHARLES SPANIEL

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.312	incipient cataract, posterior cortex	34	0.5%	141	0.5%	100	0.5%
100.313	incipient cataract, equatorial cortex	20	0.3%	91	0.3%	45	0.2%
100.314	incipient cataract, anterior sutures	2	0.0%	18	0.1%	8	0.0%
100.315	incipient cataract, posterior sutures	13	0.2%	48	0.2%	19	0.1%
100.316	incipient cataract, nucleus	22	0.3%	122	0.5%	86	0.4%
100.317	incipient cataract, capsular	0		39	0.1%	23	0.1%
100.321	incomplete cataract, anterior cortex	0		0		29	0.1%
100.322	incomplete cataract, posterior cortex	0		0		35	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		8	0.0%
100.325	incomplete cataract, posterior sutures	0		0		5	0.0%
100.326	incomplete cataract, nucleus	0		0		21	0.1%
100.327	incomplete cataract, capsular	0		0		7	0.0%
100.330	generalized/complete cataract	38	0.6%	132	0.5%	50	0.2%
100.340	resorbing/hypermature cataract	0		0		9	0.0%
100.375	subluxation/luxation, unspecified	0		8	0.0%	8	0.0%
100.999	*significant cataracts (summary)*	*351*	*5.5%*	*1143*	*4.4%*	*936*	*4.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	21	0.3%	48	0.2%	20	0.1%
110.135	PHPV/PTVL	0		17	0.1%	14	0.1%
110.320	vitreal degeneration	10	0.2%	124	0.5%	117	0.6%
FUNDUS							
97.110	choroidal hypoplasia	1	0.0%	4	0.0%	3	0.0%
97.120	coloboma	0		4	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	622	9.7%	2161	8.2%	972	4.8%
120.180	retinal dysplasia, geographic	273	4.3%	818	3.1%	427	2.1%
120.190	retinal dysplasia, detached	46	0.7%	80	0.3%	39	0.2%
120.310	generalized progressive retinal atrophy (PRA)	25	0.4%	92	0.4%	37	0.2%
120.400	retinal hemorrhage	3	0.0%	3	0.0%	0	
120.910	retinal detachment without dialysis	12	0.2%	6	0.0%	2	0.0%
120.920	retinal detachment with dialysis	0		0		2	0.0%
120.960	retinopathy	0		0		34	0.2%
OPTIC NERVE							
130.110	micropapilla	1	0.0%	16	0.1%	7	0.0%
130.120	optic nerve hypoplasia	2	0.0%	10	0.0%	0	
130.150	optic disc coloboma	2	0.0%	4	0.0%	22	0.1%
OTHER							
900.000	other, unspecified	0		159	0.6%	437	2.1%
900.100	other, not inherited	54	0.8%	1043	4.0%	556	2.7%
900.110	other, suspected as inherited	67	1.0%	95	0.4%	51	0.2%
NORMAL							
0.000	normal globe	4260	66.7%	19514	74.4%	14557	71.2%

OCULAR DISORDERS REPORT

CESKY TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2, 3	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Cesky Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

3. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
CESKY TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 38 #	 %	2000-2009 55 #	 %	2010-2016 28 #	 %
EYELIDS							
25.110	distichiasis	7	18.4%	9	16.4%	3	10.7%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	2.6%	0		0	
CORNEA							
70.700	corneal dystrophy	3	7.9%	5	9.1%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		1	1.8%	3	10.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	3.6%
97.150	chorioretinal coloboma, congenital	0		0		1	3.6%
LENS							
100.200	cataract, unspecified	1	2.6%	0		0	
100.210	cataract, suspect not inherited	1	2.6%	0		0	
100.301	punctate cataract, anterior cortex	0		1	1.8%	0	
100.307	punctate cataract, capsular	0		2	3.6%	0	
100.311	incipient cataract, anterior cortex	1	2.6%	0		0	
100.312	incipient cataract, posterior cortex	0		1	1.8%	0	
100.999	*significant cataracts (summary)*	*2*	*5.3%*	*4*	*7.3%*	*0*	
FUNDUS							
97.110	choroidal hypoplasia	0		0		1	3.6%
RETINA							
120.170	retinal dysplasia, folds	3	7.9%	4	7.3%	1	3.6%
120.910	retinal detachment without dialysis	1	2.6%	0		0	
OPTIC NERVE							
130.110	micropapilla	0		1	1.8%	0	
OTHER							
900.000	other, unspecified	0		0		1	3.6%
900.100	other, not inherited	0		4	7.3%	1	3.6%
NORMAL							
0.000	normal globe	23	60.5%	39	70.9%	20	71.4%

OCULAR DISORDERS REPORT

CHESAPEAKE BAY RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1-3 6	 Breeder option Passes with no notation
D.	Cataract	Presumed incomplete dominant	1, 4	NO
E.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1, 5	NO
F.	Retinal dysplasia - folds	Not defined	1	Breeder option
G.	Retinal dysplasia - geographic/detached	Not defined	1	NO

Description and Comments

A. Entropion

A conformational defect resulting in "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that minimizes or eliminates the likelihood of the defect.

B. Distichiasis

Eyelashes abnormally located in the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Hereditary cataracts have been described in the Chesapeake Bay Retriever and affect the young adult dog. They appear as posterior cortical, axial, triangular opacities and the Y suture tips can be affected in both the anterior and posterior cortices. Extension of the cataract into the posterior cortex and progression to impair vision can occur. An autosomal dominant inheritance with incomplete penetrance has been proposed; however, the genetics have not been completely defined and additional studies will be required.

E. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Chesapeake Bay Retriever is *PRCD* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is

characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available. It is important to note than in all breeds in which a molecular diagnostic test for the disease is available, it is possible to have dogs diagnosed clinically as affected, yet the DNA test results are normal. This suggests that other genetic causes of PRA exist or that the diagnosed affected dog has an acquired disease that mimics the inherited disorder.

A second, less common form of PRA is also present in the Chesapeake Bay Retriever with ophthalmoscopic abnormalities characteristic of mid-stage disease found in dogs between 8-12 months of age. The lesions are progressive and end-stage lesions are evident by 2-3 years of age. A DNA test is available.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Retinal dysplasia - geographic/detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. Gelatt KN. Cataracts in Chesapeake Bay retrievers. *J Am Vet Med Assoc*. 1979;175:1176-1178.

5. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
CHESAPEAKE BAY RETRIEVER

	TOTAL DOGS EXAMINED	1991-1999 4494		2000-2009 5655		2010-2016 2976	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	4	0.1%	3	0.1%	0	
10.000	glaucoma	2	0.0%	1	0.0%	1	0.0%
EYELIDS							
20.140	ectopic cilia	0		1	0.0%	1	0.0%
20.160	macropalpebral fissure	0		3	0.1%	0	
21.000	entropion, unspecified	18	0.4%	29	0.5%	8	0.3%
22.000	ectropion, unspecified	3	0.1%	4	0.1%	0	
25.110	distichiasis	320	7.1%	388	6.9%	247	8.3%
NICTITANS							
51.100	third eyelid cartilage anomaly	1	0.0%	0		1	0.0%
52.110	prolapsed gland of the third eyelid	0		0		2	0.1%
CORNEA							
70.210	corneal pannus	1	0.0%	0		0	
70.700	corneal dystrophy	21	0.5%	38	0.7%	19	0.6%
70.730	corneal endothelial degeneration	1	0.0%	0		0	
UVEA							
93.150	iris coloboma	0		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	62	1.4%	97	1.7%	71	2.4%
93.720	persistent pupillary membranes, iris to lens	2	0.0%	7	0.1%	2	0.1%
93.730	persistent pupillary membranes, iris to cornea	1	0.0%	2	0.0%	0	
93.740	persistent pupillary membranes, iris sheets	6	0.1%	8	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.0%	45	1.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		4	0.1%
93.810	uveal melanoma	0		0		1	0.0%
93.999	uveal cysts	3	0.1%	12	0.2%	11	0.4%
LENS							
100.200	cataract, unspecified	74	1.6%	0		0	
100.210	cataract, suspect not inherited	146	3.2%	266	4.7%	146	4.9%
100.301	punctate cataract, anterior cortex	18	0.4%	15	0.3%	13	0.4%
100.302	punctate cataract, posterior cortex	40	0.9%	48	0.8%	28	0.9%
100.303	punctate cataract, equatorial cortex	16	0.4%	14	0.2%	6	0.2%
100.304	punctate cataract, anterior sutures	5	0.1%	2	0.0%	2	0.1%
100.305	punctate cataract, posterior sutures	21	0.5%	12	0.2%	8	0.3%
100.306	punctate cataract, nucleus	2	0.0%	4	0.1%	1	0.0%
100.307	punctate cataract, capsular	1	0.0%	14	0.2%	5	0.2%
100.311	incipient cataract, anterior cortex	24	0.5%	23	0.4%	9	0.3%
100.312	incipient cataract, posterior cortex	77	1.7%	99	1.8%	51	1.7%
100.313	incipient cataract, equatorial cortex	20	0.4%	26	0.5%	9	0.3%
100.314	incipient cataract, anterior sutures	4	0.1%	2	0.0%	1	0.0%
100.315	incipient cataract, posterior sutures	17	0.4%	20	0.4%	12	0.4%
100.316	incipient cataract, nucleus	6	0.1%	10	0.2%	2	0.1%
100.317	incipient cataract, capsular	1	0.0%	13	0.2%	9	0.3%
100.321	incomplete cataract, anterior cortex	0		0		1	0.0%
100.322	incomplete cataract, posterior cortex	0		0		3	0.1%

OCULAR DISORDERS REPORT
CHESAPEAKE BAY RETRIEVER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.325	incomplete cataract, posterior sutures	0		0		2	0.1%
100.326	incomplete cataract, nucleus	0		0		1	0.0%
100.330	generalized/complete cataract	25	0.6%	16	0.3%	2	0.1%
100.375	subluxation/luxation, unspecified	2	0.0%	3	0.1%	2	0.1%
100.999	*significant cataracts (summary)*	*351*	*7.8%*	*318*	*5.6%*	*165*	*5.5%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	9	0.2%	10	0.2%	1	0.0%
110.135	PHPV/PTVL	3	0.1%	5	0.1%	2	0.1%
110.320	vitreal degeneration	16	0.4%	40	0.7%	41	1.4%
FUNDUS							
97.110	choroidal hypoplasia	3	0.1%	0		0	
RETINA							
120.170	retinal dysplasia, folds	25	0.6%	38	0.7%	21	0.7%
120.180	retinal dysplasia, geographic	26	0.6%	19	0.3%	4	0.1%
120.190	retinal dysplasia, detached	0		1	0.0%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	42	0.9%	37	0.7%	14	0.5%
120.400	retinal hemorrhage	0		1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	0		0	
120.960	retinopathy	0		0		6	0.2%
OPTIC NERVE							
130.110	micropapilla	0		1	0.0%	0	
130.120	optic nerve hypoplasia	1	0.0%	1	0.0%	0	
130.150	optic disc coloboma	0		2	0.0%	0	
OTHER							
900.000	other, unspecified	0		41	0.7%	86	2.9%
900.100	other, not inherited	22	0.5%	306	5.4%	114	3.8%
900.110	other, suspected as inherited	33	0.7%	19	0.3%	7	0.2%
NORMAL							
0.000	normal globe	3623	80.6%	4759	84.2%	2335	78.5%

OCULAR DISORDERS REPORT

CHIHUAHUA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - endothelial	Not defined	2, 3	NO
C.	Persistent pupillary membranes - iris to iris	Not defined	2, 4	Breeder option
D.	Cataract	Not defined	2	NO
E.	Vitreous degeneration	Not defined	2	Breeder option
F.	Retinal atrophy generalized (*prcd*) * a DNA test is available	Autosomal recessive	5, 6	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - endothelial

An abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

In the Chihuahua, this is a primary degenerative endothelial disease leading to progressive and permanent corneal edema. It is suspected to be a heritable disorder. There is no sex predilection. The condition is observed in older dogs, 6 to 13 years of age with a mean of 9.5 years. The corneal edema starts asymptomatically in the dorsal temporal corneal quadrant of one eye and slowly progresses medially, eventually involving the entire cornea. Typically, it becomes bilateral. In the later stages, discomfort, intracorneal bullae with subsequent ulceration and keratoconus may develop. Histologically, the primary endothelial disease appears slightly different from the clinically similar disorder of the Boston Terrier.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized *(prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Chihuahua is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

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3. Martin CL and Dice PF. Corneal endothelial dystrophy in the dog. *J Am Anim Hosp Assoc.* 1982;18:327.

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OCULAR DISORDERS REPORT
CHIHUAHUA

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 130 #	%	2000-2009 541 #	%	2010-2016 970 #	%
EYELIDS								
20.140	ectopic cilia		0		0		1	0.1%
21.000	entropion, unspecified		0		3	0.6%	0	
25.110	distichiasis		5	3.8%	21	3.9%	56	5.8%
NASOLACRIMAL								
32.110	imperforate lower nasolacrimal punctum		0		0		3	0.3%
40.910	keratoconjunctivitis sicca		0		0		2	0.2%
NICTITANS								
52.110	prolapsed gland of the third eyelid		1	0.8%	0		3	0.3%
CORNEA								
70.220	pigmentary keratitis		0		0		3	0.3%
70.700	corneal dystrophy		0		2	0.4%	1	0.1%
70.730	corneal endothelial degeneration		2	1.5%	1	0.2%	3	0.3%
UVEA								
93.710	persistent pupillary membranes, iris to iris		7	5.4%	34	6.3%	85	8.8%
93.720	persistent pupillary membranes, iris to lens		0		0		4	0.4%
93.730	persistent pupillary membranes, iris to cornea		0		1	0.2%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		7	0.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		1	0.2%	1	0.1%
LENS								
100.200	cataract, unspecified		3	2.3%	0		0	
100.210	cataract, suspect not inherited		0		16	3.0%	31	3.2%
100.301	punctate cataract, anterior cortex		2	1.5%	2	0.4%	4	0.4%
100.303	punctate cataract, equatorial cortex		1	0.8%	0		1	0.1%
100.304	punctate cataract, anterior sutures		0		0		1	0.1%
100.305	punctate cataract, posterior sutures		0		2	0.4%	1	0.1%
100.306	punctate cataract, nucleus		0		0		1	0.1%
100.307	punctate cataract, capsular		0		0		1	0.1%
100.311	incipient cataract, anterior cortex		2	1.5%	10	1.8%	15	1.5%
100.312	incipient cataract, posterior cortex		4	3.1%	3	0.6%	10	1.0%
100.313	incipient cataract, equatorial cortex		1	0.8%	2	0.4%	4	0.4%
100.314	incipient cataract, anterior sutures		0		0		1	0.1%
100.315	incipient cataract, posterior sutures		0		0		1	0.1%
100.316	incipient cataract, nucleus		4	3.1%	1	0.2%	1	0.1%
100.317	incipient cataract, capsular		0		0		3	0.3%
100.321	incomplete cataract, anterior cortex		0		0		2	0.2%
100.325	incomplete cataract, posterior sutures		0		0		1	0.1%
100.326	incomplete cataract, nucleus		0		0		3	0.3%
100.330	generalized/complete cataract		2	1.5%	9	1.7%	1	0.1%
100.375	subluxation/luxation, unspecified		0		1	0.2%	0	
100.999	*significant cataracts (summary)*		*19*	*14.6%*	*29*	*5.4%*	*51*	*5.3%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		0		0		2	0.2%
110.135	PHPV/PTVL		0		0		2	0.2%

OCULAR DISORDERS REPORT
CHIHUAHUA

VITREOUS CONTINUED	1991-1999	2000-2009	2010-2016
110.320 vitreal degeneration	13 10.0%	19 3.5%	33 3.4%
FUNDUS			
97.110 choroidal hypoplasia	0	0	1 0.1%
RETINA			
120.170 retinal dysplasia, folds	2 1.5%	3 0.6%	2 0.2%
120.180 retinal dysplasia, geographic	0	1 0.2%	2 0.2%
120.310 generalized progressive retinal atrophy (PRA)	3 2.3%	5 0.9%	3 0.3%
120.960 retinopathy	0	0	1 0.1%
OPTIC NERVE			
130.110 micropapilla	0	1 0.2%	0
130.150 optic disc coloboma	0	1 0.2%	0
OTHER			
900.000 other, unspecified	0	5 0.9%	16 1.6%
900.100 other, not inherited	1 0.8%	20 3.7%	30 3.1%
900.110 other, suspected as inherited	1 0.8%	2 0.4%	2 0.2%
NORMAL			
0.000 normal globe	95 73.1%	454 83.9%	764 78.8%

OCULAR DISORDERS REPORT

CHINESE CRESTED

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2, 3	Breeder option
C.	Cataract	Not defined	4	NO
D.	Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*) * a DNA test is available	Presumed autosomal recessive	8	NO
E.	Lens luxation * a DNA test is available	Not defined	5, 6	NO
F.	Vitreous degeneration	Not defined	3, 5, 6, 7	Breeder option
G.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	3, 7, 8	NO
H.	Ceroid lipofuscinosis	Not defined	9	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA in the Cardigan Welsh Corgi is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the PDE6A gene. A DNA test is available.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from its normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal atrophy - generalized *(prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Chinese Crested is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at

least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

In the Chinese Crested, a second, but very infrequency type of PRA has been identified that is caused by the mutation in the *PDE6A* gene that causes PRA in Cardigan Welsh Corgis. However, most cases of PRA that test normal for the *prcd* gene defect likely results from a gene defect that is still to be identified.

H. Ceroid lipofuscinosis

An inherited disease of humans and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease)

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OCULAR DISORDERS REPORT
CHINESE CRESTED

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	472		4606		1538	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	0		3	0.1%	1	0.1%
10.000	glaucoma	0		1	0.0%	1	0.1%
EYELIDS							
20.140	ectopic cilia	0		0		2	0.1%
21.000	entropion, unspecified	0		4	0.1%	0	
25.110	distichiasis	1	0.2%	23	0.5%	17	1.1%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		4	0.3%
40.910	keratoconjunctivitis sicca	1	0.2%	14	0.3%	3	0.2%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		2	0.0%	1	0.1%
CORNEA							
70.210	corneal pannus	4	0.8%	1	0.0%	0	
70.220	pigmentary keratitis	1	0.2%	4	0.1%	2	0.1%
70.700	corneal dystrophy	2	0.4%	26	0.6%	7	0.5%
70.730	corneal endothelial degeneration	0		2	0.0%	0	
UVEA							
93.110	iris hypoplasia	0		3	0.1%	2	0.1%
93.150	iris coloboma	1	0.2%	0		1	0.1%
93.710	persistent pupillary membranes, iris to iris	4	0.8%	112	2.4%	52	3.4%
93.720	persistent pupillary membranes, iris to lens	3	0.6%	7	0.2%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	2	0.4%	7	0.2%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	2	0.4%	3	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		3	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		3	0.2%
93.999	uveal cysts	0		3	0.1%	1	0.1%
LENS							
100.210	cataract, suspect not inherited	3	0.6%	114	2.5%	41	2.7%
100.301	punctate cataract, anterior cortex	2	0.4%	15	0.3%	16	1.0%
100.302	punctate cataract, posterior cortex	1	0.2%	13	0.3%	4	0.3%
100.303	punctate cataract, equatorial cortex	1	0.2%	8	0.2%	5	0.3%
100.304	punctate cataract, anterior sutures	0		2	0.0%	1	0.1%
100.305	punctate cataract, posterior sutures	0		3	0.1%	3	0.2%
100.306	punctate cataract, nucleus	0		6	0.1%	3	0.2%
100.307	punctate cataract, capsular	0		3	0.1%	4	0.3%
100.311	incipient cataract, anterior cortex	2	0.4%	26	0.6%	14	0.9%
100.312	incipient cataract, posterior cortex	0		22	0.5%	8	0.5%
100.313	incipient cataract, equatorial cortex	2	0.4%	19	0.4%	9	0.6%
100.314	incipient cataract, anterior sutures	0		2	0.0%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	3	0.1%	2	0.1%
100.316	incipient cataract, nucleus	0		5	0.1%	0	
100.317	incipient cataract, capsular	0		1	0.0%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		0		3	0.2%

OCULAR DISORDERS REPORT
CHINESE CRESTED

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.322	incomplete cataract, posterior cortex	0		0		3	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.1%
100.326	incomplete cataract, nucleus	0		0		1	0.1%
100.330	generalized/complete cataract	2	0.4%	21	0.5%	3	0.2%
100.340	resorbing/hypermature cataract	0		0		1	0.1%
100.375	subluxation/luxation, unspecified	2	0.4%	20	0.4%	6	0.4%
100.999	*significant cataracts (summary)*	*11*	*2.3%*	*149*	*3.2%*	*82*	*5.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	2	0.4%	4	0.1%	0	
110.135	PHPV/PTVL	0		1	0.0%	1	0.1%
110.320	vitreal degeneration	15	3.2%	592	12.9%	170	11.1%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.0%	2	0.1%
97.120	coloboma	0		2	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	0		27	0.6%	5	0.3%
120.180	retinal dysplasia, geographic	1	0.2%	5	0.1%	0	
120.190	retinal dysplasia, detached	2	0.4%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	5	1.1%	81	1.8%	10	0.7%
120.400	retinal hemorrhage	0		2	0.0%	2	0.1%
120.910	retinal detachment without dialysis	0		7	0.2%	1	0.1%
120.960	retinopathy	0		0		2	0.1%
OPTIC NERVE							
130.110	micropapilla	0		3	0.1%	1	0.1%
130.120	optic nerve hypoplasia	4	0.8%	6	0.1%	3	0.2%
130.150	optic disc coloboma	0		8	0.2%	0	
OTHER							
900.000	other, unspecified	0		26	0.6%	42	2.7%
900.100	other, not inherited	3	0.6%	149	3.2%	27	1.8%
900.110	other, suspected as inherited	6	1.3%	14	0.3%	0	
NORMAL							
0.000	normal globe	413	87.5%	3943	85.6%	1244	80.9%

CHINESE FOO DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Lens luxation * a DNA test is available	Not defined	1	NO

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Chinese Foo Dog. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

CHINESE SHAR-PEI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1	NO
B.	Entropion	Not defined	1-5	NO
C.	Prolapsed gland of third eyelid	Not defined	1	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	1-3	Breeder option
E.	Persistent pupillary membranes - iris to iris	Not defined	6	Breeder option
F.	Cataract	Not defined	1	NO
G.	Lens luxation	Autosomal recessive	1, 7	NO
H.	Retinal atrophy - generalized	Not defined	1	NO
I.	Secondary keratitis - chronic	Not defined	6	Breeder option

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

OCULAR DISORDERS REPORT

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

The condition is a particularly severe problem in the Chinese Shar-Pei and is compounded by breeder selection for facial conformation with heavy skin folds which encourages formation of entropion.

C. Prolapsed gland of the third eyelid

This condition, which is often referred to as "cherry eye," represents a protrusion of the glandular portion of the third eyelid. The mode of inheritance of this disorder is unknown. Exposure of the gland may cause ocular irritation and be associated with decreased tears (Keratoconjunctivitis sicca).

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

I. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis – chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Lenarduzzi R. Management of eyelid problems in Chinese Shar-Pei puppies. *Vet Med Small Anim Clin*. 1983;78:548-550.

3. Bedford PGC. Entropion in Shar-Peis (Correspondence). *Vet Rec*. 1984;115:666.

4. Startup FG. Entropion in the Shar-Pei (Correspondence). *Vet Rec*. 1985;116:57.

5. Barnett KC. Inherited eye disease in the dog and cat. *J Small Anim Pract*. 1988;29:462-475.

6. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

7. Lazarus JA, Pickett JP, Champagne ES. Primary lens luxation in the Chinese Shar-Pei: clinical and hereditary characteristics. *Vet Ophthalmol*. 1998;1:101-107.

OCULAR DISORDERS REPORT
CHINESE SHAR PEI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 325 #	 %	2000-2009 168 #	 %	2010-2016 114 #	 %
GLOBE								
0.110	microphthalmia		0		1	0.6%	1	0.9%
EYELIDS								
21.000	entropion, unspecified		182	56.0%	71	42.3%	54	47.4%
22.000	ectropion, unspecified		8	2.5%	2	1.2%	2	1.8%
25.110	distichiasis		1	0.3%	1	0.6%	1	0.9%
NICTITANS								
51.100	third eyelid cartilage anomaly		0		1	0.6%	1	0.9%
52.110	prolapsed gland of the third eyelid		1	0.3%	1	0.6%	0	
CORNEA								
70.210	corneal pannus		25	7.7%	4	2.4%	0	
70.220	pigmentary keratitis		3	0.9%	1	0.6%	7	6.1%
70.700	corneal dystrophy		2	0.6%	1	0.6%	1	0.9%
70.730	corneal endothelial degeneration		3	0.9%	3	1.8%	1	0.9%
UVEA								
93.710	persistent pupillary membranes, iris to iris		7	2.2%	8	4.8%	0	
93.720	persistent pupillary membranes, iris to lens		2	0.6%	3	1.8%	0	
93.730	persistent pupillary membranes, iris to cornea		3	0.9%	2	1.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		2	1.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		1	0.9%
93.810	uveal melanoma		0		1	0.6%	0	
LENS								
100.200	cataract, unspecified		4	1.2%	0		0	
100.210	cataract, suspect not inherited		5	1.5%	8	4.8%	1	0.9%
100.301	punctate cataract, anterior cortex		1	0.3%	0		1	0.9%
100.302	punctate cataract, posterior cortex		1	0.3%	0		0	
100.305	punctate cataract, posterior sutures		1	0.3%	1	0.6%	0	
100.306	punctate cataract, nucleus		0		0		1	0.9%
100.307	punctate cataract, capsular		0		1	0.6%	0	
100.311	incipient cataract, anterior cortex		0		2	1.2%	0	
100.312	incipient cataract, posterior cortex		3	0.9%	2	1.2%	1	0.9%
100.313	incipient cataract, equatorial cortex		0		0		1	0.9%
100.314	incipient cataract, anterior sutures		1	0.3%	0		0	
100.315	incipient cataract, posterior sutures		0		1	0.6%	1	0.9%
100.316	incipient cataract, nucleus		0		0		1	0.9%
100.330	generalized/complete cataract		2	0.6%	0		0	
100.375	subluxation/luxation, unspecified		7	2.2%	2	1.2%	0	
100.999	*significant cataracts (summary)*		*13*	*4.0%*	*7*	*4.2%*	*6*	*5.3%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		0		1	0.6%	0	
110.320	vitreal degeneration		0		1	0.6%	0	

OCULAR DISORDERS REPORT
CHINESE SHAR PEI

	1991-1999	2000-2009	2010-2016
RETINA			
120.170 retinal dysplasia, folds	1 0.3%	3 1.8%	0
120.180 retinal dysplasia, geographic	0	1 0.6%	0
120.310 generalized progressive retinal atrophy (PRA)	2 0.6%	0	0
120.910 retinal detachment without dialysis	1 0.3%	0	0
OPTIC NERVE			
130.120 optic nerve hypoplasia	1 0.3%	0	0
OTHER			
900.000 other, unspecified	0	2 1.2%	7 6.1%
900.100 other, not inherited	3 0.9%	11 6.5%	2 1.8%
900.110 other, suspected as inherited	16 4.9%	3 1.8%	3 2.6%
NORMAL			
0.000 normal globe	153 47.1%	85 50.6%	49 43.0%

CHINOOK

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes	Not defined	1	Breeder option
	- iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Vitreous degeneration	Not defined	2, 3	Breeder option
D.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

D. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Chinook breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

3. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

OCULAR DISORDERS REPORT
CHINOOK

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 102 #	%	2000-2009 829 #	%	2010-2016 529 #	%
EYELIDS							
20.140	ectopic cilia	0		0		1	0.2%
25.110	distichiasis	0		3	0.4%	2	0.4%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		1	0.2%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		1	0.1%	3	0.6%
CORNEA							
70.700	corneal dystrophy	0		1	0.1%	1	0.2%
70.730	corneal endothelial degeneration	0		1	0.1%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	3	2.9%	46	5.5%	42	7.9%
93.720	persistent pupillary membranes, iris to lens	0		1	0.1%	1	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.2%
93.810	uveal melanoma	0		0		1	0.2%
LENS							
100.200	cataract, unspecified	2	2.0%	0		0	
100.210	cataract, suspect not inherited	10	9.8%	45	5.4%	24	4.5%
100.301	punctate cataract, anterior cortex	0		4	0.5%	2	0.4%
100.302	punctate cataract, posterior cortex	1	1.0%	0		1	0.2%
100.303	punctate cataract, equatorial cortex	0		0		1	0.2%
100.305	punctate cataract, posterior sutures	0		1	0.1%	1	0.2%
100.306	punctate cataract, nucleus	1	1.0%	4	0.5%	2	0.4%
100.311	incipient cataract, anterior cortex	1	1.0%	6	0.7%	2	0.4%
100.312	incipient cataract, posterior cortex	2	2.0%	12	1.4%	3	0.6%
100.313	incipient cataract, equatorial cortex	4	3.9%	3	0.4%	0	
100.314	incipient cataract, anterior sutures	0		1	0.1%	0	
100.315	incipient cataract, posterior sutures	0		7	0.8%	2	0.4%
100.316	incipient cataract, nucleus	0		4	0.5%	3	0.6%
100.317	incipient cataract, capsular	0		3	0.4%	2	0.4%
100.321	incomplete cataract, anterior cortex	0		0		1	0.2%
100.322	incomplete cataract, posterior cortex	0		0		2	0.4%
100.330	generalized/complete cataract	1	1.0%	8	1.0%	0	
100.375	subluxation/luxation, unspecified	0		0		1	0.2%
100.999	*significant cataracts (summary)*	*12*	*11.8%*	*53*	*6.4%*	*22*	*4.2%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		2	0.2%	0	
110.320	vitreal degeneration	0		12	1.4%	5	0.9%
RETINA							
120.170	retinal dysplasia, folds	1	1.0%	50	6.0%	12	2.3%
120.180	retinal dysplasia, geographic	0		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		1	0.1%	0	

OCULAR DISORDERS REPORT
CHINOOK

RETINA CONTINUED	1991-1999	2000-2009	2010-2016
120.920 retinal detachment with dialysis	0	0	1 0.2%
OTHER			
900.000 other, unspecified	0	6 0.7%	13 2.5%
900.100 other, not inherited	1 1.0%	40 4.8%	13 2.5%
900.110 other, suspected as inherited	2 2.0%	0	0
NORMAL			
0.000 normal globe	80 78.4%	698 84.2%	443 83.7%

CHOW CHOW

DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A. Glaucoma	Not defined	1-3	NO
B. Entropion	Not defined	1	NO
C. Ectropion	Not defined	4	Breeder option
D. Corneal dystrophy - endothelial	Not defined	1	NO
E. Persistent pupillary membranes			
- iris to iris	Not defined	1, 5	Breeder option
- iris to lens	Not defined	6	NO
- iris to cornea	Not defined	6	NO
- lens pigment foci/no strands	Not defined	9	Passes with no notation
F. Cataract	Not defined	1, 7	NO
G. Secondary keratitis – chronic	Not defined	4, 8	Breeder option

DESCRIPTION AND COMMENTS

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine screening exam for certification.

Age of onset in the Chow Chow appears to be anywhere between 3-6 years of age and has been observed as a bilateral condition. Gonioscopy has shown extremely narrow iridocorneal angles and in many regions no evidence of trabecular meshwork.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

Entropion in the Chow Chow has been observed for decades and is definitely related to the amount of skin covering the head and face. Because of the conformation admired by both fanciers and the judges, it is doubtful that we will see a significant change in the incidence of entropion as folds are, in many cases, desired by these individuals. Entropion requires surgical correction in the Chow Chow to return comfort and decrease chances for vision loss.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Major PPM's have been observed in the Chow Chow. Many ophthalmologists have observed puppies so severely affected that they are temporarily or permanently blind. The blindness is due to adherence of the membranes to the cornea and/or lens.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely

(diffuse) or in a localized region.

In the Chow Chow, the only reported cataract is congenital. The clinical appearance is variable, ranging from small nuclear or capsular opacities to generalized opacity. The central lens (nucleus) is most consistently affected with variable involvement of the peripheral lens (cortex). Concurrent ocular anomalies may include entropion, microphthalmia, persistent pupillary membranes, and retinal folds, although any direct relationship of these latter conditions to the cataract is unclear.

G. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other - unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis - chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Gelatt KN, MacKay EO. Prevalence of the breed-related glaucomas in pure-bred dogs in North America. *Vet Ophthalmol*. 2004;7:97-111.

3. Corcaran KA, Koch SA. Primary glaucoma in the Chow chows. *Prog Vet Comp Ophthal*. 1994;4:193-197.

4. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

5. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

6. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

7. Collins BK, Collier LL, Johnson GS, et al. Familial cataracts and concurrent ocular anomalies in chow chows. *J Am Vet Med Assoc*. 1992;200:1485-1491.

8. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

9. ACVO Genetics Committee, 2017 and/or Data from Cerf All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
CHOW CHOW

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**384**		**598**		**390**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
GLOBE							
0.110	microphthalmia	2	0.5%	2	0.3%	0	
EYELIDS							
20.160	macropalpebral fissure	1	0.3%	1	0.2%	1	0.3%
21.000	entropion, unspecified	118	30.7%	183	30.6%	73	18.7%
22.000	ectropion, unspecified	7	1.8%	10	1.7%	8	2.1%
25.110	distichiasis	5	1.3%	1	0.2%	2	0.5%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		2	0.5%
CORNEA							
70.210	corneal pannus	5	1.3%	4	0.7%	0	
70.220	pigmentary keratitis	0		17	2.8%	8	2.1%
70.700	corneal dystrophy	4	1.0%	4	0.7%	0	
70.730	corneal endothelial degeneration	9	2.3%	7	1.2%	1	0.3%
UVEA							
93.140	corneal endothelial pigment without PPM	0		4	0.7%	1	0.3%
93.710	persistent pupillary membranes, iris to iris	87	22.7%	254	42.5%	134	34.4%
93.720	persistent pupillary membranes, iris to lens	5	1.3%	9	1.5%	3	0.8%
93.730	persistent pupillary membranes, iris to cornea	18	4.7%	26	4.3%	12	3.1%
93.740	persistent pupillary membranes, iris sheets	2	0.5%	6	1.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		16	4.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		2	0.5%
LENS							
100.210	cataract, suspect not inherited	5	1.3%	19	3.2%	6	1.5%
100.301	punctate cataract, anterior cortex	2	0.5%	0		0	
100.302	punctate cataract, posterior cortex	3	0.8%	2	0.3%	0	
100.303	punctate cataract, equatorial cortex	0		2	0.3%	0	
100.305	punctate cataract, posterior sutures	1	0.3%	0		0	
100.306	punctate cataract, nucleus	1	0.3%	0		1	0.3%
100.307	punctate cataract, capsular	0		1	0.2%	0	
100.311	incipient cataract, anterior cortex	4	1.0%	1	0.2%	0	
100.312	incipient cataract, posterior cortex	4	1.0%	4	0.7%	1	0.3%
100.315	incipient cataract, posterior sutures	0		0		1	0.3%
100.316	incipient cataract, nucleus	1	0.3%	2	0.3%	0	
100.326	incomplete cataract, nucleus	0		0		1	0.3%
100.330	generalized/complete cataract	1	0.3%	0		0	
100.999	*significant cataracts (summary)*	*17*	*4.4%*	*12*	*2.0%*	*4*	*1.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	0.8%	1	0.2%	1	0.3%
110.320	vitreal degeneration	1	0.3%	1	0.2%	1	0.3%
RETINA							
120.170	retinal dysplasia, folds	0		2	0.3%	0	
120.180	retinal dysplasia, geographic	0		1	0.2%	0	

OCULAR DISORDERS REPORT
CHOW CHOW

RETINA CONTINUED	1991-1999	2000-2009	2010-2016
120.190 retinal dysplasia, detached	1 0.3%	0	0
120.310 generalized progressive retinal atrophy (PRA)	4 1.0%	3 0.5%	1 0.3%
OPTIC NERVE			
130.120 optic nerve hypoplasia	1 0.3%	0	0
OTHER			
900.000 other, unspecified	0	6 1.0%	11 2.8%
900.100 other, not inherited	0	22 3.7%	8 2.1%
900.110 other, suspected as inherited	9 2.3%	6 1.0%	0
NORMAL			
0.000 normal globe	175 45.6%	265 44.3%	176 45.1%

CLUMBER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia	Not defined	1	NO
B.	Keratoconjunctivitis sicca	Not defined	1, 2	NO
C.	Entropion	Not defined	1, 3	Breeder option
D.	Ectropion	Not defined	1	Breeder option
E.	Distichiasis	Not defined	1	Breeder option
F.	Persistent pupillary membranes - iris to iris	Not defined	1, 4	Breeder option
G.	Cataract	Not defined	1	NO
H.	Retinal dysplasia - folds	Not defined	1	Breeder option
I.	Secondary keratitis - chronic	Not defined	1	Breeder option

Description and Comments

A. Microphthalmia

Microphthalmia is a congenital defect characterized by a small eye often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina.

An association has been made between partial albinism, multiple ocular defects (especially microphthalmia) and deafness in a number of canine breeds including the Collie. From these reports it appears that a predominantly white hair coat is associated with a higher incidence of ocular defects.

B. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

C. Entropion

A conformational defect resulting in "in-rolling" of one or both of the eyelids, which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

I. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis – chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

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OCULAR DISORDERS REPORT
CLUMBER SPANIEL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 991 #	%	2000-2009 1311 #	%	2010-2016 437 #	%
GLOBE							
0.110	microphthalmia	4	0.4%	2	0.2%	0	
EYELIDS							
20.140	ectopic cilia	0		1	0.1%	0	
20.160	macropalpebral fissure	63	6.4%	92	7.0%	12	2.7%
21.000	entropion, unspecified	227	22.9%	269	20.5%	93	21.3%
22.000	ectropion, unspecified	195	19.7%	184	14.0%	63	14.4%
25.110	distichiasis	48	4.8%	106	8.1%	43	9.8%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.1%	0		4	0.9%
40.910	keratoconjunctivitis sicca	4	0.4%	10	0.8%	4	0.9%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		1	0.1%	0	
CORNEA							
70.210	corneal pannus	9	0.9%	4	0.3%	0	
70.220	pigmentary keratitis	7	0.7%	4	0.3%	0	
70.700	corneal dystrophy	2	0.2%	3	0.2%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	30	3.0%	27	2.1%	8	1.8%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	4	0.4%	2	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0		0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		2	0.5%
LENS							
100.200	cataract, unspecified	15	1.5%	0		0	
100.210	cataract, suspect not inherited	21	2.1%	54	4.1%	11	2.5%
100.301	punctate cataract, anterior cortex	11	1.1%	8	0.6%	1	0.2%
100.302	punctate cataract, posterior cortex	9	0.9%	13	1.0%	6	1.4%
100.303	punctate cataract, equatorial cortex	0		5	0.4%	0	
100.304	punctate cataract, anterior sutures	0		1	0.1%	0	
100.305	punctate cataract, posterior sutures	5	0.5%	5	0.4%	6	1.4%
100.306	punctate cataract, nucleus	5	0.5%	0		0	
100.307	punctate cataract, capsular	1	0.1%	0		0	
100.311	incipient cataract, anterior cortex	6	0.6%	8	0.6%	1	0.2%
100.312	incipient cataract, posterior cortex	14	1.4%	25	1.9%	3	0.7%
100.313	incipient cataract, equatorial cortex	3	0.3%	1	0.1%	3	0.7%
100.314	incipient cataract, anterior sutures	2	0.2%	0		0	
100.315	incipient cataract, posterior sutures	5	0.5%	7	0.5%	4	0.9%
100.316	incipient cataract, nucleus	5	0.5%	2	0.2%	0	
100.317	incipient cataract, capsular	1	0.1%	3	0.2%	1	0.2%
100.322	incomplete cataract, posterior cortex	0		0		1	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.2%
100.326	incomplete cataract, nucleus	0		0		1	0.2%
100.330	generalized/complete cataract	4	0.4%	1	0.1%	0	

OCULAR DISORDERS REPORT
CLUMBER SPANIEL

LENS CONTINUED	1991-1999		2000-2009		2010-2016	
100.999 significant cataracts (summary)	*86*	*8.7%*	*79*	*6.0%*	*28*	*6.4%*
VITREOUS						
110.120 persistent hyaloid artery/remnant	2	0.2%	4	0.3%	0	
110.135 PHPV/PTVL	0		3	0.2%	0	
FUNDUS						
97.110 choroidal hypoplasia	2	0.2%	0		0	
97.120 coloboma	3	0.3%	0		0	
RETINA						
120.170 retinal dysplasia, folds	77	7.8%	89	6.8%	15	3.4%
120.180 retinal dysplasia, geographic	4	0.4%	3	0.2%	2	0.5%
120.310 generalized progressive retinal atrophy (PRA)	8	0.8%	6	0.5%	1	0.2%
120.910 retinal detachment without dialysis	0		1	0.1%	0	
120.960 retinopathy	0		0		1	0.2%
OPTIC NERVE						
130.150 optic disc coloboma	0		1	0.1%	1	0.2%
OTHER						
900.000 other, unspecified	0		10	0.8%	15	3.4%
900.100 other, not inherited	5	0.5%	56	4.3%	9	2.1%
900.110 other, suspected as inherited	14	1.4%	7	0.5%	3	0.7%
NORMAL						
0.000 normal globe	515	52.0%	732	55.8%	208	47.6%

OCULAR DISORDERS REPORT

COCKER SPANIEL

(*American)

*The official breed name is Cocker Spaniel. The designation "American" has been used to avoid confusion and emphasize the distinction from the English Cocker Spaniel breed.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Keratoconjunctivitis sicca	Not defined	1, 2	NO
B.	Glaucoma	Not defined	1, 3, 4	NO
C.	Entropion	Not defined		Breeder option
D.	Ectropion	Not defined		Breeder option
E.	Distichiasis	Not defined	1, 2, 5, 6	Breeder option
F.	Eury/Macroblepharon	Not defined		Breeder option
G.	Imperforate lacrimal punctum	Not defined		Breeder option
H.	Prolapsed gland of the third eyelid	Not defined	1, 7	Breeder option
I.	Corneal dystrophy - epithelial/stromal	Not defined		Breeder option
J.	Corneal dystrophy - posterior polymorphous	Not defined		Breeder option
K.	Persistent pupillary membranes - iris to iris	Not defined	8	Breeder option
L.	Cataract	Presumed autosomal recessive	1, 2, 9-12	NO

OCULAR DISORDERS REPORT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
M.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1, 13-15	NO
N.	Retinal dysplasia - folds	Not defined	1, 16	Breeder option
O.	Retinal dysplasia - geographic/detached	Not defined	1, 16	NO
P.	Secondary keratitis - chronic	Not defined	1, 17	Breeder option

Description and Comments

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

OCULAR DISORDERS REPORT

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Eury/Macroblepharon

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other - unlisted conditions suspected as inherited. Then in the comments box please write eury/macroblepharon.

Macroblepharon is defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion.

G. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct adjacent to the eye. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

H. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

I. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

J. Corneal dystrophy - posterior polymorphous

Posterior polymorphous dystrophy appears as multifocal, non-pigmented, vesicular to linear posterior corneal opacities at the level of the corneal endothelium. The condition is bilateral and has been seen in dogs from 1-7 years of age. Progression of the dystrophy is limited, and there is no treatment. It differs from endothelial dystrophy by an absence of corneal edema. Corneal endothelial cells distant from the corneal opacities are normal.

OCULAR DISORDERS REPORT

K. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

L. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In this breed, the onset of cataract may occur at an early age (less than 2 years) with rapid progression to maturity and associated with significant lens-induced inflammation.

M. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Cocker Spaniel is PRCD which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

N. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

O. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

P. Secondary keratitis - chronic

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other - unlisted conditions suspected as inherited. Then in the comments box please write secondary keratitis - chronic.

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. Often associated with entropion or a combination of entropion and ectropion

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

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OCULAR DISORDERS REPORT
COCKER SPANIEL

	TOTAL DOGS EXAMINED	1991-1999 27349		2000-2009 21729		2010-2016 9245	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	25	0.1%	8	0.0%	2	0.0%
10.000	glaucoma	27	0.1%	1	0.0%	8	0.1%
EYELIDS							
20.110	eyelid dermoid	2	0.0%	0		0	
20.140	ectopic cilia	39	0.1%	12	0.1%	5	0.1%
20.160	macropalpebral fissure	105	0.4%	67	0.3%	7	0.1%
21.000	entropion, unspecified	91	0.3%	59	0.3%	8	0.1%
22.000	ectropion, unspecified	623	2.3%	291	1.3%	77	0.8%
25.110	distichiasis	14836	54.2%	9921	45.7%	4571	49.4%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	352	1.3%	6	0.0%	142	1.5%
40.910	keratoconjunctivitis sicca	144	0.5%	73	0.3%	146	1.6%
NICTITANS							
51.100	third eyelid cartilage anomaly	6	0.0%	2	0.0%	0	
52.110	prolapsed gland of the third eyelid	90	0.3%	96	0.4%	39	0.4%
CORNEA							
70.210	corneal pannus	375	1.4%	119	0.5%	3	0.0%
70.220	pigmentary keratitis	114	0.4%	226	1.0%	167	1.8%
70.700	corneal dystrophy	753	2.8%	616	2.8%	244	2.6%
70.730	corneal endothelial degeneration	20	0.1%	15	0.1%	4	0.0%
UVEA							
90.250	pigmentary uveitis	0		1	0.0%	0	
93.110	iris hypoplasia	0		0		3	0.0%
93.140	corneal endothelial pigment without PPM	0		2	0.0%	0	
93.150	iris coloboma	2	0.0%	4	0.0%	2	0.0%
93.710	persistent pupillary membranes, iris to iris	45	0.2%	78	0.4%	45	0.5%
93.720	persistent pupillary membranes, iris to lens	19	0.1%	11	0.1%	1	0.0%
93.730	persistent pupillary membranes, iris to cornea	20	0.1%	13	0.1%	2	0.0%
93.740	persistent pupillary membranes, iris sheets	13	0.0%	14	0.1%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		40	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		4	0.0%
93.810	uveal melanoma	0		0		1	0.0%
93.999	uveal cysts	3	0.0%	13	0.1%	6	0.1%
97.150	chorioretinal coloboma, congenital	0		0		6	0.1%
LENS							
100.200	cataract, unspecified	1023	3.7%	0		0	
100.210	cataract, suspect not inherited	1164	4.3%	1544	7.1%	739	8.0%
100.301	punctate cataract, anterior cortex	490	1.8%	320	1.5%	149	1.6%
100.302	punctate cataract, posterior cortex	275	1.0%	187	0.9%	78	0.8%
100.303	punctate cataract, equatorial cortex	70	0.3%	52	0.2%	24	0.3%
100.304	punctate cataract, anterior sutures	70	0.3%	54	0.2%	13	0.1%
100.305	punctate cataract, posterior sutures	90	0.3%	77	0.4%	30	0.3%
100.306	punctate cataract, nucleus	50	0.2%	20	0.1%	7	0.1%

OCULAR DISORDERS REPORT
COCKER SPANIEL

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.307	punctate cataract, capsular	4	0.0%	39	0.2%	22	0.2%
100.311	incipient cataract, anterior cortex	439	1.6%	457	2.1%	163	1.8%
100.312	incipient cataract, posterior cortex	529	1.9%	532	2.4%	170	1.8%
100.313	incipient cataract, equatorial cortex	121	0.4%	146	0.7%	54	0.6%
100.314	incipient cataract, anterior sutures	41	0.1%	52	0.2%	13	0.1%
100.315	incipient cataract, posterior sutures	95	0.3%	71	0.3%	19	0.2%
100.316	incipient cataract, nucleus	111	0.4%	61	0.3%	24	0.3%
100.317	incipient cataract, capsular	4	0.0%	53	0.2%	32	0.3%
100.321	incomplete cataract, anterior cortex	0		0		61	0.7%
100.322	incomplete cataract, posterior cortex	0		0		58	0.6%
100.323	incomplete cataract, equatorial cortex	0		0		9	0.1%
100.324	incomplete cataract, anterior sutures	0		0		1	0.0%
100.325	incomplete cataract, posterior sutures	0		0		4	0.0%
100.326	incomplete cataract, nucleus	0		0		14	0.2%
100.327	incomplete cataract, capsular	0		0		1	0.0%
100.330	generalized/complete cataract	581	2.1%	363	1.7%	83	0.9%
100.340	resorbing/hypermature cataract	0		0		21	0.2%
100.375	subluxation/luxation, unspecified	32	0.1%	29	0.1%	12	0.1%
100.999	*significant cataracts (summary)*	*3993*	*14.6%*	*2484*	*11.4%*	*1050*	*11.4%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	21	0.1%	14	0.1%	7	0.1%
110.135	PHPV/PTVL	3	0.0%	5	0.0%	1	0.0%
110.320	vitreal degeneration	57	0.2%	62	0.3%	47	0.5%
FUNDUS							
97.110	choroidal hypoplasia	13	0.0%	17	0.1%	3	0.0%
97.120	coloboma	11	0.0%	3	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	3725	13.6%	2448	11.3%	670	7.2%
120.180	retinal dysplasia, geographic	102	0.4%	49	0.2%	17	0.2%
120.190	retinal dysplasia, detached	4	0.0%	5	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	264	1.0%	160	0.7%	39	0.4%
120.400	retinal hemorrhage	7	0.0%	0		0	
120.910	retinal detachment without dialysis	13	0.0%	1	0.0%	0	
120.960	retinopathy	0		0		25	0.3%
OPTIC NERVE							
130.110	micropapilla	2	0.0%	2	0.0%	0	
130.120	optic nerve hypoplasia	7	0.0%	3	0.0%	0	
130.150	optic disc coloboma	73	0.3%	22	0.1%	17	0.2%
OTHER							
900.000	other, unspecified	0		144	0.7%	307	3.3%
900.100	other, not inherited	75	0.3%	961	4.4%	300	3.2%
900.110	other, suspected as inherited	452	1.7%	186	0.9%	26	0.3%
NORMAL							
0.000	normal globe	10559	38.6%	9649	44.4%	3755	40.6%

OCULAR DISORDERS REPORT

COLLIE

(Rough and Smooth varieties)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia	Not defined	1, 2	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	3	Breeder option
D.	Persistent pupillary membranes - iris to iris - iris to lens	 Not defined Not defined	 1, 3 4	 Breeder option NO
E.	Cataract	Not defined	1	NO
F.	Persistent hyaloid artery	Not defined	5	Breeder option
G.	Retinal atrophy - generalized	Not defined	1	NO
H.	Retinal atrophy-Rod/cone dysplasia type 2- (*rcd2*) * a DNA test is available	Autosomal recessive	6-9	NO
I.	Retinal dysplasia - folds	Not defined	1	Breeder option
J.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma * a DNA test is available	Autosomal recessive	1, 10-34	NO

OCULAR DISORDERS REPORT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
K.	Stationary night blindness	Presumed autosomal recessive	35	NO
L.	Proliferative keratoconjunctivitis	Not defined	1, 36, 37	Breeder option

Description and Comments

A. Microphthalmia

Microphthalmia is a congenital defect characterized by a small eye often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina.

An association has been made between partial albinism, multiple ocular defects (especially microphthalmia) and deafness in a number of canine breeds including the Collie. From these reports it appears that a predominantly white hair coat is associated with a higher incidence of ocular defects.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. In the Collie, because there is significant clinical disease associated with the abnormal hairs, breeding of affected animals should be discouraged.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Collie, this is a particularly serious problem noted frequently on routine screening examination. The majority of persistent pupillary membranes identified on routine screening examinations include iris sheets, and bridging from the iris to cornea and the iris to lens. These may result in vision impairment.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds. In the Collie, the rod/cone degeneration occurs very rarely and in those cases has not been caused by any of the known genetic mutations.

H. Retinal atrophy - Rod-cone dysplasia type 2- (*rcd2*)

An inherited retinal disease characterized by abortive or abnormal development of rods and cones. The disease can be detected histologically by 6 weeks. Clinical night blindness is observed as early as 6 weeks with total blindness by 1 year of age. It may be diagnosed as early as 24 days with an ERG. Histologically the disease can be detected by 6 weeks. This form of retinal dysplasia is clinically similar to, but genetically distinct from that seen in the Irish Setter. This condition is caused by an insertion in *RD3.* A DNA test is available.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

J. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

A DNA test is available and may not be predictive of all populations. As the genotype-phenotype correlation is complex, and not always straightforward, one should refer to http://www.optigen.com/opt9_coloboma_res.html for a summary and more details of the molecular studies of CEA.

K. Stationary night blindness

An inherited defect in vision in which rod function is markedly abnormal or absent, but cone function is either normal or minimally affected. The condition does not progress to complete blindness, and there is no ophthalmoscopic evidence of retinal degeneration. Definitive diagnosis requires electroretinography. Only a single case has been reported in the literature.

L. Proliferative keratoconjunctivitis

An acquired condition characterized by a progressive, pink, fleshy mass involving the cornea, raised bands of inflammatory tissue on the anterior aspect of the nictitating membrane, and conjunctivitis. The condition is most likely immune-mediated but affects Collies more frequently than other breeds.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

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OCULAR DISORDERS REPORT
COLLIE

	TOTAL DOGS EXAMINED	1991-1999 24617		2000-2009 21417		2010-2016 11061	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	282	1.1%	340	1.6%	254	2.3%
10.000	glaucoma	6	0.0%	1	0.0%	0	
EYELIDS							
20.110	eyelid dermoid	1	0.0%	0		0	
20.140	ectopic cilia	4	0.0%	1	0.0%	0	
20.160	macropalpebral fissure	0		1	0.0%	0	
21.000	entropion, unspecified	18	0.1%	31	0.1%	7	0.1%
22.000	ectropion, unspecified	5	0.0%	3	0.0%	0	
25.110	distichiasis	484	2.0%	357	1.7%	226	2.0%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.0%	4	0.0%	3	0.0%
40.910	keratoconjunctivitis sicca	1	0.0%	1	0.0%	3	0.0%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		8	0.1%
52.110	prolapsed gland of the third eyelid	0		1	0.0%	1	0.0%
CORNEA							
70.210	corneal pannus	2	0.0%	0		1	0.0%
70.220	pigmentary keratitis	2	0.0%	5	0.0%	0	
70.700	corneal dystrophy	212	0.9%	127	0.6%	54	0.5%
70.730	corneal endothelial degeneration	5	0.0%	7	0.0%	0	
UVEA							
90.250	pigmentary uveitis	0		1	0.0%	0	
93.110	iris hypoplasia	0		0		4	0.0%
93.140	corneal endothelial pigment without PPM	0		1	0.0%	0	
93.150	iris coloboma	11	0.0%	8	0.0%	4	0.0%
93.710	persistent pupillary membranes, iris to iris	2597	10.5%	3776	17.6%	2933	26.5%
93.720	persistent pupillary membranes, iris to lens	129	0.5%	168	0.8%	168	1.5%
93.730	persistent pupillary membranes, iris to cornea	55	0.2%	50	0.2%	19	0.2%
93.740	persistent pupillary membranes, iris sheets	30	0.1%	33	0.2%	2	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		31	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		2	0.0%	10	0.1%
93.810	uveal melanoma	0		0		4	0.0%
93.999	uveal cysts	6	0.0%	6	0.0%	12	0.1%
97.150	chorioretinal coloboma, congenital	0		0		224	2.0%
LENS							
100.200	cataract, unspecified	114	0.5%	0		0	
100.210	cataract, suspect not inherited	154	0.6%	214	1.0%	177	1.6%
100.301	punctate cataract, anterior cortex	35	0.1%	27	0.1%	17	0.2%
100.302	punctate cataract, posterior cortex	17	0.1%	3	0.0%	2	0.0%
100.303	punctate cataract, equatorial cortex	2	0.0%	1	0.0%	2	0.0%
100.304	punctate cataract, anterior sutures	15	0.1%	6	0.0%	6	0.1%
100.305	punctate cataract, posterior sutures	9	0.0%	6	0.0%	5	0.0%
100.306	punctate cataract, nucleus	28	0.1%	59	0.3%	52	0.5%

OCULAR DISORDERS REPORT
COLLIE

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.307	punctate cataract, capsular	6	0.0%	16	0.1%	9	0.1%
100.311	incipient cataract, anterior cortex	31	0.1%	38	0.2%	27	0.2%
100.312	incipient cataract, posterior cortex	50	0.2%	42	0.2%	15	0.1%
100.313	incipient cataract, equatorial cortex	14	0.1%	15	0.1%	8	0.1%
100.314	incipient cataract, anterior sutures	20	0.1%	9	0.0%	5	0.0%
100.315	incipient cataract, posterior sutures	13	0.1%	6	0.0%	5	0.0%
100.316	incipient cataract, nucleus	53	0.2%	60	0.3%	28	0.3%
100.317	incipient cataract, capsular	0		20	0.1%	7	0.1%
100.321	incomplete cataract, anterior cortex	0		0		1	0.0%
100.322	incomplete cataract, posterior cortex	0		0		1	0.0%
100.326	incomplete cataract, nucleus	0		0		4	0.0%
100.330	generalized/complete cataract	33	0.1%	13	0.1%	3	0.0%
100.375	subluxation/luxation, unspecified	4	0.0%	2	0.0%	2	0.0%
100.999	*significant cataracts (summary)*	*440*	*1.8%*	*321*	*1.5%*	*197*	*1.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	240	1.0%	101	0.5%	37	0.3%
110.135	PHPV/PTVL	12	0.0%	21	0.1%	17	0.2%
110.320	vitreal degeneration	16	0.1%	19	0.1%	11	0.1%
FUNDUS							
97.110	choroidal hypoplasia	16556	67.3%	14527	67.8%	8039	72.7%
97.120	coloboma	1375	5.6%	808	3.8%	115	1.0%
RETINA							
120.170	retinal dysplasia, folds	1196	4.9%	1625	7.6%	1036	9.4%
120.180	retinal dysplasia, geographic	32	0.1%	21	0.1%	2	0.0%
120.190	retinal dysplasia, detached	22	0.1%	32	0.1%	44	0.4%
120.310	generalized progressive retinal atrophy (PRA)	89	0.4%	585	2.7%	139	1.3%
120.400	retinal hemorrhage	72	0.3%	33	0.2%	0	
120.910	retinal detachment without dialysis	441	1.8%	316	1.5%	66	0.6%
120.920	retinal detachment with dialysis	0		0		90	0.8%
120.960	retinopathy	0		0		1	0.0%
OPTIC NERVE							
130.110	micropapilla	13	0.1%	76	0.4%	55	0.5%
130.120	optic nerve hypoplasia	127	0.5%	72	0.3%	38	0.3%
130.150	optic disc coloboma	2118	8.6%	1395	6.5%	1011	9.1%
OTHER							
900.000	other, unspecified	0		41	0.2%	91	0.8%
900.100	other, not inherited	50	0.2%	208	1.0%	67	0.6%
900.110	other, suspected as inherited	291	1.2%	260	1.2%	29	0.3%
NORMAL							
0.000	normal globe	6611	26.9%	5687	26.6%	2173	19.6%

COTON DE TULEAR

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
D.	Cataract	Not defined	2	NO
E.	Vitreous degeneration	Not defined	2	Breeder option
F.	Retinal atrophy - generalized	Not defined	3	NO
G.	Multifocal retinopathy - *cmr2* * a DNA test is available	Autosomal recessive	4, 5	Breeder Option
H.	Retinal dysplasia - folds	Presumed autosomal recessive	3	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized (PRA)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

G. Multifocal retinopathy – cmr2

Canine Multi-focal Retinopathy type 2 (cmr2) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There is typically a serous sub-retinal fluid in the Coton de Tulear, although there may be accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 15 weeks to 1 year of age. The lesions typically remain static in size and color beyond 1 year of age. The bullae appear to gradually lose the serous sub-retinal fluid after 4-5 years of age. Discrete areas of tapetal hyper-reflectivity might also be seen. Most dogs exhibit no noticeable problem with vision despite their abnormal appearing retinas. Electroretinograms reveal significant differences in photopic flickers in affected dogs.
Canine Multi-focal Retinopathy type 2 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Coton du Tulear. A DNA test is available.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding or bullae that may be single or multiple. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
COTON DE TULEAR

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 428 #	%	2000-2009 3260 #	%	2010-2016 1572 #	%
GLOBE							
0.110	microphthalmia	0		1	0.0%	0	
EYELIDS							
20.140	ectopic cilia	0		1	0.0%	0	
21.000	entropion, unspecified	0		4	0.1%	0	
25.110	distichiasis	3	0.7%	29	0.9%	13	0.8%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		2	0.1%
40.910	keratoconjunctivitis sicca	0		1	0.0%	0	
NICTITANS							
52.110	prolapsed gland of the third eyelid	1	0.2%	9	0.3%	5	0.3%
CORNEA							
70.220	pigmentary keratitis	0		1	0.0%	0	
70.700	corneal dystrophy	3	0.7%	32	1.0%	16	1.0%
70.730	corneal endothelial degeneration	0		1	0.0%	0	
UVEA							
93.110	iris hypoplasia	0		0		2	0.1%
93.150	iris coloboma	0		2	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	12	2.8%	310	9.5%	126	8.0%
93.720	persistent pupillary membranes, iris to lens	1	0.2%	7	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.2%	4	0.1%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	0		1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		8	0.5%
93.999	uveal cysts	0		2	0.1%	2	0.1%
97.150	chorioretinal coloboma, congenital	0		0		1	0.1%
LENS							
100.210	cataract, suspect not inherited	11	2.6%	113	3.5%	62	3.9%
100.301	punctate cataract, anterior cortex	0		6	0.2%	3	0.2%
100.302	punctate cataract, posterior cortex	0		3	0.1%	1	0.1%
100.303	punctate cataract, equatorial cortex	0		3	0.1%	0	
100.305	punctate cataract, posterior sutures	0		7	0.2%	5	0.3%
100.306	punctate cataract, nucleus	0		2	0.1%	0	
100.307	punctate cataract, capsular	0		2	0.1%	3	0.2%
100.311	incipient cataract, anterior cortex	2	0.5%	8	0.2%	4	0.3%
100.312	incipient cataract, posterior cortex	0		9	0.3%	8	0.5%
100.313	incipient cataract, equatorial cortex	0		6	0.2%	4	0.3%
100.314	incipient cataract, anterior sutures	0		2	0.1%	0	
100.315	incipient cataract, posterior sutures	0		1	0.0%	4	0.3%
100.316	incipient cataract, nucleus	0		4	0.1%	1	0.1%
100.317	incipient cataract, capsular	0		4	0.1%	2	0.1%
100.321	incomplete cataract, anterior cortex	0		0		1	0.1%
100.330	generalized/complete cataract	2	0.5%	5	0.2%	0	
100.340	resorbing/hypermature cataract	0		0		1	0.1%

OCULAR DISORDERS REPORT
COTON DE TULEAR

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.375	subluxation/luxation, unspecified	0		0		1	0.1%
100.999	*significant cataracts (summary)*	*4*	*0.9%*	*62*	*1.9%*	*37*	*2.4%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		3	0.1%	4	0.3%
110.135	PHPV/PTVL	0		1	0.0%	0	
110.320	vitreal degeneration	3	0.7%	30	0.9%	17	1.1%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	7	1.6%	6	0.2%	8	0.5%
120.180	retinal dysplasia, geographic	2	0.5%	8	0.2%	1	0.1%
120.190	retinal dysplasia, detached	0		3	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	8	1.9%	19	0.6%	5	0.3%
120.370	multifocal retinopathy	0		2	0.1%	0	
120.910	retinal detachment without dialysis	1	0.2%	0		0	
120.960	retinopathy	0		0		1	0.1%
OPTIC NERVE							
130.110	micropapilla	1	0.2%	2	0.1%	0	
130.120	optic nerve hypoplasia	2	0.5%	0		0	
130.150	optic disc coloboma	0		1	0.0%	0	
OTHER							
900.000	other, unspecified	0		20	0.6%	24	1.5%
900.100	other, not inherited	4	0.9%	145	4.4%	32	2.0%
900.110	other, suspected as inherited	11	2.6%	18	0.6%	3	0.2%
NORMAL							
0.000	normal globe	368	86.0%	2803	86.0%	1312	83.5%

OCULAR DISORDERS REPORT

CURLY-COATED RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	2 7	Breeder option Passes with no notation
D.	Cataract	Not defined	1, 3	NO
E.	Vitreous degeneration	Not defined	4, 5	Breeder option
F.	Choroidal hypoplasia	Not defined	6	NO
G.	Optic nerve coloboma	Not defined	6	NO
H.	Retinal dysplasia - folds	Not defined	6	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membrane (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Curly-Coated Retriever the following cataracts have been reported:

1. **Anterior cortical subcapsular cataract:** Anterior subcapsular striate cortical cataracts usually occur bilaterally, slowly progress and usually occur between 5-8 years of age.

2. **Posterior subcapsular cataract:** Posterior polar subcapsular opacities occur at 2-4 years of age and progress slowly.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Choroidal hypoplasia

Inadequate development of the choroid present at birth and non-progressive. This condition is more commonly identified in the Collie breed where it is a manifestation of "Collie Eye Anomaly."

G. Optic nerve coloboma

A congenital cavity in the optic nerve which, if large, may cause blindness or vision impairment.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
CURLY-COATED RETRIEVER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 731 #	%	2000-2009 905 #	%	2010-2016 300 #	%
GLOBE								
0.110	microphthalmia		0		1	0.1%	0	
EYELIDS								
20.140	ectopic cilia		0		3	0.3%	1	0.3%
21.000	entropion, unspecified		5	0.7%	5	0.6%	1	0.3%
22.000	ectropion, unspecified		1	0.1%	0		2	0.7%
25.110	distichiasis		46	6.3%	67	7.4%	38	12.7%
NICTITANS								
51.100	third eyelid cartilage anomaly		0		0		2	0.7%
52.110	prolapsed gland of the third eyelid		0		0		1	0.3%
CORNEA								
70.700	corneal dystrophy		6	0.8%	4	0.4%	4	1.3%
70.730	corneal endothelial degeneration		1	0.1%	0		0	
UVEA								
90.250	pigmentary uveitis		0		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris		20	2.7%	38	4.2%	13	4.3%
93.720	persistent pupillary membranes, iris to lens		2	0.3%	2	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea		4	0.5%	1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets		0		2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	0.1%	11	3.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		1	0.3%
93.999	uveal cysts		0		1	0.1%	0	
LENS								
100.200	cataract, unspecified		19	2.6%	0		0	
100.210	cataract, suspect not inherited		16	2.2%	62	6.9%	35	11.7%
100.301	punctate cataract, anterior cortex		6	0.8%	3	0.3%	2	0.7%
100.302	punctate cataract, posterior cortex		6	0.8%	3	0.3%	3	1.0%
100.303	punctate cataract, equatorial cortex		1	0.1%	1	0.1%	0	
100.304	punctate cataract, anterior sutures		0		0		1	0.3%
100.305	punctate cataract, posterior sutures		1	0.1%	6	0.7%	5	1.7%
100.307	punctate cataract, capsular		0		6	0.7%	2	0.7%
100.311	incipient cataract, anterior cortex		3	0.4%	7	0.8%	1	0.3%
100.312	incipient cataract, posterior cortex		3	0.4%	6	0.7%	4	1.3%
100.313	incipient cataract, equatorial cortex		4	0.5%	5	0.6%	2	0.7%
100.314	incipient cataract, anterior sutures		0		1	0.1%	0	
100.315	incipient cataract, posterior sutures		0		3	0.3%	2	0.7%
100.316	incipient cataract, nucleus		2	0.3%	1	0.1%	0	
100.317	incipient cataract, capsular		0		3	0.3%	0	
100.375	subluxation/luxation, unspecified		0		2	0.2%	1	0.3%
100.999	*significant cataracts (summary)*		*45*	*6.2%*	*45*	*5.0%*	*22*	*7.3%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		1	0.1%	0		1	0.3%
110.320	vitreal degeneration		0		20	2.2%	0	

OCULAR DISORDERS REPORT
CURLY-COATED RETRIEVER

		1991-1999		2000-2009		2010-2016	
FUNDUS							
97.110	choroidal hypoplasia	13	1.8%	0		0	
RETINA							
120.170	retinal dysplasia, folds	8	1.1%	5	0.6%	5	1.7%
120.180	retinal dysplasia, geographic	0		3	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	0.7%	6	0.7%	0	
120.960	retinopathy	0		0		1	0.3%
OPTIC NERVE							
130.120	optic nerve hypoplasia	2	0.3%	1	0.1%	0	
130.150	optic disc coloboma	10	1.4%	3	0.3%	0	
OTHER							
900.000	other, unspecified	0		9	1.0%	7	2.3%
900.100	other, not inherited	2	0.3%	31	3.4%	14	4.7%
900.110	other, suspected as inherited	11	1.5%	2	0.2%	1	0.3%
NORMAL							
0.000	normal globe	600	82.1%	746	82.4%	204	68.0%

OCULAR DISORDERS REPORT

DACHSHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia and multiple ocular defects	Not defined	1-3	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Chronic superficial keratitis/pannus	Presumed autosomal recessive	1, 4	NO
D.	Punctate keratitis	Not defined		NO
E.	Corneal dystrophy - epithelial/stromal	Not defined	1, 5	Breeder option
F.	Corneal dystrophy - endothelial	Not defined	1, 5, 6	NO
G.	Iris coloboma	Not defined	7	NO
H.	Persistent pupillary membranes			
	- iris to iris	Not defined	7, 8	Breeder option
	- iris to cornea	Not defined	8	NO
	- iris to lens	Not defined	9	NO
	- lens pigment foci/no strands	Not defined	28	Passes with no notation
I.	Cataract	Not defined	1	NO
J.	Persistent hyaloid artery	Not defined	8, 10	Breeder option
K.	Retinal atrophy - generalized * a DNA test is available	Not defined	1, 11-22	NO
L.	Retinopathy - associated with ceroid lipufuscinosis * a DNA test is available	Autosomal recessive	23, 24	NO

OCULAR DISORDERS REPORT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
M.	Retinal dysplasia - folds	Not defined	7, 8	Breeder option
N.	Coloboma/ staphyloma (Smooth standard only)	Not defined	25	NO
O.	Optic nerve coloboma	Not defined	1	NO
P.	Optic nerve hypoplasia	Not defined	8	NO
Q.	Micropapilla	Not defined	1, 8	Breeder option
R.	Dermoid	Not defined	1, 26	Breeder option
S.	Uveodermatologic syndrome	Not defined	27	NO

Description and Comments

A. Microphthalmia and multiple ocular anomalies

Microphthalmia is a congenital defect characterized by a small eye often with associated defects of the cornea, anterior chamber, lens and/or retina.

An association has been made between partial albinism, multiple ocular defects (especially microphthalmia) and deafness in a number of canine breeds including the Dachshund. From these reports it appears that a predominantly white hair coat is associated with a higher incidence of ocular defects.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Chronic superficial keratitis/pannus

A bilateral disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized sub-epithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with

plasma cell infiltration of the nictitans.

D. Punctate keratitis

Focal circular rings usually affecting the central sub-epithelial and/or anterior portion of the cornea. There often is an associated dry eye with corneal erosions. The mode of inheritance is unknown.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

F. Corneal dystrophy - endothelial

An abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision.

G. Iris coloboma

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin.

H. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

I. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

J. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

K. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram before it is apparent clinically.

In Miniature Longhaired Dachshunds there is a recessively inherited disorder caused by a 44 base pair insertion in the *RPGRIP1* gene. The insertion presumably truncates the protein and its major C-terminal RPGR binding domain. The resulting disease is called cone-rod dystrophy 1 (crd1) as the salient clinical abnormalities are a cone ERG dysfunction which does not correlate with photopic vision defects. The onset of the disease is variable, and is influenced by a second modifier locus which also is located on canine chromosome 15. Dogs homozygous for both defects have retinal abnormalities on ophthalmoscopy before 1-2 years of age. Dogs homozygous only for the *RPGRIP* insertion may have a late onset (>6 years) retinal degeneration diagnosed by ophthalmoscopy. Although the *RPGRIP1* molecular defect can be identified by means of a DNA test, questions have been raised about its validity given the poor genotype-phenotype correlation. A DNA test is available.

In a previous study using an inbred research colony, a 44-nucleotide insertion (ins44) in exon 2 of RPGRIP1 was associated with retinal degeneration. Despite concordance of ins44 with retinal degeneration, evidence indicate that there was phenotype-genotype discordance within the miniature long-haired dachshunds that were not directly related to the experimental colony as not all dogs that were homozygous for ins44 were developing early onset retinal degeneration, but were developing retinal degeneration at a much later stage or not at all. In this investigation MAP9 deletion associated with early retinal degeneration onset was identified. Given the new genome assembly, the nominal title is CanFam3.1MAP9 corrected. Deletion was confirmed in early onset retinal degeneration cases and not late onset retinal degeneration cases, there is a variable age of onset and demonstrate the interaction of two independent loci that contribute to the phenotype. This study has shown that RPGRIP1 ins44/ins44 dogs with early onset retinal degeneration has several polymorphisms in MAP9, some of them potentially harmful, when compared with MAP9 in late onset retinal degeneration dogs. Detection of the presence or absence of MAP early onset retinal degeneration by qPCR can be used to specify early onset or late onset status for ins44 homozygotes. The story, however, is not as straightforward as suggested by the Forman et al. 2016 paper. Unpublished work by K. Miyadera and G. Aguirre in a research colony in which one of the founders originated from a MLHD at the Animal Health Trust finds that dogs that are homozygous for the RPGRIP1 ins 44 and the newly identified MAP9 deletion still do not show early-onset retinal degeneration. This suggests that there probably is a third genetic locus that interacts with MAP9 and RPGRIP1 in determining the age of disease onset and severity of the phenotype. Regardless, the identification of the MAP9 deletion is a major finding that will help unravel the complex genetics of this retinal disorder.

L. Retinopathy associated with ceroid lipufuscinosis

Progressive, multifocal serous retinal detachments first appear in Longhaired Dachshunds with late infantile neuronal ceroid lipofuscinosis at age 5-10 months. Late infantile ceroid neuronal lipofuscinosis in Miniature Dachshunds is a fatal, autosomal recessive, inherited lysosomal storage disease characterized by progressive neurodegeneration. The disease results from a defect in the TPP1 (Tripeptidyl peptidase) gene. Inheritance of the retinopathy is linked to the gene causing late infantile neuronal ceroid lipofuscinosis.

M. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

N. Coloboma/staphyloma

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia (entity "A" above).

O. Optic nerve coloboma

A congenital cavity in the optic nerve which, if large, may cause blindness or vision impairment.

P. Optic nerve hypoplasia

Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

Q. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

R. Dermoid

A dermoid is a focal area of normal epidermal tissue (skin) that forms in an abnormal location (usually the cornea, conjunctiva or eyelid). The lesion generally causes discomfort to the affected animal.

S. Uveodermatologic syndrome

Uveodermatologic syndrome in the Dachshund bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. Adhesions between the iris and lens (posterior synechia) and the peripheral iris and cornea (peripheral anterior synechia) develop rapidly. Other complications include cataract development, retinal degeneration, retinal separation or detachment, optic disc atrophy and secondary glaucoma. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. The genetics of this condition are unclear, but some genetic predisposition is indicated by the higher prevalence of this disorder in Dachshunds compared with other dog breeds. Affected dogs are generally young, ranging in age between 1½ to 4 years.

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OCULAR DISORDERS REPORT
DACHSHUND

		1991-1999 2389		2000-2009 2571		2010-2016 1461	
	TOTAL DOGS EXAMINED						
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	5	0.2%	13	0.5%	5	0.3%
10.000	glaucoma	1	0.0%	0		1	0.1%
EYELIDS							
21.000	entropion, unspecified	6	0.3%	0		1	0.1%
25.110	distichiasis	91	3.8%	150	5.8%	158	10.8%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		1	0.0%	1	0.1%
40.910	keratoconjunctivitis sicca	2	0.1%	0		2	0.1%
NICTITANS							
50.210	pannus of third eyelid	0		0		1	0.1%
51.100	third eyelid cartilage anomaly	0		1	0.0%	1	0.1%
52.110	prolapsed gland of the third eyelid	1	0.0%	0		7	0.5%
CORNEA							
70.210	corneal pannus	2	0.1%	0		1	0.1%
70.700	corneal dystrophy	7	0.3%	21	0.8%	5	0.3%
70.730	corneal endothelial degeneration	2	0.1%	4	0.2%	3	0.2%
UVEA							
93.110	iris hypoplasia	0		2	0.1%	5	0.3%
93.150	iris coloboma	5	0.2%	18	0.7%	2	0.1%
93.710	persistent pupillary membranes, iris to iris	45	1.9%	128	5.0%	88	6.0%
93.720	persistent pupillary membranes, iris to lens	10	0.4%	13	0.5%	2	0.1%
93.730	persistent pupillary membranes, iris to cornea	6	0.3%	16	0.6%	9	0.6%
93.740	persistent pupillary membranes, iris sheets	3	0.1%	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.1%	91	6.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		12	0.8%
93.999	uveal cysts	0		3	0.1%	1	0.1%
97.150	chorioretinal coloboma, congenital	0		0		2	0.1%
LENS							
100.200	cataract, unspecified	43	1.8%	0		0	
100.210	cataract, suspect not inherited	71	3.0%	133	5.2%	59	4.0%
100.301	punctate cataract, anterior cortex	13	0.5%	9	0.4%	8	0.5%
100.302	punctate cataract, posterior cortex	8	0.3%	3	0.1%	4	0.3%
100.303	punctate cataract, equatorial cortex	6	0.3%	2	0.1%	2	0.1%
100.304	punctate cataract, anterior sutures	2	0.1%	0		2	0.1%
100.305	punctate cataract, posterior sutures	3	0.1%	2	0.1%	6	0.4%
100.306	punctate cataract, nucleus	2	0.1%	4	0.2%	3	0.2%
100.307	punctate cataract, capsular	4	0.2%	5	0.2%	2	0.1%
100.311	incipient cataract, anterior cortex	17	0.7%	24	0.9%	8	0.5%
100.312	incipient cataract, posterior cortex	7	0.3%	11	0.4%	5	0.3%
100.313	incipient cataract, equatorial cortex	5	0.2%	8	0.3%	2	0.1%
100.314	incipient cataract, anterior sutures	2	0.1%	0		0	
100.315	incipient cataract, posterior sutures	6	0.3%	8	0.3%	4	0.3%
100.316	incipient cataract, nucleus	2	0.1%	4	0.2%	3	0.2%

OCULAR DISORDERS REPORT
DACHSHUND

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.317	incipient cataract, capsular	1	0.0%	6	0.2%	0	
100.321	incomplete cataract, anterior cortex	0		0		2	0.1%
100.324	incomplete cataract, anterior sutures	0		0		1	0.1%
100.330	generalized/complete cataract	23	1.0%	12	0.5%	4	0.3%
100.340	resorbing/hypermature cataract	0		0		3	0.2%
100.375	subluxation/luxation, unspecified	1	0.0%	4	0.2%	2	0.1%
100.999	*significant cataracts (summary)*	*144*	*6.0%*	*98*	*3.8%*	*59*	*4.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	15	0.6%	20	0.8%	4	0.3%
110.135	PHPV/PTVL	2	0.1%	8	0.3%	5	0.3%
110.320	vitreal degeneration	11	0.5%	16	0.6%	12	0.8%
FUNDUS							
97.110	choroidal hypoplasia	0		5	0.2%	0	
97.120	coloboma	4	0.2%	9	0.4%	1	0.1%
RETINA							
120.170	retinal dysplasia, folds	15	0.6%	30	1.2%	11	0.8%
120.180	retinal dysplasia, geographic	1	0.0%	6	0.2%	0	
120.190	retinal dysplasia, detached	1	0.0%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	63	2.6%	40	1.6%	20	1.4%
120.400	retinal hemorrhage	0		1	0.0%	0	
120.910	retinal detachment without dialysis	2	0.1%	2	0.1%	1	0.1%
120.920	retinal detachment with dialysis	0		0		2	0.1%
120.960	retinopathy	0		0		2	0.1%
OPTIC NERVE							
130.110	micropapilla	1	0.0%	8	0.3%	11	0.8%
130.120	optic nerve hypoplasia	23	1.0%	10	0.4%	7	0.5%
130.150	optic disc coloboma	15	0.6%	7	0.3%	4	0.3%
OTHER							
900.000	other, unspecified	0		31	1.2%	58	4.0%
900.100	other, not inherited	9	0.4%	185	7.2%	57	3.9%
900.110	other, suspected as inherited	34	1.4%	14	0.5%	4	0.3%
NORMAL							
0.000	normal globe	1938	81.1%	2031	79.0%	1029	70.4%

OCULAR DISORDERS REPORT

DALMATIAN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-3	NO
B.	Entropion	Not defined		Breeder option
C.	Distichiasis	Not defined	4	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	4	Breeder option
E.	Iris hypoplasia	Not defined	12	Breeder option
F.	Iris coloboma	Not defined	5	NO
G.	Iris sphincter dysplasia	Not defined	6	Breeder option
H.	Persistent pupillary membranes - iris to iris	Not defined	5	Breeder option
I.	Cataract	Not defined	1, 2	NO
J.	Vitreous degeneration	Not defined	11	Breeder option
K.	Retinal dysplasia - folds	Not defined	5	Breeder option
L.	Dermoid	Not defined	1, 2	Breeder option
M.	Neuronal ceroid-lipofuscinosis	Presumed autosomal recessive	7-10	NO

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris hypoplasia/sphincter dysplasia.

OCULAR DISORDERS REPORT

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In the Dalmatian, entropion normally involves the lower lid.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Iris Hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

F. Iris coloboma

An abnormality in the development of the iris which may present as a minor notching of the pupillary margin, a hole in the iris or complete absence of iridal development. The relationship of iris coloboma to other ocular abnormalities in this breed has not been determined.

OCULAR DISORDERS REPORT

G. Iris sphincter dysplasia (ISD)

Defective development of the iris, or part of the iris, resulting in an immature state. ISD is the result of poorly developed iris sphincter muscles. The pupils of dogs with ISD do not properly contract in bright light. Dogs usually are uncomfortable and often squint in sunlight. The disorder exposes the interior of the eye to ultraviolet light that may potentially cause serious vision problems, such as cataracts or retinal damage, as dogs age.

H. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

I. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

J. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

K. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

L. Dermoid

A patch of skin, usually located on the cornea; its presence usually causes ocular irritation and if large can affect vision.

This abnormal development of the cornea has been observed so extensively in some Dalmatian dogs that little corneal tissue remains visible. It has been observed both unilaterally and bilaterally and in more than one dog in a litter on occasion. Surgical correction in most patients helps to return comfort and improve vision.

M. Neuronal Ceroid lipofuscinosisc

A systemic metabolic disorder that affects the retina and retinal pigment epithelium with accumulation of lipopigments resulting in retinal degeneration. In Dalmatians, the age of onset is approximately 6 months.

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OCULAR DISORDERS REPORT
DALMATIAN

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 454 #	%	2000-2009 1278 #	%	2010-2016 1230 #	%
GLOBE							
0.110	microphthalmia	0		1	0.1%	0	
EYELIDS							
20.140	ectopic cilia	1	0.2%	0		0	
21.000	entropion, unspecified	3	0.7%	0		2	0.2%
22.000	ectropion, unspecified	0		1	0.1%	0	
25.110	distichiasis	8	1.8%	48	3.8%	87	7.1%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.2%	0		1	0.1%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		1	0.1%	0	
CORNEA							
70.210	corneal pannus	0		1	0.1%	0	
70.700	corneal dystrophy	10	2.2%	31	2.4%	40	3.3%
70.730	corneal endothelial degeneration	2	0.4%	0		0	
UVEA							
93.110	iris hypoplasia	0		29	2.3%	36	2.9%
93.150	iris coloboma	0		11	0.9%	4	0.3%
93.710	persistent pupillary membranes, iris to iris	4	0.9%	11	0.9%	9	0.7%
93.720	persistent pupillary membranes, iris to lens	0		1	0.1%	2	0.2%
93.730	persistent pupillary membranes, iris to cornea	3	0.7%	1	0.1%	2	0.2%
93.740	persistent pupillary membranes, iris sheets	0		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	0.2%
93.999	uveal cysts	0		3	0.2%	0	
97.150	chorioretinal coloboma, congenital	0		0		1	0.1%
LENS							
100.110	microphakia, congenital	0		0		1	0.1%
100.200	cataract, unspecified	1	0.2%	0		0	
100.210	cataract, suspect not inherited	6	1.3%	23	1.8%	29	2.4%
100.301	punctate cataract, anterior cortex	2	0.4%	2	0.2%	4	0.3%
100.302	punctate cataract, posterior cortex	0		2	0.2%	4	0.3%
100.303	punctate cataract, equatorial cortex	1	0.2%	3	0.2%	3	0.2%
100.305	punctate cataract, posterior sutures	0		0		1	0.1%
100.306	punctate cataract, nucleus	0		2	0.2%	1	0.1%
100.307	punctate cataract, capsular	0		1	0.1%	0	
100.311	incipient cataract, anterior cortex	3	0.7%	9	0.7%	8	0.7%
100.312	incipient cataract, posterior cortex	1	0.2%	6	0.5%	5	0.4%
100.313	incipient cataract, equatorial cortex	1	0.2%	6	0.5%	6	0.5%
100.314	incipient cataract, anterior sutures	0		3	0.2%	0	
100.315	incipient cataract, posterior sutures	0		1	0.1%	0	
100.316	incipient cataract, nucleus	0		2	0.2%	4	0.3%
100.317	incipient cataract, capsular	0		2	0.2%	0	
100.321	incomplete cataract, anterior cortex	0		0		4	0.3%
100.322	incomplete cataract, posterior cortex	0		0		2	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.1%

OCULAR DISORDERS REPORT
DALMATIAN

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.327	incomplete cataract, capsular	0		0		1	0.1%
100.330	generalized/complete cataract	2	0.4%	4	0.3%	0	
100.340	resorbing/hypermature cataract	0		0		1	0.1%
100.375	subluxation/luxation, unspecified	0		4	0.3%	0	
100.999	*significant cataracts (summary)*	*11*	*2.4%*	*43*	*3.4%*	*45*	*3.7%*
VITREOUS							
110.135	PHPV/PTVL	0		2	0.2%	0	
110.320	vitreal degeneration	1	0.2%	16	1.3%	13	1.1%
FUNDUS							
97.110	choroidal hypoplasia	1	0.2%	0		0	
RETINA							
120.170	retinal dysplasia, folds	1	0.2%	9	0.7%	3	0.2%
120.310	generalized progressive retinal atrophy (PRA)	1	0.2%	4	0.3%	0	
120.400	retinal hemorrhage	0		1	0.1%	0	
120.910	retinal detachment without dialysis	1	0.2%	0		0	
120.960	retinopathy	0		0		1	0.1%
OPTIC NERVE							
130.110	micropapilla	0		1	0.1%	0	
OTHER							
900.000	other, unspecified	0		12	0.9%	31	2.5%
900.100	other, not inherited	2	0.4%	85	6.7%	44	3.6%
900.110	other, suspected as inherited	23	5.1%	51	4.0%	2	0.2%
NORMAL							
0.000	normal globe	383	84.4%	1066	83.4%	992	80.7%

DANDIE DINMONT TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1	NO
B.	Distichiasis	Not defined	2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	3	Breeder option
D.	Cataract	Not defined	2	NO

Description and Comments

A. Glaucoma

Glaucoma is an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

In the Dandie Dinmont terrier a 9.5 Mb susceptibility locus has been identified on canine chromosome 8. The definitive mutation has not been determined. A genetic test is not yet available.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

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OCULAR DISORDERS REPORT
DANDIE DINMONT TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 87 #	%	2000-2009 89 #	%	2010-2016 98 #	%
GLOBE								
0.110	microphthalmia		0		1	1.1%	0	
10.000	glaucoma		1	1.1%	0		0	
EYELIDS								
25.110	distichiasis		2	2.3%	4	4.5%	15	15.3%
CORNEA								
70.700	corneal dystrophy		2	2.3%	2	2.2%	2	2.0%
UVEA								
93.710	persistent pupillary membranes, iris to iris		9	10.3%	11	12.4%	7	7.1%
93.720	persistent pupillary membranes, iris to lens		1	1.1%	0		0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		4	4.1%
93.999	uveal cysts		0		0		2	2.0%
LENS								
100.200	cataract, unspecified		4	4.6%	0		0	
100.210	cataract, suspect not inherited		10	11.5%	8	9.0%	11	11.2%
100.301	punctate cataract, anterior cortex		0		0		3	3.1%
100.302	punctate cataract, posterior cortex		0		1	1.1%	2	2.0%
100.305	punctate cataract, posterior sutures		0		1	1.1%	0	
100.307	punctate cataract, capsular		0		1	1.1%	2	2.0%
100.311	incipient cataract, anterior cortex		1	1.1%	0		4	4.1%
100.312	incipient cataract, posterior cortex		0		1	1.1%	0	
100.330	generalized/complete cataract		2	2.3%	3	3.4%	0	
100.375	subluxation/luxation, unspecified		0		1	1.1%	0	
100.999	*significant cataracts (summary)*		*7*	*8.0%*	*7*	*7.9%*	*11*	*11.2%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		2	2.3%	1	1.1%	0	
OTHER								
900.000	other, unspecified		0		0		6	6.1%
900.100	other, not inherited		1	1.1%	5	5.6%	7	7.1%
900.110	other, suspected as inherited		0		0		1	1.0%
NORMAL								
0.000	normal globe		58	66.7%	67	75.3%	58	59.2%

DOBERMAN PINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined		NO
B.	Distichiasis	Not defined		Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1-6	Breeder option
	- lens pigment foci/no strands	Not defined	17	Passes with no notation
	- iris to lens	Not defined		NO
D.	Cataract	Not defined		NO
E.	Persistent hyperplastic primary vitreous/ Persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Presumed dominant/ incomplete penetrance	1, 7-15	NO
F.	Retinal dysplasia - folds	Not defined		Breeder option
G.	Ligneous conjunctivitis	Not defined		NO

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (retinal dysplasia). Note that this syndrome is distinct from "E," PHPV/PHTVL, which may also be associated with microphthalmia.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

Cataracts have been infrequently observed in the Doberman Pinscher and there is no specific location attributed to cataracts within the Doberman lens. Most cataracts are bilateral, usually observed within the first two years of life, and may cause significant vision loss.

E. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The condition in the Doberman includes a spectrum of malformations ranging from spots of pigment on the posterior surface of the lens to posterior lenticonus, cataract and a dense fibrous plaque on the posterior surface of the lens. In the more severe forms, partial or complete vision impairment occurs. PHPV has been extensively studied in the

Doberman in Europe. This disorder has been observed occasionally in the Doberman in the United States.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Ligneous conjunctivitis

A rare type of conjunctivitis characterized by the formation of thick membranes covering conjunctiva of the nictitans and eyelids of affected dogs. This condition has been diagnosed in four unrelated Doberman Pinschers, three of which had life-threatening systemic disease. Ligneous conjunctivitis has also been reported in one Yorkshire Terrier.

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OCULAR DISORDERS REPORT
DOBERMAN PINSCHER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1943 #	 %	2000-2009 2144 #	 %	2010-2016 1441 #	 %
GLOBE							
0.110	microphthalmia	4	0.2%	1	0.0%	2	0.1%
EYELIDS							
20.140	ectopic cilia	0		1	0.0%	0	
21.000	entropion, unspecified	3	0.2%	2	0.1%	2	0.1%
22.000	ectropion, unspecified	0		1	0.0%	0	
25.110	distichiasis	33	1.7%	37	1.7%	20	1.4%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		1	0.0%	0	
NICTITANS							
51.100	third eyelid cartilage anomaly	3	0.2%	1	0.0%	3	0.2%
52.110	prolapsed gland of the third eyelid	0		1	0.0%	6	0.4%
CORNEA							
70.700	corneal dystrophy	5	0.3%	4	0.2%	1	0.1%
70.730	corneal endothelial degeneration	0		3	0.1%	1	0.1%
UVEA							
93.110	iris hypoplasia	0		1	0.0%	0	
93.140	corneal endothelial pigment without PPM	0		1	0.0%	1	0.1%
93.150	iris coloboma	1	0.1%	0		0	
93.710	persistent pupillary membranes, iris to iris	44	2.3%	41	1.9%	35	2.4%
93.720	persistent pupillary membranes, iris to lens	17	0.9%	14	0.7%	2	0.1%
93.730	persistent pupillary membranes, iris to cornea	5	0.3%	2	0.1%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	3	0.2%	1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.1%	102	7.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		3	0.2%
93.810	uveal melanoma	0		1	0.0%	3	0.2%
93.999	uveal cysts	1	0.1%	4	0.2%	5	0.3%
LENS							
100.200	cataract, unspecified	32	1.6%	0		0	
100.210	cataract, suspect not inherited	63	3.2%	162	7.6%	75	5.2%
100.301	punctate cataract, anterior cortex	11	0.6%	2	0.1%	2	0.1%
100.302	punctate cataract, posterior cortex	2	0.1%	1	0.0%	2	0.1%
100.303	punctate cataract, equatorial cortex	0		1	0.0%	0	
100.304	punctate cataract, anterior sutures	1	0.1%	2	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures	1	0.1%	7	0.3%	2	0.1%
100.306	punctate cataract, nucleus	2	0.1%	2	0.1%	4	0.3%
100.307	punctate cataract, capsular	1	0.1%	11	0.5%	4	0.3%
100.311	incipient cataract, anterior cortex	3	0.2%	3	0.1%	3	0.2%
100.312	incipient cataract, posterior cortex	6	0.3%	8	0.4%	4	0.3%
100.313	incipient cataract, equatorial cortex	4	0.2%	3	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures	1	0.1%	7	0.3%	0	
100.316	incipient cataract, nucleus	4	0.2%	8	0.4%	5	0.3%
100.317	incipient cataract, capsular	0		8	0.4%	2	0.1%
100.330	generalized/complete cataract	7	0.4%	5	0.2%	2	0.1%

OCULAR DISORDERS REPORT
DOBERMAN PINSCHER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.375	subluxation/luxation, unspecified	1	0.1%	1	0.0%	0	
100.999	*significant cataracts (summary)*	*75*	*3.9%*	*68*	*3.2%*	*32*	*2.2%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	12	0.6%	3	0.1%	4	0.3%
110.135	PHPV/PTVL	9	0.5%	17	0.8%	19	1.3%
110.320	vitreal degeneration	2	0.1%	3	0.1%	5	0.3%
FUNDUS							
97.110	choroidal hypoplasia	2	0.1%	0		0	
97.120	coloboma	1	0.1%	0		0	
RETINA							
120.170	retinal dysplasia, folds	29	1.5%	56	2.6%	12	0.8%
120.180	retinal dysplasia, geographic	2	0.1%	9	0.4%	1	0.1%
120.310	generalized progressive retinal atrophy (PRA)	5	0.3%	7	0.3%	0	
120.910	retinal detachment without dialysis	2	0.1%	0		0	
120.960	retinopathy	0		0		1	0.1%
OPTIC NERVE							
130.120	optic nerve hypoplasia	2	0.1%	0		1	0.1%
OTHER							
900.000	other, unspecified	0		20	0.9%	37	2.6%
900.100	other, not inherited	9	0.5%	149	6.9%	61	4.2%
900.110	other, suspected as inherited	17	0.9%	26	1.2%	9	0.6%
NORMAL							
0.000	normal globe	1691	87.0%	1801	84.0%	1135	78.8%

DOGUE DE BORDEAUX

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Entropion	Not defined	2	Breeder option
C.	Ectropion	Not defined	3	Breeder option
D.	Eury/Macroblepharon	Not defined	2	Breeder option
E.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder option
F.	Cataract	Not defined	1	NO
G.	Multifocal retinopathy - *cmr1* * a DNA test is available.	Autosomal recessive	5	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion in the Mastiff is severe and may require multiple surgical corrections.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Multifocal retinopathy

Canine Multi-focal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multi-focal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

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OCULAR DISORDERS REPORT
DOGUE DE BORDEAUX

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 5 #	%	2000-2009 179 #	%	2010-2016 136 #	%
EYELIDS								
20.160	macropalpebral fissure		0		4	2.2%	5	3.7%
21.000	entropion, unspecified		1	20.0%	2	1.1%	15	11.0%
22.000	ectropion, unspecified		0		22	12.3%	13	9.6%
25.110	distichiasis		0		17	9.5%	14	10.3%
NICTITANS								
52.110	prolapsed gland of the third eyelid		0		1	0.6%	0	
CORNEA								
70.700	corneal dystrophy		0		3	1.7%	3	2.2%
70.730	corneal endothelial degeneration		0		0		1	0.7%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		8	4.5%	6	4.4%
93.720	persistent pupillary membranes, iris to lens		0		1	0.6%	0	
93.730	persistent pupillary membranes, iris to cornea		0		3	1.7%	1	0.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		2	1.1%	3	2.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		1	0.7%
93.999	uveal cysts		0		0		3	2.2%
LENS								
100.210	cataract, suspect not inherited		0		5	2.8%	4	2.9%
100.301	punctate cataract, anterior cortex		0		0		1	0.7%
100.306	punctate cataract, nucleus		0		3	1.7%	0	
100.311	incipient cataract, anterior cortex		0		1	0.6%	0	
100.316	incipient cataract, nucleus		0		0		1	0.7%
100.999	*significant cataracts (summary)*		*0*		*4*	*2.2%*	*2*	*1.5%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		0		1	0.6%	0	
RETINA								
120.170	retinal dysplasia, folds		1	20.0%	3	1.7%	2	1.5%
120.960	retinopathy		0		0		1	0.7%
OTHER								
900.000	other, unspecified		0		4	2.2%	2	1.5%
900.100	other, not inherited		0		10	5.6%	4	2.9%
900.110	other, suspected as inherited		0		2	1.1%	0	
NORMAL								
0.000	normal globe		3	60.0%	133	74.3%	84	61.8%

DUTCH SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Dutch Shepherd breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
DUTCH SHEPHERD

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 12 #	%	2010-2016 51 #	%
EYELIDS								
25.110	distichiasis		0		1	8.3%	2	3.9%
CORNEA								
70.700	corneal dystrophy		0		0		1	2.0%
UVEA								
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		2	3.9%
LENS								
100.210	cataract, suspect not inherited		0		1	8.3%	9	17.6%
100.301	punctate cataract, anterior cortex		0		1	8.3%	0	
100.303	punctate cataract, equatorial cortex		0		0		1	2.0%
100.304	punctate cataract, anterior sutures		0		1	8.3%	0	
100.306	punctate cataract, nucleus		0		0		1	2.0%
100.307	punctate cataract, capsular		0		0		1	2.0%
100.311	incipient cataract, anterior cortex		0		1	8.3%	0	
100.312	incipient cataract, posterior cortex		0		0		1	2.0%
100.313	incipient cataract, equatorial cortex		0		0		1	2.0%
100.999	*significant cataracts (summary)*		*0*		*3*	*25.0%*	*5*	*9.8%*
RETINA								
120.310	generalized progressive retinal atrophy (PRA)		0		0		1	2.0%
OTHER								
900.000	other, unspecified		0		1	8.3%	2	3.9%
900.100	other, not inherited		0		0		4	7.8%
NORMAL								
0.000	normal globe		0		10	83.3%	38	74.5%

OCULAR DISORDERS REPORT

ENGLISH COCKER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Keratoconjunctivitis sicca	Not defined	1	NO
B.	Glaucoma	Not defined	2-4	NO
C.	Ectropion	Not defined	2	Breeder option
D.	Distichiasis	Not defined	2	Breeder option
E.	Corneal dystrophy - epithelial/stromal	Not defined	5	Breeder option
F.	Persistent pupillary membranes			
	- iris to iris	Not defined	2, 5, 6	Breeder option
	- iris to cornea	Not defined	6, 7	NO
	- lens pigment foci/no strands	Not defined	18	Passes with no notation
G.	Cataract	Not defined	2, 6, 8-10	NO
H.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	2, 11-13	NO
I.	Central progressive retinal atrophy	Not defined	14-16	NO
J.	Retinal dysplasia - folds	Presumed autosomal recessive	2, 17	Breeder option

Description and Comments

A. Keratoconjunctivitis sicca (KCS)

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine screening exam for certification.

Glaucoma in the English Cocker Spaniel is recognized in England. The frequency and significance of this disease in the breed in the United States is not known, but is probably low.

C. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the English Cocker Spaniel, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the English Cocker Spaniel, this is a particularly serious problem as the majority of PPMs identified on routine screening examination bridge from the iris to the cornea and are associated with corneal opacities which may result in vision impairment.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Congenital cataracts have been reported in Red Cocker Spaniels, presumably English Cocker Spaniels, in Denmark. The cataracts affected the anterior capsule; in some cases the cortex and/or nucleus were opaque. Associated findings in some dogs were persistent pupillary membrane (PPM) and/or microphthalmia. It is likely that these cataracts are part of a syndrome characterized by multiple congenital ocular anomalies. The condition is familial, but a specific mode of inheritance has not been defined.

H. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the English Cocker Spaniel is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However, in the English Cocker Spaniel, the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not *prcd* are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

I. Central progressive retinal atrophy (CPRA)

A progressive retinal degeneration in which photoreceptor degeneration occurs secondary to disease of the underlying pigment epithelium. Progression is slow and some animals may never lose vision. CPRA is a frequent occurrence in England, but is uncommon elsewhere.

CPRA is characterized by the appearance of brown spots and patches primarily in the tapetal fundus and retinal degeneration. These areas are created by an accumulation of autofluorescent lipopigment within the retinal pigment epithelium cells. These changes are

consistent with retinal changes observed in Vitamin E deficiency. Neurologic signs including ataxia and proprioceptive deficits have also been identified in affected dogs.

In the English Cocker Spaniel, retinal lesions of CPRA have been related to an underlying abnormal metabolism of Vitamin E resulting in a systemic deficiency.

J. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
ENGLISH COCKER SPANIEL

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 6339 #	%	2000-2009 3660 #	%	2010-2016 1148 #	%
GLOBE								
0.110	microphthalmia		11	0.2%	3	0.1%	0	
10.000	glaucoma		1	0.0%	0		0	
EYELIDS								
20.110	eyelid dermoid		1	0.0%	0		0	
20.140	ectopic cilia		3	0.0%	2	0.1%	1	0.1%
20.160	macropalpebral fissure		2	0.0%	0		1	0.1%
21.000	entropion, unspecified		27	0.4%	13	0.4%	6	0.5%
22.000	ectropion, unspecified		60	0.9%	33	0.9%	4	0.3%
25.110	distichiasis		1008	15.9%	777	21.2%	212	18.5%
NASOLACRIMAL								
32.110	imperforate lower nasolacrimal punctum		15	0.2%	0		4	0.3%
40.910	keratoconjunctivitis sicca		4	0.1%	6	0.2%	2	0.2%
NICTITANS								
52.110	prolapsed gland of the third eyelid		2	0.0%	2	0.1%	2	0.2%
CORNEA								
70.210	corneal pannus		8	0.1%	2	0.1%	0	
70.220	pigmentary keratitis		1	0.0%	9	0.2%	1	0.1%
70.700	corneal dystrophy		44	0.7%	39	1.1%	14	1.2%
70.730	corneal endothelial degeneration		31	0.5%	5	0.1%	1	0.1%
UVEA								
90.250	pigmentary uveitis		0		1	0.0%	0	
93.140	corneal endothelial pigment without PPM		0		6	0.2%	0	
93.150	iris coloboma		2	0.0%	0		0	
93.710	persistent pupillary membranes, iris to iris		46	0.7%	67	1.8%	29	2.5%
93.720	persistent pupillary membranes, iris to lens		26	0.4%	11	0.3%	5	0.4%
93.730	persistent pupillary membranes, iris to cornea		121	1.9%	56	1.5%	8	0.7%
93.740	persistent pupillary membranes, iris sheets		6	0.1%	4	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		43	3.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		7	0.2%	11	1.0%
93.999	uveal cysts		3	0.0%	2	0.1%	0	
LENS								
100.200	cataract, unspecified		172	2.7%	0		0	
100.210	cataract, suspect not inherited		311	4.9%	292	8.0%	84	7.3%
100.301	punctate cataract, anterior cortex		58	0.9%	31	0.8%	9	0.8%
100.302	punctate cataract, posterior cortex		25	0.4%	21	0.6%	4	0.3%
100.303	punctate cataract, equatorial cortex		8	0.1%	11	0.3%	0	
100.304	punctate cataract, anterior sutures		9	0.1%	2	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures		14	0.2%	15	0.4%	2	0.2%
100.306	punctate cataract, nucleus		13	0.2%	7	0.2%	3	0.3%
100.307	punctate cataract, capsular		0		7	0.2%	3	0.3%
100.311	incipient cataract, anterior cortex		71	1.1%	53	1.4%	7	0.6%
100.312	incipient cataract, posterior cortex		75	1.2%	47	1.3%	14	1.2%
100.313	incipient cataract, equatorial cortex		48	0.8%	32	0.9%	5	0.4%

OCULAR DISORDERS REPORT
ENGLISH COCKER SPANIEL

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.314	incipient cataract, anterior sutures	4	0.1%	4	0.1%	0	
100.315	incipient cataract, posterior sutures	14	0.2%	10	0.3%	2	0.2%
100.316	incipient cataract, nucleus	28	0.4%	27	0.7%	5	0.4%
100.317	incipient cataract, capsular	3	0.0%	11	0.3%	4	0.3%
100.321	incomplete cataract, anterior cortex	0		0		1	0.1%
100.322	incomplete cataract, posterior cortex	0		0		2	0.2%
100.326	incomplete cataract, nucleus	0		0		3	0.3%
100.327	incomplete cataract, capsular	0		0		1	0.1%
100.330	generalized/complete cataract	64	1.0%	31	0.8%	6	0.5%
100.375	subluxation/luxation, unspecified	5	0.1%	3	0.1%	1	0.1%
100.999	*significant cataracts (summary)*	*606*	*9.6%*	*309*	*8.4%*	*72*	*6.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	4	0.1%	2	0.1%	3	0.3%
110.135	PHPV/PTVL	2	0.0%	2	0.1%	0	
110.320	vitreal degeneration	12	0.2%	10	0.3%	3	0.3%
RETINA							
120.170	retinal dysplasia, folds	59	0.9%	86	2.3%	18	1.6%
120.180	retinal dysplasia, geographic	6	0.1%	4	0.1%	5	0.4%
120.190	retinal dysplasia, detached	2	0.0%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	274	4.3%	136	3.7%	14	1.2%
120.400	retinal hemorrhage	2	0.0%	1	0.0%	0	
120.960	retinopathy	0		0		3	0.3%
OPTIC NERVE							
130.110	micropapilla	2	0.0%	0		0	
130.120	optic nerve hypoplasia	2	0.0%	0		0	
130.150	optic disc coloboma	10	0.2%	3	0.1%	2	0.2%
OTHER							
900.000	other, unspecified	0		18	0.5%	29	2.5%
900.100	other, not inherited	24	0.4%	217	5.9%	53	4.6%
900.110	other, suspected as inherited	93	1.5%	27	0.7%	1	0.1%
NORMAL							
0.000	normal globe	4409	69.6%	2396	65.5%	736	64.1%

ENGLISH SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder option
	- iris to cornea	Not defined	1	NO
C.	Cataract	Not defined	1	NO
D.	Retinal atrophy - generalized	Presumed autosomal recessive	1, 3	NO
E.	Retinal atrophy - rod-cone dysplasia recessive type 1 (*rcd4*) * a DNA test is available	Autosomal recessive	4	NO
F.	Retinal dysplasia			
	- folds	Not defined	1	Breeder option
	- geographic	Not defined	5	NO
G.	Ceroid lipofuscinosis * A DNA test is available	Autosomal recessive	6-10	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of the dog. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal.

OCULAR DISORDERS REPORT

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal atrophy – generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

E. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

Retinal dysplasia - geographic

Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and areas of retinal disorganization. This form may be associated with vision impairment.

G. Ceroid lipofuscinosis

An inherited disease of humans and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's Disease.) A DNA test is available.

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OCULAR DISORDERS REPORT
ENGLISH SETTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 522 #	1991-1999 522 %	2000-2009 1023 #	2000-2009 1023 %	2010-2016 193 #	2010-2016 193 %
EYELIDS							
21.000	entropion, unspecified	2	0.4%	5	0.5%	1	0.5%
22.000	ectropion, unspecified	2	0.4%	1	0.1%	0	
25.110	distichiasis	36	6.9%	29	2.8%	6	3.1%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		2	0.2%	0	
CORNEA							
70.700	corneal dystrophy	2	0.4%	9	0.9%	2	1.0%
70.730	corneal endothelial degeneration	2	0.4%	1	0.1%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	4	0.8%	56	5.5%	3	1.6%
93.720	persistent pupillary membranes, iris to lens	2	0.4%	3	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea	5	1.0%	2	0.2%	0	
93.999	uveal cysts	0		1	0.1%	0	
LENS							
100.200	cataract, unspecified	5	1.0%	0		0	
100.210	cataract, suspect not inherited	13	2.5%	45	4.4%	5	2.6%
100.301	punctate cataract, anterior cortex	2	0.4%	2	0.2%	2	1.0%
100.302	punctate cataract, posterior cortex	4	0.8%	5	0.5%	1	0.5%
100.305	punctate cataract, posterior sutures	0		1	0.1%	2	1.0%
100.306	punctate cataract, nucleus	2	0.4%	0		0	
100.307	punctate cataract, capsular	0		2	0.2%	0	
100.311	incipient cataract, anterior cortex	0		4	0.4%	1	0.5%
100.312	incipient cataract, posterior cortex	1	0.2%	5	0.5%	2	1.0%
100.313	incipient cataract, equatorial cortex	0		0		1	0.5%
100.315	incipient cataract, posterior sutures	0		1	0.1%	1	0.5%
100.316	incipient cataract, nucleus	0		1	0.1%	1	0.5%
100.317	incipient cataract, capsular	0		2	0.2%	0	
100.330	generalized/complete cataract	1	0.2%	1	0.1%	1	0.5%
100.375	subluxation/luxation, unspecified	1	0.2%	0		0	
100.999	*significant cataracts (summary)*	*15*	*2.9%*	*24*	*2.3%*	*12*	*6.2%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	2	0.4%	5	0.5%	0	
110.135	PHPV/PTVL	0		1	0.1%	0	
110.320	vitreal degeneration	1	0.2%	0		3	1.6%
RETINA							
120.170	retinal dysplasia, folds	5	1.0%	29	2.8%	1	0.5%
120.180	retinal dysplasia, geographic	1	0.2%	14	1.4%	0	
120.190	retinal dysplasia, detached	0		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	4	0.8%	16	1.6%	2	1.0%
OPTIC NERVE							
130.110	micropapilla	0		1	0.1%	0	
130.120	optic nerve hypoplasia	0		1	0.1%	0	

OCULAR DISORDERS REPORT
ENGLISH SETTER

	1991-1999	2000-2009	2010-2016
OTHER			
900.000 other, unspecified	0	3 0.3%	3 1.6%
900.100 other, not inherited	1 0.2%	51 5.0%	2 1.0%
900.110 other, suspected as inherited	1 0.2%	2 0.2%	1 0.5%
NORMAL			
0.000 normal globe	437 83.7%	859 84.0%	170 88.1%

ENGLISH SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1	NO
B.	Choroidal hypoplasia (Collie Eye Anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma * a DNA test is available	Autosomal recessive	2, 3, 4	NO

Description and Comments

A. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the English Shepherd is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

B. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

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OCULAR DISORDERS REPORT
ENGLISH SHEPHERD

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 30 #	 %	2000-2009 60 #	 %	2010-2016 42 #	 %
GLOBE							
0.110	microphthalmia	2	6.7%	0		0	
EYELIDS							
21.000	entropion, unspecified	4	13.3%	1	1.7%	0	
CORNEA							
70.210	corneal pannus	0		0		1	2.4%
70.700	corneal dystrophy	0		0		1	2.4%
UVEA							
93.710	persistent pupillary membranes, iris to iris	1	3.3%	4	6.7%	1	2.4%
93.720	persistent pupillary membranes, iris to lens	0		1	1.7%	0	
LENS							
100.210	cataract, suspect not inherited	1	3.3%	0		2	4.8%
100.301	punctate cataract, anterior cortex	2	6.7%	0		0	
100.315	incipient cataract, posterior sutures	0		1	1.7%	0	
100.317	incipient cataract, capsular	0		1	1.7%	0	
100.321	incomplete cataract, anterior cortex	0		0		2	4.8%
100.322	incomplete cataract, posterior cortex	0		0		3	7.1%
100.330	generalized/complete cataract	0		0		4	9.5%
100.999	*significant cataracts (summary)*	*2*	*6.7%*	*2*	*3.3%*	*9*	*21.4%*
RETINA							
120.170	retinal dysplasia, folds	2	6.7%	0		0	
OTHER							
900.100	other, not inherited	0		4	6.7%	8	19.0%
NORMAL							
0.000	normal globe	26	86.7%	53	88.3%	25	59.5%

OCULAR DISORDERS REPORT

ENGLISH SPRINGER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined		Breeder option
B.	Distichiasis	Not defined		Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined		Breeder option
D.	Persistent pupillary membranes			
	- iris to iris	Not defined		Breeder option
	- iris to lens	Not defined		NO
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
E.	Cataract	Not defined		NO
F.	Persistent hyaloid artery	Not defined	5, 6	Breeder option
G.	Vitreous degeneration	Not defined	7	Breeder option
H.	Retinal atrophy - generalized	Not defined	8	NO
I.	Retinal atrophy - cord-1 * a DNA test is available	Autosomal recessive	9	NO
J.	Retinal dysplasia - folds	Presumed autosomal recessive	1, 10-12, 15	NO
K.	Retinal dysplasia - geographic/ detached	Autosomal recessive	1, 10-12	NO

OCULAR DISORDERS REPORT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
L.	Refractive error	Not defined	13, 14	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In the English Springer Spaniel this usually involves the lower lateral lid margin.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted

E. Cataract

Lens opacity which may affect one or both eyes and may involve the lens partially or completely. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies.

Cataract in the English Springer Spaniel is reported to be a familial trait usually involving the posterior subcapsular region of the lens that progresses slowly.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

I. Retinal atrophy - cord-1

Cord-1 PRA in the English Springer Spaniel has an onset of clinical signs at 2 to 9 years of age leading to blindness in most affected dogs. Cord1 PRA in the English Springer Spaniel has been described as beginning with increased granularity of the fundus or tiny hyporeflective brown or grey patches in the far peripheral tapetum. Over time, these abnormalities become more diffuse with mottling over much of the tapetum. Vessel attenuation accompanies the more diffuse changes. In advanced cases, there is generalized tapetal hyperreflectivity and vessel attenuation. Pedigree analysis has shown cord-1 in the English Springer Spaniel to be an autosomal recessive trait. A mutation in the *RPGRIP1* gene in cone-rod dystrophy (cord1) was found through genetic testing to be associated with one form of PRA in English Springer Spaniels, but not all clinically affected dogs have the *RPGRIP1* mutation, implying that other mutations have yet to be identified. A DNA test is available. The test is accurate only for this mutation and will not identify other forms of PRA. Not all dogs homozygous for the *RPGRIP1* genotype demonstrate the phenotype clinically.

J. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

The relationship between folds and geographic/detached lesions has been a topic of dispute for many years. It is the consensus of the English Springer Spaniel Field Trial Association

Heritable Defects Committee (the parent breed club in the United States) that none of the forms of retinal dysplasia are desirable in a breeding animal.

K. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.
Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

Retinal dysplasia with multiple ocular defects - A syndrome of retinal dysplasia in association with other ocular defects has been reported in English Springer Spaniels. Congenital lenticular abnormalities include colobomata, microphakia and subluxation. Glaucoma and buphthalmos are frequent. The prognosis for vision and comfort in affected eyes is guarded to poor.

L. Refractive Myopia

A condition of the eye where the light that comes in does not directly focus on the retina but in front of it. In common terminology, "near-sighted." This condition has been shown to have a genetic component in English Springer Spaniels, although the exact mode of inheritance has not been determined.

References

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2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2016 and/or Data from OFA All-Breeds Report, 2010-2016.

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15. Historical breed club request.

OCULAR DISORDERS REPORT
ENGLISH SPRINGER SPANIEL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 15812 #	%	2000-2009 20017 #	%	2010-2016 12277 #	%
GLOBE							
0.110	microphthalmia	10	0.1%	13	0.1%	3	0.0%
10.000	glaucoma	3	0.0%	1	0.0%	1	0.0%
EYELIDS							
20.110	eyelid dermoid	2	0.0%	0		0	
20.160	macropalpebral fissure	0		2	0.0%	1	0.0%
21.000	entropion, unspecified	104	0.7%	117	0.6%	61	0.5%
22.000	ectropion, unspecified	31	0.2%	20	0.1%	6	0.0%
25.110	distichiasis	129	0.8%	170	0.8%	81	0.7%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	2	0.0%	0		2	0.0%
40.910	keratoconjunctivitis sicca	3	0.0%	4	0.0%	4	0.0%
NICTITANS							
52.110	prolapsed gland of the third eyelid	2	0.0%	2	0.0%	4	0.0%
CORNEA							
70.210	corneal pannus	1	0.0%	3	0.0%	2	0.0%
70.220	pigmentary keratitis	0		2	0.0%	2	0.0%
70.700	corneal dystrophy	209	1.3%	228	1.1%	155	1.3%
70.730	corneal endothelial degeneration	4	0.0%	8	0.0%	0	
UVEA							
93.110	iris hypoplasia	0		3	0.0%	8	0.1%
93.140	corneal endothelial pigment without PPM	0		4	0.0%	0	
93.150	iris coloboma	10	0.1%	13	0.1%	5	0.0%
93.710	persistent pupillary membranes, iris to iris	881	5.6%	1691	8.4%	1058	8.6%
93.720	persistent pupillary membranes, iris to lens	56	0.4%	38	0.2%	24	0.2%
93.730	persistent pupillary membranes, iris to cornea	47	0.3%	32	0.2%	11	0.1%
93.740	persistent pupillary membranes, iris sheets	21	0.1%	27	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		4	0.0%	74	0.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		2	0.0%	14	0.1%
93.810	uveal melanoma	0		1	0.0%	1	0.0%
93.999	uveal cysts	0		11	0.1%	7	0.1%
97.150	chorioretinal coloboma, congenital	0		0		1	0.0%
LENS							
100.200	cataract, unspecified	97	0.6%	0		0	
100.210	cataract, suspect not inherited	286	1.8%	587	2.9%	327	2.7%
100.301	punctate cataract, anterior cortex	50	0.3%	57	0.3%	48	0.4%
100.302	punctate cataract, posterior cortex	33	0.2%	35	0.2%	35	0.3%
100.303	punctate cataract, equatorial cortex	15	0.1%	21	0.1%	13	0.1%
100.304	punctate cataract, anterior sutures	5	0.0%	11	0.1%	4	0.0%
100.305	punctate cataract, posterior sutures	37	0.2%	31	0.2%	19	0.2%
100.306	punctate cataract, nucleus	9	0.1%	11	0.1%	14	0.1%
100.307	punctate cataract, capsular	3	0.0%	20	0.1%	15	0.1%
100.311	incipient cataract, anterior cortex	53	0.3%	96	0.5%	45	0.4%
100.312	incipient cataract, posterior cortex	55	0.3%	80	0.4%	62	0.5%

OCULAR DISORDERS REPORT
ENGLISH SPRINGER SPANIEL

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.313	incipient cataract, equatorial cortex	33	0.2%	37	0.2%	27	0.2%
100.314	incipient cataract, anterior sutures	7	0.0%	12	0.1%	5	0.0%
100.315	incipient cataract, posterior sutures	20	0.1%	15	0.1%	7	0.1%
100.316	incipient cataract, nucleus	18	0.1%	29	0.1%	20	0.2%
100.317	incipient cataract, capsular	1	0.0%	20	0.1%	10	0.1%
100.321	incomplete cataract, anterior cortex	0		0		6	0.0%
100.322	incomplete cataract, posterior cortex	0		0		5	0.0%
100.326	incomplete cataract, nucleus	0		0		2	0.0%
100.327	incomplete cataract, capsular	0		0		3	0.0%
100.330	generalized/complete cataract	33	0.2%	48	0.2%	8	0.1%
100.375	subluxation/luxation, unspecified	17	0.1%	7	0.0%	3	0.0%
100.999	*significant cataracts (summary)*	*469*	*3.0%*	*523*	*2.6%*	*348*	*2.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	89	0.6%	91	0.5%	63	0.5%
110.135	PHPV/PTVL	12	0.1%	17	0.1%	9	0.1%
110.320	vitreal degeneration	67	0.4%	66	0.3%	72	0.6%
FUNDUS							
97.110	choroidal hypoplasia	1	0.0%	3	0.0%	0	
97.120	coloboma	3	0.0%	0		2	0.0%
RETINA							
120.170	retinal dysplasia, folds	789	5.0%	791	4.0%	319	2.6%
120.180	retinal dysplasia, geographic	348	2.2%	270	1.3%	110	0.9%
120.190	retinal dysplasia, detached	61	0.4%	47	0.2%	17	0.1%
120.310	generalized progressive retinal atrophy (PRA)	165	1.0%	231	1.2%	88	0.7%
120.400	retinal hemorrhage	3	0.0%	5	0.0%	0	
120.910	retinal detachment without dialysis	34	0.2%	22	0.1%	1	0.0%
120.920	retinal detachment with dialysis	0		0		2	0.0%
120.960	retinopathy	0		0		18	0.1%
OPTIC NERVE							
130.110	micropapilla	0		1	0.0%	9	0.1%
130.120	optic nerve hypoplasia	4	0.0%	2	0.0%	2	0.0%
130.150	optic disc coloboma	5	0.0%	5	0.0%	3	0.0%
OTHER							
900.000	other, unspecified	0		98	0.5%	238	1.9%
900.100	other, not inherited	44	0.3%	666	3.3%	232	1.9%
900.110	other, suspected as inherited	156	1.0%	47	0.2%	15	0.1%
NORMAL							
0.000	normal globe	12771	80.8%	16766	83.8%	10014	81.6%

OCULAR DISORDERS REPORT

ENGLISH TOY SPANIEL

(King Charles, Prince Charles, Ruby, Blenheim)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Eury/macroblepharon	Not defined	2	Breeder option
C.	Distichiasis	Not defined	1	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
E.	Exposure/pigmentary keratitis	Not defined	3	Breeder option
F.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder option
G.	Cataract	Not defined	1	NO
H.	Persistent hyperplastic primary vitreous /Persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Presumed dominant/ incomplete penetrance	1	NO
I.	Persistent hyaloid artery	Not defined	1	Breeder option
J.	Vitreous degeneration	Not defined	5	Breeder option
K.	Retinal dysplasia - folds	Presumed autosomal recessive	1	Breeder option

OCULAR DISORDERS REPORT

Description and Comments

A. Entropion

A conformational defect resulting in "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures, which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation. This condition is no longer listed on the CAER form. Please mark other conditions suspected as inherited and describe in the comments section.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Exposure/Pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Onset of cataract in the English Toy Spaniel is at an early age (less than 6 months), affecting the cortex and nucleus with rapid progression to complete cataract, resulting in blindness.

H. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

I. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA**)** or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

J. Vitreous degeneration

Liquefaction of the vitreous gel, which may predispose to retinal detachment.

K. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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References

There are no references providing detailed descriptions of hereditary ocular conditions of the English Toy Spaniel breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

3. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

4. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

5. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

OCULAR DISORDERS REPORT
ENGLISH TOY SPANIEL

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 125 #	 %	2000-2009 448 #	 %	2010-2016 568 #	 %
GLOBE							
0.110	microphthalmia	2	1.6%	1	0.2%	1	0.2%
EYELIDS							
20.140	ectopic cilia	0		0		1	0.2%
20.160	macropalpebral fissure	3	2.4%	6	1.3%	1	0.2%
21.000	entropion, unspecified	15	12.0%	33	7.4%	8	1.4%
22.000	ectropion, unspecified	3	2.4%	0		0	
25.110	distichiasis	9	7.2%	48	10.7%	70	12.3%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		2	0.4%
NICTITANS							
52.110	prolapsed gland of the third eyelid	1	0.8%	1	0.2%	0	
CORNEA							
70.210	corneal pannus	1	0.8%	0		0	
70.220	pigmentary keratitis	2	1.6%	9	2.0%	9	1.6%
70.700	corneal dystrophy	13	10.4%	50	11.2%	86	15.1%
70.730	corneal endothelial degeneration	0		2	0.4%	2	0.4%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		2	0.4%	11	1.9%
93.720	persistent pupillary membranes, iris to lens	0		0		2	0.4%
93.730	persistent pupillary membranes, iris to cornea	0		0		1	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		5	0.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.2%
93.999	uveal cysts	0		0		1	0.2%
LENS							
100.200	cataract, unspecified	10	8.0%	0		0	
100.210	cataract, suspect not inherited	6	4.8%	10	2.2%	48	8.5%
100.301	punctate cataract, anterior cortex	2	1.6%	0		5	0.9%
100.302	punctate cataract, posterior cortex	5	4.0%	5	1.1%	6	1.1%
100.303	punctate cataract, equatorial cortex	0		1	0.2%	1	0.2%
100.305	punctate cataract, posterior sutures	1	0.8%	2	0.4%	3	0.5%
100.306	punctate cataract, nucleus	0		1	0.2%	2	0.4%
100.307	punctate cataract, capsular	2	1.6%	4	0.9%	7	1.2%
100.311	incipient cataract, anterior cortex	7	5.6%	8	1.8%	8	1.4%
100.312	incipient cataract, posterior cortex	5	4.0%	11	2.5%	5	0.9%
100.313	incipient cataract, equatorial cortex	0		0		2	0.4%
100.315	incipient cataract, posterior sutures	1	0.8%	0		0	
100.316	incipient cataract, nucleus	0		2	0.4%	11	1.9%
100.317	incipient cataract, capsular	0		10	2.2%	4	0.7%
100.321	incomplete cataract, anterior cortex	0		0		4	0.7%
100.322	incomplete cataract, posterior cortex	0		0		3	0.5%
100.323	incomplete cataract, equatorial cortex	0		0		2	0.4%
100.326	incomplete cataract, nucleus	0		0		2	0.4%
100.327	incomplete cataract, capsular	0		0		1	0.2%

OCULAR DISORDERS REPORT
ENGLISH TOY SPANIEL

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.330	generalized/complete cataract	8	6.4%	8	1.8%	4	0.7%
100.340	resorbing/hypermature cataract	0		0		3	0.5%
100.999	*significant cataracts (summary)*	*41*	*32.8%*	*52*	*11.6%*	*73*	*12.9%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	15	12.0%	24	5.4%	42	7.4%
110.135	PHPV/PTVL	1	0.8%	3	0.7%	10	1.8%
110.320	vitreal degeneration	1	0.8%	9	2.0%	11	1.9%
RETINA							
120.170	retinal dysplasia, folds	6	4.8%	38	8.5%	16	2.8%
120.180	retinal dysplasia, geographic	0		3	0.7%	5	0.9%
120.190	retinal dysplasia, detached	0		1	0.2%	1	0.2%
120.310	generalized progressive retinal atrophy (PRA)	0		5	1.1%	1	0.2%
120.920	retinal detachment with dialysis	0		0		1	0.2%
OPTIC NERVE							
130.110	micropapilla	0		1	0.2%	0	
130.150	optic disc coloboma	1	0.8%	0		0	
OTHER							
900.000	other, unspecified	0		17	3.8%	38	6.7%
900.100	other, not inherited	0		32	7.1%	44	7.7%
900.110	other, suspected as inherited	2	1.6%	9	2.0%	6	1.1%
NORMAL							
0.000	normal globe	49	39.2%	271	60.5%	266	46.8%

ENTLEBUCHER MOUNTAIN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1	NO
B.	Distichiasis	Not defined	2	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 3, 4 10	 Breeder option Passes with no notation
E.	Cataract	Presumed autosomal recessive	1, 5, 6	NO
F.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1, 6-8	NO
G.	Retinal dysplasia - folds	Not defined	9	Breeder option

Description and Comments

A. Glaucoma

Glaucoma is an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not

been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Cataracts in the Entlebucher Mountain Dog generally become evident in young to middle-aged dogs (5.5 +/- 2.6 years). The opacities typically begin in the posterior subcapsular/capsular polar region along the suture lines as early as 1-2 years of age. Most dogs are affected with bilaterally symmetrical cataracts, which may or may not progress. Pedigree analysis suggests an autosomal recessive mode of inheritance.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Retinal atrophy - generalized *(prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent

clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Entlebucher Mountain Dog is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

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10. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
ENTLEBUCHER MOUNTAIN DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 137 #	1991-1999 137 %	2000-2009 544 #	2000-2009 544 %	2010-2016 347 #	2010-2016 347 %
EYELIDS							
20.140	ectopic cilia	0		1	0.2%	0	
21.000	entropion, unspecified	0		1	0.2%	0	
25.110	distichiasis	5	3.6%	3	0.6%	3	0.9%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		3	0.9%
CORNEA							
70.700	corneal dystrophy	0		5	0.9%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	4	2.9%	25	4.6%	21	6.1%
93.720	persistent pupillary membranes, iris to lens	0		4	0.7%	0	
93.730	persistent pupillary membranes, iris to cornea	0		2	0.4%	0	
93.740	persistent pupillary membranes, iris sheets	0		1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.2%	6	1.7%
93.999	uveal cysts	0		1	0.2%	1	0.3%
LENS							
100.210	cataract, suspect not inherited	2	1.5%	38	7.0%	23	6.6%
100.301	punctate cataract, anterior cortex	1	0.7%	1	0.2%	1	0.3%
100.302	punctate cataract, posterior cortex	5	3.6%	18	3.3%	12	3.5%
100.303	punctate cataract, equatorial cortex	3	2.2%	2	0.4%	2	0.6%
100.304	punctate cataract, anterior sutures	0		1	0.2%	0	
100.305	punctate cataract, posterior sutures	2	1.5%	0		1	0.3%
100.306	punctate cataract, nucleus	0		1	0.2%	1	0.3%
100.307	punctate cataract, capsular	0		4	0.7%	3	0.9%
100.311	incipient cataract, anterior cortex	1	0.7%	11	2.0%	1	0.3%
100.312	incipient cataract, posterior cortex	10	7.3%	43	7.9%	19	5.5%
100.313	incipient cataract, equatorial cortex	3	2.2%	6	1.1%	0	
100.315	incipient cataract, posterior sutures	0		3	0.6%	1	0.3%
100.316	incipient cataract, nucleus	0		4	0.7%	0	
100.317	incipient cataract, capsular	0		9	1.7%	2	0.6%
100.322	incomplete cataract, posterior cortex	0		0		2	0.6%
100.330	generalized/complete cataract	0		9	1.7%	0	
100.375	subluxation/luxation, unspecified	0		1	0.2%	0	
100.999	*significant cataracts (summary)*	*25*	*18.2%*	*112*	*20.6%*	*45*	*13.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.7%	0		0	
110.320	vitreal degeneration	0		3	0.6%	2	0.6%
RETINA							
120.170	retinal dysplasia, folds	3	2.2%	13	2.4%	11	3.2%
120.180	retinal dysplasia, geographic	1	0.7%	3	0.6%	3	0.9%
120.190	retinal dysplasia, detached	0		1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	6	4.4%	22	4.0%	2	0.6%
120.960	retinopathy	0		0		2	0.6%

OCULAR DISORDERS REPORT
ENTLEBUCHER MOUNTAIN DOG

	1991-1999	2000-2009	2010-2016
OPTIC NERVE			
130.110 micropapilla	0	0	2 0.6%
130.120 optic nerve hypoplasia	0	0	1 0.3%
OTHER			
900.000 other, unspecified	0	10 1.8%	10 2.9%
900.100 other, not inherited	0	36 6.6%	16 4.6%
900.110 other, suspected as inherited	5 3.6%	3 0.6%	5 1.4%
NORMAL			
0.000 normal globe	96 70.1%	410 75.4%	254 73.2%

OCULAR DISORDERS REPORT

EURASIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Glaucoma	Not defined	2, 3	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening examination.

References

1. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

2. Strom AR, Hassig M, Iburg TM, et al. Epidemiology of canine glaucoma presented to University of Zurich from 1995 to 2009. Part 1: Congenital and primary glaucoma (4 and 123 cases). *Vet Ophthalmol*. 2011;14:121-126. Epub 2011/03/04.

3. Rosolen SG, Boillot T, Dulaurent T, et al. Morphological, biometrical and biochemical susceptibilities for glaucoma in a healthy Eurasier dog - ECVO 2014 abstract #44. *Vet Ophthalmol*. 2014;17:E23.

OCULAR DISORDERS REPORT
EURASIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 3 #	%	2000-2009 54 #	%	2010-2016 59 #	%
EYELIDS								
25.110	distichiasis		1	33.3%	17	31.5%	19	32.2%
CORNEA								
70.700	corneal dystrophy		1	33.3%	1	1.9%	1	1.7%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		0		2	3.4%
LENS								
100.210	cataract, suspect not inherited		0		2	3.7%	5	8.5%
100.302	punctate cataract, posterior cortex		0		0		2	3.4%
100.305	punctate cataract, posterior sutures		0		0		1	1.7%
100.307	punctate cataract, capsular		0		0		1	1.7%
100.999	*significant cataracts (summary)*		*0*		*0*		*4*	*6.8%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		0		0		1	1.7%
OTHER								
900.000	other, unspecified		0		2	3.7%	3	5.1%
900.100	other, not inherited		1	33.3%	4	7.4%	2	3.4%
900.110	other, suspected as inherited		0		2	3.7%	0	
NORMAL								
0.000	normal globe		0		39	72.2%	33	55.9%

OCULAR DISORDERS REPORT

FIELD SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Ectropion	Not defined	1	Breeder option
C.	Eury/Macroblepharon	Not defined	2	Breeder option
D.	Distichiasis	Not defined	3	Breeder option
E.	Corneal dystrophy - epithelial/stromal	Not defined	4	Breeder option
F.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	5, 6 7	Breeder option Passes with no notation
G.	Cataract	Not defined	3	NO
H.	Retinal dysplasia - folds	Not defined	3	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that reduces or eliminates the likelihood of the defect.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents and the conformation of the skull.

OCULAR DISORDERS REPORT

C. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation. This condition is no longer listed on the CAER form. Please mark other conditions suspected as inherited and describe in the comments section.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Field Spaniel breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

5. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

6. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

7. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
FIELD SPANIEL

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 512 #	%	2000-2009 1129 #	%	2010-2016 946 #	%
EYELIDS								
20.160	macropalpebral fissure		0		6	0.5%	0	
21.000	entropion, unspecified		0		10	0.9%	0	
22.000	ectropion, unspecified		3	0.6%	7	0.6%	1	0.1%
25.110	distichiasis		53	10.4%	64	5.7%	44	4.7%
NASOLACRIMAL								
32.110	imperforate lower nasolacrimal punctum		2	0.4%	0		6	0.6%
NICTITANS								
52.110	prolapsed gland of the third eyelid		0		0		1	0.1%
CORNEA								
70.220	pigmentary keratitis		0		1	0.1%	0	
70.700	corneal dystrophy		2	0.4%	5	0.4%	23	2.4%
70.730	corneal endothelial degeneration		0		1	0.1%	0	
UVEA								
93.710	persistent pupillary membranes, iris to iris		7	1.4%	76	6.7%	78	8.2%
93.720	persistent pupillary membranes, iris to lens		1	0.2%	5	0.4%	0	
93.730	persistent pupillary membranes, iris to cornea		2	0.4%	3	0.3%	2	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		3	0.3%	14	1.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		5	0.5%
LENS								
100.200	cataract, unspecified		3	0.6%	0		0	
100.210	cataract, suspect not inherited		31	6.1%	64	5.7%	33	3.5%
100.301	punctate cataract, anterior cortex		6	1.2%	5	0.4%	6	0.6%
100.302	punctate cataract, posterior cortex		1	0.2%	1	0.1%	1	0.1%
100.304	punctate cataract, anterior sutures		1	0.2%	0		1	0.1%
100.305	punctate cataract, posterior sutures		0		0		1	0.1%
100.306	punctate cataract, nucleus		0		1	0.1%	1	0.1%
100.307	punctate cataract, capsular		0		5	0.4%	2	0.2%
100.311	incipient cataract, anterior cortex		1	0.2%	11	1.0%	2	0.2%
100.312	incipient cataract, posterior cortex		0		4	0.4%	2	0.2%
100.313	incipient cataract, equatorial cortex		0		1	0.1%	0	
100.314	incipient cataract, anterior sutures		0		2	0.2%	1	0.1%
100.315	incipient cataract, posterior sutures		0		3	0.3%	2	0.2%
100.316	incipient cataract, nucleus		1	0.2%	4	0.4%	3	0.3%
100.317	incipient cataract, capsular		0		3	0.3%	2	0.2%
100.321	incomplete cataract, anterior cortex		0		0		1	0.1%
100.322	incomplete cataract, posterior cortex		0		0		1	0.1%
100.330	generalized/complete cataract		2	0.4%	0		0	
100.999	*significant cataracts (summary)*		*15*	*2.9%*	*40*	*3.5%*	*26*	*2.7%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		1	0.2%	1	0.1%	2	0.2%
110.135	PHPV/PTVL		0		0		4	0.4%
110.320	vitreal degeneration		0		0		4	0.4%

OCULAR DISORDERS REPORT
FIELD SPANIEL

	1991-1999		2000-2009		2010-2016	
FUNDUS						
97.120 coloboma	0		1	0.1%	0	
RETINA						
120.170 retinal dysplasia, folds	65	12.7%	112	9.9%	86	9.1%
120.180 retinal dysplasia, geographic	2	0.4%	5	0.4%	5	0.5%
120.190 retinal dysplasia, detached	0		0		1	0.1%
120.310 generalized progressive retinal atrophy (PRA)	1	0.2%	2	0.2%	0	
120.400 retinal hemorrhage	1	0.2%	3	0.3%	0	
120.910 retinal detachment without dialysis	0		1	0.1%	0	
OPTIC NERVE						
130.110 micropapilla	0		0		3	0.3%
130.120 optic nerve hypoplasia	0		0		1	0.1%
OTHER						
900.000 other, unspecified	0		16	1.4%	31	3.3%
900.100 other, not inherited	0		60	5.3%	57	6.0%
900.110 other, suspected as inherited	6	1.2%	3	0.3%	2	0.2%
NORMAL						
0.000 normal globe	355	69.3%	876	77.6%	646	68.3%

FINNISH LAPPHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- iris to cornea	Not defined	2	NO
B.	Cataract	Not defined	3	NO
C.	Retinal atrophy - generalized (*prcd)* * a DNA test is available	Autosomal recessive	1, 4	NO
D.	Multifocal retinopathy - *cmr3* * a DNA test is available	Autosomal recessive	2	NO
E.	Retinal dysplasia - folds	Not defined	2	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the form of PRA in the Finnish Lapphund is PRCD which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

D. Multifocal retinopathy (cmr3)

Canine Multi-focal Retinopathy type 3 (cmr3) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Clinically the disease is similar to that seen in the Bullmastiff and Coton deTulear, but the mutation in the Bestrophin 1 gene (*BEST1* alias *VMD2*) is different. The multifocal retinopathy seen in the Lapponian Herder is caused by a deletion at position 1,388 and a substitution at position 1,466 and is therefore called cmr3. A DNA test is available.

E. Retinal Dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and the more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

3. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2009.

4. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563.

OCULAR DISORDERS REPORT
FINNISH LAPPHUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 29 #	 %	2000-2009 226 #	 %	2010-2016 312 #	 %
EYELIDS								
25.110	distichiasis		1	3.4%	0		0	
CORNEA								
70.220	pigmentary keratitis		1	3.4%	0		0	
UVEA								
93.710	persistent pupillary membranes, iris to iris		3	10.3%	16	7.1%	38	12.2%
93.720	persistent pupillary membranes, iris to lens		0		0		1	0.3%
93.730	persistent pupillary membranes, iris to cornea		0		5	2.2%	1	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		2	0.6%
LENS								
100.210	cataract, suspect not inherited		2	6.9%	18	8.0%	18	5.8%
100.301	punctate cataract, anterior cortex		0		0		1	0.3%
100.302	punctate cataract, posterior cortex		0		1	0.4%	6	1.9%
100.305	punctate cataract, posterior sutures		1	3.4%	0		1	0.3%
100.306	punctate cataract, nucleus		0		0		2	0.6%
100.307	punctate cataract, capsular		0		0		1	0.3%
100.311	incipient cataract, anterior cortex		0		0		1	0.3%
100.312	incipient cataract, posterior cortex		0		0		1	0.3%
100.313	incipient cataract, equatorial cortex		0		0		2	0.6%
100.330	generalized/complete cataract		0		1	0.4%	0	
100.999	*significant cataracts (summary)*		*1*	*3.4%*	*2*	*0.9%*	*15*	*4.8%*
RETINA								
120.170	retinal dysplasia, folds		1	3.4%	6	2.7%	3	1.0%
120.310	generalized progressive retinal atrophy (PRA)		0		0		1	0.3%
120.960	retinopathy		0		0		1	0.3%
OTHER								
900.000	other, unspecified		0		1	0.4%	9	2.9%
900.100	other, not inherited		1	3.4%	12	5.3%	5	1.6%
900.110	other, suspected as inherited		2	6.9%	2	0.9%	1	0.3%
NORMAL								
0.000	normal globe		20	69.0%	194	85.8%	251	80.4%

OCULAR DISORDERS REPORT

FINNISH SPITZ

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Finnish Spitz breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
FINNISH SPITZ

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 157 #	 %	2000-2009 68 #	 %	2010-2016 24 #	 %
EYELIDS							
20.140	ectopic cilia	1	0.6%	0		0	
CORNEA							
70.700	corneal dystrophy	2	1.3%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		2	2.9%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	8.3%
LENS							
100.200	cataract, unspecified	1	0.6%	0		0	
100.210	cataract, suspect not inherited	23	14.6%	9	13.2%	1	4.2%
100.301	punctate cataract, anterior cortex	2	1.3%	0		0	
100.302	punctate cataract, posterior cortex	1	0.6%	0		0	
100.304	punctate cataract, anterior sutures	1	0.6%	0		0	
100.307	punctate cataract, capsular	1	0.6%	1	1.5%	0	
100.311	incipient cataract, anterior cortex	1	0.6%	0		0	
100.312	incipient cataract, posterior cortex	1	0.6%	0		0	
100.999	*significant cataracts (summary)*	*8*	*5.1%*	*1*	*1.5%*	*0*	
VITREOUS							
110.120	persistent hyaloid artery/remnant	2	1.3%	2	2.9%	0	
110.320	vitreal degeneration	3	1.9%	0		0	
RETINA							
120.170	retinal dysplasia, folds	1	0.6%	1	1.5%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		4	5.9%	2	8.3%
OTHER							
900.000	other, unspecified	0		1	1.5%	2	8.3%
900.100	other, not inherited	0		8	11.8%	0	
900.110	other, suspected as inherited	1	0.6%	1	1.5%	0	
NORMAL							
0.000	normal globe	126	80.3%	52	76.5%	19	79.2%

FLAT-COATED RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1, 2, 7	NO
B.	Distichiasis	Not defined	3	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	4	Breeder option
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	4 6	Breeder option Passes with no notation
E.	Cataract	Not defined	3	NO
F.	Retinopathy	Not defined	5	Breeder Option

Description and Comments

A. Glaucoma (with pectinate ligament dysplasia)

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

Flat-Coated Retrievers have been shown to have a higher prevalence of pectinate ligament dysplasia compared with other breeds. There is a significant association between pectinate ligament dysplasia and glaucoma in this breed. The heritability of pectinate ligament dyplasia in Flat-Coated Retrievers is estimated at 0.7. Since glaucoma and pectinate ligament dysplasia are closely associated, glaucoma may also be heritable.

In a recent report, pectinate ligament dysplasia (PLD) was prevalent and significantly associated with age in a population of Flat-Coated Retrievers in the UK.

Due to the incidence of PLD in the breed and the increased progression observed with age, it may be prudent to perform repeated gonioscopy examinations over time.

OCULAR DISORDERS REPORT

B. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. The exact frequency and significance of cataracts in the breed is not known.

F. Retinopathy

Patchy focal unilateral or bilateral hyper reflective tapetal lesions most frequently peripheral but occasionally central around a pigmented spot, usually non progressive. Not usually present prior to 3 months of age but usually present by 18 months of age.

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OCULAR DISORDERS REPORT
FLAT-COATED RETRIEVER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 2598 #	%	2000-2009 3681 #	%	2010-2016 2855 #	%
GLOBE							
0.110	microphthalmia	0		2	0.1%	1	0.0%
10.000	glaucoma	2	0.1%	0		0	
EYELIDS							
20.140	ectopic cilia	3	0.1%	3	0.1%	3	0.1%
20.160	macropalpebral fissure	1	0.0%	1	0.0%	0	
21.000	entropion, unspecified	6	0.2%	9	0.2%	2	0.1%
22.000	ectropion, unspecified	15	0.6%	15	0.4%	4	0.1%
25.110	distichiasis	324	12.5%	424	11.5%	394	13.8%
NICTITANS							
50.210	pannus of third eyelid	0		0		1	0.0%
52.110	prolapsed gland of the third eyelid	0		0		4	0.1%
CORNEA							
70.220	pigmentary keratitis	0		0		2	0.1%
70.700	corneal dystrophy	21	0.8%	17	0.5%	18	0.6%
70.730	corneal endothelial degeneration	2	0.1%	1	0.0%	1	0.0%
UVEA							
93.110	iris hypoplasia	0		1	0.0%	1	0.0%
93.140	corneal endothelial pigment without PPM	0		0		1	0.0%
93.710	persistent pupillary membranes, iris to iris	40	1.5%	86	2.3%	109	3.8%
93.720	persistent pupillary membranes, iris to lens	3	0.1%	11	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.0%	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.0%	74	2.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		5	0.2%
93.810	uveal melanoma	0		1	0.0%	1	0.0%
93.999	uveal cysts	3	0.1%	12	0.3%	14	0.5%
LENS							
100.200	cataract, unspecified	16	0.6%	0		0	
100.210	cataract, suspect not inherited	158	6.1%	439	11.9%	444	15.6%
100.301	punctate cataract, anterior cortex	20	0.8%	31	0.8%	29	1.0%
100.302	punctate cataract, posterior cortex	3	0.1%	6	0.2%	10	0.4%
100.303	punctate cataract, equatorial cortex	1	0.0%	2	0.1%	7	0.2%
100.304	punctate cataract, anterior sutures	3	0.1%	14	0.4%	8	0.3%
100.305	punctate cataract, posterior sutures	0		5	0.1%	13	0.5%
100.306	punctate cataract, nucleus	0		6	0.2%	4	0.1%
100.307	punctate cataract, capsular	0		6	0.2%	6	0.2%
100.311	incipient cataract, anterior cortex	10	0.4%	18	0.5%	12	0.4%
100.312	incipient cataract, posterior cortex	8	0.3%	7	0.2%	7	0.2%
100.313	incipient cataract, equatorial cortex	5	0.2%	11	0.3%	1	0.0%
100.314	incipient cataract, anterior sutures	2	0.1%	2	0.1%	2	0.1%
100.315	incipient cataract, posterior sutures	3	0.1%	5	0.1%	2	0.1%
100.316	incipient cataract, nucleus	0		3	0.1%	3	0.1%
100.317	incipient cataract, capsular	0		2	0.1%	3	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.0%
100.326	incomplete cataract, nucleus	0		0		1	0.0%

OCULAR DISORDERS REPORT
FLAT-COATED RETRIEVER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.330	generalized/complete cataract	2	0.1%	3	0.1%	1	0.0%
100.375	subluxation/luxation, unspecified	0		2	0.1%	1	0.0%
100.999	*significant cataracts (summary)*	*73*	*2.8%*	*121*	*3.3%*	*110*	*3.9%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	6	0.2%	4	0.1%	4	0.1%
110.135	PHPV/PTVL	1	0.0%	3	0.1%	1	0.0%
110.320	vitreal degeneration	0		1	0.0%	0	
FUNDUS							
97.110	choroidal hypoplasia	0		0		1	0.0%
97.120	coloboma	0		1	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	4	0.2%	11	0.3%	4	0.1%
120.180	retinal dysplasia, geographic	2	0.1%	9	0.2%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	8	0.3%	29	0.8%	16	0.6%
120.910	retinal detachment without dialysis	0		0		1	0.0%
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		18	0.6%
OPTIC NERVE							
130.110	micropapilla	0		0		7	0.2%
130.120	optic nerve hypoplasia	2	0.1%	1	0.0%	0	
130.150	optic disc coloboma	10	0.4%	1	0.0%	10	0.4%
OTHER							
900.000	other, unspecified	0		48	1.3%	112	3.9%
900.100	other, not inherited	22	0.8%	240	6.5%	138	4.8%
900.110	other, suspected as inherited	30	1.2%	23	0.6%	7	0.2%
NORMAL							
0.000	normal globe	2003	77.1%	2892	78.6%	1947	68.2%

FRENCH BULLDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	2	Breeder option
C.	Imperforate lacrimal punctum	Not defined	3	Breeder option
D.	Prolapsed gland of the third eyelid	Not defined	4	Breeder option
E.	Corneal dystrophy - epithelial/stromal	Not defined	5	Breeder option
F.	Exposure/Pigmentary Keratitis	Not defined	6	Breeder option
G.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 7	Breeder option
	- iris to cornea	Not defined	8	NO
	- endothelial opacity/no strands	Not defined	8, 10	NO
H.	Cataract * a DNA test is available	Autosomal recessive	2, 9	NO
I.	Retinal dysplasia - folds	Not defined	2	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

OCULAR DISORDERS REPORT

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of the dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

C. Imperforate lacrimal punctum

A developmental anomaly resulting in failure of opening of the lacrimal duct located at the medial lid margins. The lower punctum is more frequently affected. This defect usually results in epiphora, an overflow of tears onto the face.

D. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

French Bulldogs were overrepresented in a study of prolapsed gland of the third eyelid. In the study, 100% of the prolapsed glands in French Bulldogs occurred before 1 year of age. French Bulldogs were also more likely to develop bilateral prolapsed glands that occurred either simultaneously with the first prolapse or with a short time interval between prolapses.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

F. Exposure/Pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the French Bulldog, the condition is inherited as an autosomal recessive mutation in the HSF4 gene (*HSF4-1*). A DNA test is available.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
FRENCH BULLDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 482 #	%	2000-2009 1654 #	%	2010-2016 2211 #	%
GLOBE							
0.110	microphthalmia	0		1	0.1%	1	0.0%
EYELIDS							
20.140	ectopic cilia	0		0		1	0.0%
20.160	macropalpebral fissure	0		3	0.2%	0	
21.000	entropion, unspecified	0		19	1.1%	24	1.1%
22.000	ectropion, unspecified	0		2	0.1%	5	0.2%
25.110	distichiasis	31	6.4%	100	6.0%	157	7.1%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		5	0.3%	27	1.2%
40.910	keratoconjunctivitis sicca	0		1	0.1%	3	0.1%
NICTITANS							
50.210	pannus of third eyelid	0		0		1	0.0%
52.110	prolapsed gland of the third eyelid	2	0.4%	1	0.1%	4	0.2%
CORNEA							
70.210	corneal pannus	3	0.6%	1	0.1%	0	
70.220	pigmentary keratitis	2	0.4%	2	0.1%	22	1.0%
70.700	corneal dystrophy	4	0.8%	8	0.5%	23	1.0%
70.730	corneal endothelial degeneration	0		2	0.1%	4	0.2%
UVEA							
93.150	iris coloboma	0		0		1	0.0%
93.710	persistent pupillary membranes, iris to iris	6	1.2%	35	2.1%	69	3.1%
93.720	persistent pupillary membranes, iris to lens	0		4	0.2%	2	0.1%
93.730	persistent pupillary membranes, iris to cornea	4	0.8%	28	1.7%	29	1.3%
93.740	persistent pupillary membranes, iris sheets	0		3	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		8	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.1%	42	1.9%
93.810	uveal melanoma	0		0		2	0.1%
93.999	uveal cysts	1	0.2%	5	0.3%	3	0.1%
97.150	chorioretinal coloboma, congenital	0		0		1	0.0%
LENS							
100.210	cataract, suspect not inherited	1	0.2%	37	2.2%	60	2.7%
100.301	punctate cataract, anterior cortex	0		6	0.4%	5	0.2%
100.302	punctate cataract, posterior cortex	1	0.2%	2	0.1%	2	0.1%
100.303	punctate cataract, equatorial cortex	2	0.4%	1	0.1%	4	0.2%
100.305	punctate cataract, posterior sutures	2	0.4%	0		0	
100.306	punctate cataract, nucleus	0		0		5	0.2%
100.307	punctate cataract, capsular	0		1	0.1%	1	0.0%
100.311	incipient cataract, anterior cortex	7	1.5%	20	1.2%	14	0.6%
100.312	incipient cataract, posterior cortex	7	1.5%	6	0.4%	1	0.0%
100.313	incipient cataract, equatorial cortex	6	1.2%	3	0.2%	10	0.5%
100.314	incipient cataract, anterior sutures	0		3	0.2%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	3	0.2%	0	
100.316	incipient cataract, nucleus	1	0.2%	6	0.4%	4	0.2%

OCULAR DISORDERS REPORT
FRENCH BULLDOG

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.317	incipient cataract, capsular	0		2	0.1%	5	0.2%
100.321	incomplete cataract, anterior cortex	0		0		2	0.1%
100.322	incomplete cataract, posterior cortex	0		0		1	0.0%
100.326	incomplete cataract, nucleus	0		0		1	0.0%
100.330	generalized/complete cataract	5	1.0%	11	0.7%	2	0.1%
100.999	*significant cataracts (summary)*	*32*	*6.6%*	*64*	*3.9%*	*57*	*2.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		6	0.4%	11	0.5%
110.135	PHPV/PTVL	0		0		1	0.0%
110.320	vitreal degeneration	0		3	0.2%	6	0.3%
RETINA							
120.170	retinal dysplasia, folds	15	3.1%	43	2.6%	42	1.9%
120.180	retinal dysplasia, geographic	0		7	0.4%	6	0.3%
120.310	generalized progressive retinal atrophy (PRA)	0		1	0.1%	0	
120.400	retinal hemorrhage	0		1	0.1%	0	
120.910	retinal detachment without dialysis	0		1	0.1%	0	
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		2	0.1%
OPTIC NERVE							
130.110	micropapilla	0		0		1	0.0%
OTHER							
900.000	other, unspecified	0		14	0.8%	51	2.3%
900.100	other, not inherited	5	1.0%	81	4.9%	56	2.5%
900.110	other, suspected as inherited	2	0.4%	9	0.5%	5	0.2%
NORMAL							
0.000	normal globe	403	83.6%	1402	84.8%	1741	78.7%

OCULAR DISORDERS REPORT

GERMAN PINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to lens	Not defined	2	NO
	- lens pigment foci/no strands	Not defined	8	Passes with no notation
C.	Cataract	Not defined	1, 3-5	NO
D.	Persistent hyperplastic tunica vasculosa lentis (PHTVL)	Not defined	4, 5	NO
E.	Vitreous degeneration	Not defined	3	Breeder option
F.	Optic nerve hypoplasia	Not defined	6, 7	NO
G.	Micropapilla	Not defined	6, 7	Breeder option

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

There may be more than one type of inherited cataract in German Pinschers. One form is reported in Finland with a later age of onset in which a pedigree analysis suggested autosomal recessive or incomplete dominant inheritance (4). Another form is reported in Germany with an earlier age of onset in which a pedigree analysis suggested autosomal recessive inheritance (5). Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent tunica vasculosa lentis results from the failure of regression of the embryologic vascular network which surrounds the developing lens. This disorder has been observed in German Pinschers in Finland and Germany. A pedigree analysis suggested recessive or incomplete dominant inheritance (4).

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

G. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

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8. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
GERMAN PINSCHER

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**104**		**462**		**656**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
EYELIDS							
25.110	distichiasis	0		2	0.4%	4	0.6%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		1	0.2%
CORNEA							
70.700	corneal dystrophy	3	2.9%	9	1.9%	8	1.2%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		3	0.6%	6	0.9%
93.720	persistent pupillary membranes, iris to lens	0		5	1.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		12	1.8%
LENS							
100.210	cataract, suspect not inherited	5	4.8%	32	6.9%	44	6.7%
100.301	punctate cataract, anterior cortex	1	1.0%	7	1.5%	8	1.2%
100.302	punctate cataract, posterior cortex	5	4.8%	11	2.4%	8	1.2%
100.304	punctate cataract, anterior sutures	1	1.0%	3	0.6%	2	0.3%
100.305	punctate cataract, posterior sutures	1	1.0%	6	1.3%	2	0.3%
100.306	punctate cataract, nucleus	0		0		1	0.2%
100.307	punctate cataract, capsular	1	1.0%	4	0.9%	1	0.2%
100.311	incipient cataract, anterior cortex	3	2.9%	10	2.2%	8	1.2%
100.312	incipient cataract, posterior cortex	4	3.8%	19	4.1%	16	2.4%
100.313	incipient cataract, equatorial cortex	0		5	1.1%	3	0.5%
100.314	incipient cataract, anterior sutures	1	1.0%	4	0.9%	1	0.2%
100.315	incipient cataract, posterior sutures	0		8	1.7%	1	0.2%
100.316	incipient cataract, nucleus	1	1.0%	1	0.2%	4	0.6%
100.317	incipient cataract, capsular	0		7	1.5%	1	0.2%
100.321	incomplete cataract, anterior cortex	0		0		1	0.2%
100.322	incomplete cataract, posterior cortex	0		0		1	0.2%
100.325	incomplete cataract, posterior sutures	0		0		1	0.2%
100.330	generalized/complete cataract	4	3.8%	4	0.9%	0	
100.999	*significant cataracts (summary)*	*22*	*21.2%*	*89*	*19.3%*	*59*	*9.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	1.0%	1	0.2%	0	
110.135	PHPV/PTVL	1	1.0%	2	0.4%	1	0.2%
110.320	vitreal degeneration	2	1.9%	6	1.3%	6	0.9%
RETINA							
120.170	retinal dysplasia, folds	0		1	0.2%	1	0.2%
120.180	retinal dysplasia, geographic	0		1	0.2%	0	
120.400	retinal hemorrhage	1	1.0%	0		0	
120.960	retinopathy	0		0		2	0.3%
OPTIC NERVE							
130.110	micropapilla	0		3	0.6%	7	1.1%
130.120	optic nerve hypoplasia	5	4.8%	0		1	0.2%

OCULAR DISORDERS REPORT
GERMAN PINSCHER

	1991-1999		2000-2009		2010-2016	
OTHER						
900.000 other, unspecified	0		9	1.9%	17	2.6%
900.100 other, not inherited	4	3.8%	27	5.8%	21	3.2%
900.110 other, suspected as inherited	2	1.9%	1	0.2%	0	
NORMAL						
0.000 normal globe	76	73.1%	379	82.0%	528	80.5%

OCULAR DISORDERS REPORT

GERMAN SHEPHERD DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined		Breeder option
B.	Plasmoma/atypical pannus	Not defined		NO
C.	Corneal dystrophy - epithelial/stromal	Not defined	3, 4	Breeder option
D.	Chronic superficial keratitis/pannus * a DNA test is available	Not defined	3, 5-11	NO
E.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 12, 13 25	 Breeder option Passes with no notation
F.	Cataract 1. Congenital	Presumed autosomal dominant	3, 14, 15	NO
	2. Cortical	Presumed autosomal recessive	3, 16	NO
G.	Retinal atrophy - generalized	Not defined	3, 17-19	NO
H.	Cone degeneration - hemeralopia/ achromatopsia * a DNA test is available	Autosomal recessive		NO
I.	Retinal dysplasia - folds	Not defined		Breeder option

OCULAR DISORDERS REPORT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
J.	Retinal dysplasia -geographic/detached	Not defined	21	NO
K.	Optic nerve hypoplasia	Not defined	3	NO
. L.	Micropapilla	Not defined	22	Breeder option
M.	Limbal melanoma	Not defined		NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Plasmoma/atypical pannus

Bilateral lymphocytic/plasmocytic infiltration of the nictitating membranes which may occur independent of corneal Pannus.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans which may also occur independent of corneal disease.

The German Shepherd Dog has a higher incidence of pannus than any other breed. The MHC class II risk haplotype has been shown. Although there are likely several other genes and environmental factors that contribute to CSK, a recent paper suggested that MHC class II is a major genetic risk factor. Dogs with the risk haplotype were 2.7 times more likely to develop CSK. Homozygosity of the risk haplotype increased the risk of CSK to over eightfold.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

1. **Congenital:** Reported by von Hippel in Germany in 1930, these cataracts are present at birth and visible when the eyes open. They are usually non-progressive. Test breedings indicate an autosomal dominant mode of transmission. The occurrence is rare.

2. **Cortical:** Reported by Barnett in Great Britain, opacities are first apparent at 8-12 weeks of age, in the posterior cortex and progress to involve the Y-sutures and nucleus. The equatorial subcapsular cortex is unaffected. No progression is noted after 1-2 years of age. Test breeding suggests an autosomal recessive mode of inheritance.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

H. Cone degeneration - hemeralopia/achromatopsia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Afflicted puppies develop day-blindness and colorblindness. Afflicted dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. A 5-month-old German Shepherd puppy with vision loss during daylight hours was recently identified with a mutation in the *CNGA3* gene.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

J. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth; however, in the Golden Retriever, Labrador Retriever, and German Shepherd it has been demonstrated that the geographic form of retinal dysplasia may not be apparent before dogs are 10 weeks of age.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds

K. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

L. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

M. Limbal melanoma

Most limbal melanomas are really epibulbar melanocytomas, but there is a possibility of an extension of an intraocular melanoma extending outward and presenting as a limbal melanoma. An epibulbar melanocytoma originates from the superficial pigment lining the limbus and the lesion may eventually extend into the eye. Metastasis has not been documented and the mass is characterized by large epithelioid cells The lesion presents as a subconjunctival smooth mass most commonly in the dorsolateral limbal region and extends later into the cornea and posterior on the sclera. Breed predisposition have been noted in the German Shepherd, Labrador and Golden Retriever.

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OCULAR DISORDERS REPORT
GERMAN SHEPHERD DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1973 #	 %	2000-2009 1725 #	 %	2010-2016 1211 #	 %
GLOBE							
0.110	microphthalmia	5	0.3%	2	0.1%	1	0.1%
10.000	glaucoma	3	0.2%	0		0	
EYELIDS							
20.140	ectopic cilia	0		1	0.1%	0	
20.160	macropalpebral fissure	1	0.1%	0		0	
21.000	entropion, unspecified	1	0.1%	1	0.1%	1	0.1%
22.000	ectropion, unspecified	3	0.2%	1	0.1%	0	
25.110	distichiasis	36	1.8%	13	0.8%	6	0.5%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.1%	0		0	
40.910	keratoconjunctivitis sicca	2	0.1%	1	0.1%	0	
NICTITANS							
50.210	pannus of third eyelid	0		0		15	1.2%
51.100	third eyelid cartilage anomaly	1	0.1%	2	0.1%	1	0.1%
52.110	prolapsed gland of the third eyelid	0		0		1	0.1%
CORNEA							
70.210	corneal pannus	30	1.5%	58	3.4%	24	2.0%
70.220	pigmentary keratitis	0		0		1	0.1%
70.700	corneal dystrophy	90	4.6%	95	5.5%	42	3.5%
70.730	corneal endothelial degeneration	1	0.1%	1	0.1%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	19	1.0%	26	1.5%	23	1.9%
93.720	persistent pupillary membranes, iris to lens	3	0.2%	11	0.6%	2	0.2%
93.730	persistent pupillary membranes, iris to cornea	0		8	0.5%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	0		2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		14	1.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.1%
93.810	uveal melanoma	0		1	0.1%	1	0.1%
93.999	uveal cysts	6	0.3%	11	0.6%	6	0.5%
LENS							
100.200	cataract, unspecified	28	1.4%	0		0	
100.210	cataract, suspect not inherited	73	3.7%	99	5.7%	90	7.4%
100.301	punctate cataract, anterior cortex	7	0.4%	11	0.6%	12	1.0%
100.302	punctate cataract, posterior cortex	7	0.4%	5	0.3%	2	0.2%
100.303	punctate cataract, equatorial cortex	2	0.1%	8	0.5%	3	0.2%
100.304	punctate cataract, anterior sutures	1	0.1%	0		0	
100.305	punctate cataract, posterior sutures	6	0.3%	4	0.2%	5	0.4%
100.306	punctate cataract, nucleus	10	0.5%	11	0.6%	12	1.0%
100.307	punctate cataract, capsular	2	0.1%	3	0.2%	4	0.3%
100.311	incipient cataract, anterior cortex	9	0.5%	20	1.2%	8	0.7%
100.312	incipient cataract, posterior cortex	17	0.9%	9	0.5%	4	0.3%
100.313	incipient cataract, equatorial cortex	4	0.2%	16	0.9%	0	
100.314	incipient cataract, anterior sutures	2	0.1%	1	0.1%	0	

OCULAR DISORDERS REPORT
GERMAN SHEPHERD DOG

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.315	incipient cataract, posterior sutures	2	0.1%	3	0.2%	3	0.2%
100.316	incipient cataract, nucleus	24	1.2%	21	1.2%	16	1.3%
100.317	incipient cataract, capsular	0		2	0.1%	3	0.2%
100.322	incomplete cataract, posterior cortex	0		0		1	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.1%
100.326	incomplete cataract, nucleus	0		0		1	0.1%
100.327	incomplete cataract, capsular	0		0		1	0.1%
100.330	generalized/complete cataract	14	0.7%	7	0.4%	1	0.1%
100.375	subluxation/luxation, unspecified	2	0.1%	4	0.2%	2	0.2%
100.999	*significant cataracts (summary)*	*135*	*6.8%*	*121*	*7.0%*	*77*	*6.4%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	0.2%	0		4	0.3%
110.135	PHPV/PTVL	2	0.1%	1	0.1%	0	
110.320	vitreal degeneration	6	0.3%	4	0.2%	6	0.5%
FUNDUS							
97.110	choroidal hypoplasia	1	0.1%	0		0	
RETINA							
120.170	retinal dysplasia, folds	38	1.9%	39	2.3%	17	1.4%
120.180	retinal dysplasia, geographic	8	0.4%	6	0.3%	5	0.4%
120.310	generalized progressive retinal atrophy (PRA)	8	0.4%	8	0.5%	4	0.3%
120.910	retinal detachment without dialysis	2	0.1%	2	0.1%	0	
120.920	retinal detachment with dialysis	0		0		2	0.2%
120.960	retinopathy	0		0		2	0.2%
OPTIC NERVE							
130.110	micropapilla	0		20	1.2%	8	0.7%
130.120	optic nerve hypoplasia	27	1.4%	6	0.3%	2	0.2%
130.150	optic disc coloboma	2	0.1%	0		2	0.2%
OTHER							
900.000	other, unspecified	0		13	0.8%	45	3.7%
900.100	other, not inherited	7	0.4%	133	7.7%	54	4.5%
900.110	other, suspected as inherited	22	1.1%	15	0.9%	5	0.4%
NORMAL							
0.000	normal globe	1545	78.3%	1294	75.0%	905	74.7%

GERMAN SHORTHAIRED POINTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Nictitans cartilage anomaly/eversion	Not defined	1, 2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 3	Breeder option
D.	Cataract	Not defined	1	NO
E.	Retinal atrophy - generalized	Not defined	1, 4	NO
F.	Retinal dysplasia - folds	Not defined	1	Breeder option
G.	Cone degeneration - (achromatopsia) * a DNA test is available	Autosomal recessive	5	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

OCULAR DISORDERS REPORT

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Cone degeneration - hemeralopia/achromatopsia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Afflicted puppies develop day-blindness, colorblindness, and photophobia between 8 and 12 weeks of age. Afflicted dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. A missense mutation in the same gene (*CNGB3*) that has been identified in CD-affected Alaskan Malamute-derived dogs has been detected in German Shorthaired Pointers affected with a clinically identical allelic disorder. A DNA test is available.

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OCULAR DISORDERS REPORT
GERMAN SHORTHAIRED POINTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1286 #	 %	2000-2009 2698 #	 %	2010-2016 2574 #	 %
GLOBE							
10.000	glaucoma	0		1	0.0%	0	
EYELIDS							
20.160	macropalpebral fissure	1	0.1%	0		0	
21.000	entropion, unspecified	4	0.3%	5	0.2%	1	0.0%
22.000	ectropion, unspecified	2	0.2%	0		2	0.1%
25.110	distichiasis	41	3.2%	91	3.4%	112	4.4%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	1	0.1%	0		0	
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		3	0.1%
52.110	prolapsed gland of the third eyelid	0		0		1	0.0%
CORNEA							
70.210	corneal pannus	0		0		1	0.0%
70.700	corneal dystrophy	3	0.2%	8	0.3%	9	0.3%
70.730	corneal endothelial degeneration	1	0.1%	0		0	
UVEA							
93.110	iris hypoplasia	0		0		2	0.1%
93.140	corneal endothelial pigment without PPM	0		0		1	0.0%
93.150	iris coloboma	1	0.1%	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	48	3.7%	198	7.3%	197	7.7%
93.720	persistent pupillary membranes, iris to lens	6	0.5%	9	0.3%	2	0.1%
93.730	persistent pupillary membranes, iris to cornea	3	0.2%	1	0.0%	2	0.1%
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0		1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.1%	18	0.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		4	0.2%
93.810	uveal melanoma	0		0		1	0.0%
93.999	uveal cysts	0		6	0.2%	1	0.0%
97.150	chorioretinal coloboma, congenital	0		0		1	0.0%
LENS							
100.200	cataract, unspecified	9	0.7%	0		0	
100.210	cataract, suspect not inherited	58	4.5%	139	5.2%	132	5.1%
100.301	punctate cataract, anterior cortex	9	0.7%	9	0.3%	8	0.3%
100.302	punctate cataract, posterior cortex	11	0.9%	21	0.8%	18	0.7%
100.303	punctate cataract, equatorial cortex	3	0.2%	7	0.3%	3	0.1%
100.304	punctate cataract, anterior sutures	0		1	0.0%	1	0.0%
100.305	punctate cataract, posterior sutures	6	0.5%	1	0.0%	5	0.2%
100.306	punctate cataract, nucleus	2	0.2%	7	0.3%	6	0.2%
100.307	punctate cataract, capsular	3	0.2%	4	0.1%	3	0.1%
100.311	incipient cataract, anterior cortex	4	0.3%	8	0.3%	6	0.2%
100.312	incipient cataract, posterior cortex	26	2.0%	44	1.6%	23	0.9%
100.313	incipient cataract, equatorial cortex	6	0.5%	12	0.4%	3	0.1%
100.314	incipient cataract, anterior sutures	0		1	0.0%	1	0.0%
100.315	incipient cataract, posterior sutures	5	0.4%	9	0.3%	2	0.1%

OCULAR DISORDERS REPORT
GERMAN SHORTHAIRED POINTER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.316	incipient cataract, nucleus	2	0.2%	10	0.4%	8	0.3%
100.317	incipient cataract, capsular	1	0.1%	7	0.3%	6	0.2%
100.321	incomplete cataract, anterior cortex	0		0		1	0.0%
100.322	incomplete cataract, posterior cortex	0		0		7	0.3%
100.325	incomplete cataract, posterior sutures	0		0		1	0.0%
100.326	incomplete cataract, nucleus	0		0		1	0.0%
100.330	generalized/complete cataract	13	1.0%	1	0.0%	0	
100.340	resorbing/hypermature cataract	0		0		1	0.0%
100.375	subluxation/luxation, unspecified	2	0.2%	0		0	
100.999	*significant cataracts (summary)*	*100*	*7.8%*	*142*	*5.3%*	*104*	*4.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		2	0.1%	14	0.5%
110.135	PHPV/PTVL	4	0.3%	2	0.1%	9	0.3%
110.320	vitreal degeneration	1	0.1%	12	0.4%	12	0.5%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	34	2.6%	57	2.1%	42	1.6%
120.180	retinal dysplasia, geographic	4	0.3%	12	0.4%	9	0.3%
120.310	generalized progressive retinal atrophy (PRA)	4	0.3%	3	0.1%	2	0.1%
120.920	retinal detachment with dialysis	0		0		3	0.1%
120.960	retinopathy	0		0		5	0.2%
OPTIC NERVE							
130.110	micropapilla	0		3	0.1%	0	
130.120	optic nerve hypoplasia	0		4	0.1%	1	0.0%
130.150	optic disc coloboma	1	0.1%	0		0	
OTHER							
900.000	other, unspecified	0		19	0.7%	80	3.1%
900.100	other, not inherited	8	0.6%	125	4.6%	67	2.6%
900.110	other, suspected as inherited	13	1.0%	4	0.1%	2	0.1%
NORMAL							
0.000	normal globe	1014	78.8%	2246	83.2%	2046	79.5%

OCULAR DISORDERS REPORT

GERMAN SPITZ

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - generalized *(prcd)* * a DNA test is available	Not defined	1	NO

Description and Comments

A. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the American Eskimo is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. However in the American Eskimo Dog the phenotype can be very variable in the age of onset. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the German Spitz breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
GERMAN SPITZ

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 0 #	%	2010-2016 5 #	%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		1	20.0%
RETINA							
120.960	retinopathy	0		0		1	20.0%
NORMAL							
0.000	normal globe	0		0		4	80.0%

OCULAR DISORDERS REPORT

GERMAN WIREHAIRED POINTER

(Drathaar, Deutsch Drathaar)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	2	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the German Wirehaired Pointer breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
GERMAN WIREHAIRED POINTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 158 #	 %	2000-2009 183 #	 %	2010-2016 428 #	 %
EYELIDS							
20.160	macropalpebral fissure	1	0.6%	0		0	
25.110	distichiasis	4	2.5%	1	0.5%	4	0.9%
UVEA							
93.110	iris hypoplasia	0		0		1	0.2%
93.710	persistent pupillary membranes, iris to iris	2	1.3%	2	1.1%	7	1.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.2%
LENS							
100.200	cataract, unspecified	5	3.2%	0		0	
100.210	cataract, suspect not inherited	4	2.5%	4	2.2%	15	3.5%
100.301	punctate cataract, anterior cortex	0		2	1.1%	0	
100.302	punctate cataract, posterior cortex	2	1.3%	1	0.5%	2	0.5%
100.305	punctate cataract, posterior sutures	1	0.6%	0		1	0.2%
100.312	incipient cataract, posterior cortex	1	0.6%	3	1.6%	7	1.6%
100.315	incipient cataract, posterior sutures	0		1	0.5%	0	
100.316	incipient cataract, nucleus	0		0		1	0.2%
100.317	incipient cataract, capsular	0		1	0.5%	2	0.5%
100.327	incomplete cataract, capsular	0		0		1	0.2%
100.330	generalized/complete cataract	1	0.6%	1	0.5%	0	
100.999	*significant cataracts (summary)*	*10*	*6.3%*	*9*	*4.9%*	*14*	*3.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.6%	0		1	0.2%
110.320	vitreal degeneration	1	0.6%	0		3	0.7%
RETINA							
120.170	retinal dysplasia, folds	3	1.9%	0		0	
120.180	retinal dysplasia, geographic	0		0		1	0.2%
120.190	retinal dysplasia, detached	0		0		1	0.2%
120.910	retinal detachment without dialysis	1	0.6%	0		0	
OTHER							
900.000	other, unspecified	0		1	0.5%	8	1.9%
900.100	other, not inherited	0		8	4.4%	12	2.8%
900.110	other, suspected as inherited	3	1.9%	1	0.5%	0	
NORMAL							
0.000	normal globe	132	83.5%	170	92.9%	373	87.1%

GIANT SCHNAUZER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	2	Breeder option
	- iris to cornea	Not defined	1	NO
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
C.	Cataract	Not defined	1	NO
D.	Retinal atrophy generalized (*prcd*) *a DNA test is available	Autosomal recessive	*	NO
E.	Retinal dysplasia - folds	Not defined	2	Breeder option

Description and Comments

A. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Giant Schnauzer breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
GIANT SCHNAUZER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 260 #	 %	2000-2009 517 #	 %	2010-2016 444 #	 %
GLOBE							
0.110	microphthalmia	0		1	0.2%	0	
EYELIDS							
25.110	distichiasis	1	0.4%	2	0.4%	2	0.5%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.2%
NICTITANS							
51.100	third eyelid cartilage anomaly	2	0.8%	5	1.0%	3	0.7%
52.110	prolapsed gland of the third eyelid	0		0		2	0.5%
CORNEA							
70.700	corneal dystrophy	0		1	0.2%	0	
70.730	corneal endothelial degeneration	1	0.4%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	8	3.1%	26	5.0%	25	5.6%
93.720	persistent pupillary membranes, iris to lens	1	0.4%	3	0.6%	0	
93.730	persistent pupillary membranes, iris to cornea	5	1.9%	1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		10	2.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.2%
93.999	uveal cysts	0		0		2	0.5%
LENS							
100.200	cataract, unspecified	5	1.9%	0		0	
100.210	cataract, suspect not inherited	9	3.5%	31	6.0%	18	4.1%
100.301	punctate cataract, anterior cortex	0		2	0.4%	2	0.5%
100.302	punctate cataract, posterior cortex	2	0.8%	3	0.6%	3	0.7%
100.304	punctate cataract, anterior sutures	0		0		1	0.2%
100.305	punctate cataract, posterior sutures	1	0.4%	1	0.2%	0	
100.306	punctate cataract, nucleus	0		1	0.2%	0	
100.307	punctate cataract, capsular	1	0.4%	2	0.4%	6	1.4%
100.311	incipient cataract, anterior cortex	0		2	0.4%	1	0.2%
100.312	incipient cataract, posterior cortex	5	1.9%	15	2.9%	5	1.1%
100.313	incipient cataract, equatorial cortex	0		5	1.0%	3	0.7%
100.315	incipient cataract, posterior sutures	1	0.4%	2	0.4%	1	0.2%
100.316	incipient cataract, nucleus	0		2	0.4%	0	
100.317	incipient cataract, capsular	0		1	0.2%	3	0.7%
100.330	generalized/complete cataract	2	0.8%	0		0	
100.375	subluxation/luxation, unspecified	0		2	0.4%	0	
100.999	*significant cataracts (summary)*	*17*	*6.5%*	*36*	*7.0%*	*25*	*5.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	1.2%	1	0.2%	2	0.5%
110.135	PHPV/PTVL	1	0.4%	1	0.2%	3	0.7%
110.320	vitreal degeneration	1	0.4%	0		1	0.2%

OCULAR DISORDERS REPORT
GIANT SCHNAUZER

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	6	2.3%	15	2.9%	6	1.4%
120.180	retinal dysplasia, geographic	0		1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	4	1.5%	4	0.8%	0	
120.960	retinopathy	0		0		2	0.5%
OTHER							
900.000	other, unspecified	0		5	1.0%	21	4.7%
900.100	other, not inherited	0		19	3.7%	11	2.5%
900.110	other, suspected as inherited	3	1.2%	0		0	
NORMAL							
0.000	normal globe	214	82.3%	444	85.9%	368	82.9%

OCULAR DISORDERS REPORT

GLEN OF IMAAL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Cataract	Not defined	2	NO
C.	Retinal atrophy - generalized	Not defined	1-3	NO
D.	Cone rod dystrophy (*crd3*) * a DNA test is available	Autosomal recessive	4, 5	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal atrophy-generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

D. Cone rod dystrophy

A form of late-onset PRA identified in Glen of Imaal Terriers. Ophthalmoscopic lesions are typically diagnosed by 5 years of age, however lesions may be present as early as 3 years of age in affected dogs. Two distinct phenotypes are observed in affected Glen of Imaal Terriers. The most common phenotype is subtle but generalized tapetal hyperreflectivity and retinal vascular attenuation that progresses over 1 – 2 years after initial examination. The less common phenotype is a focal mid-temporal (area centralis) area of distinct tapetal hyperreflectivity without generalized retinal disease. This lesion may remain unchanged for over a year but will progress to generalized retinal atrophy by 2 – 4 years after initial examination. ERG dysfunction can be observed as early as 15 weeks of age. The disorder is caused by a mutation present in the ADAM9 gene. A DNA test is available that will unequivocally identify normal, affected, and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2003-2004 and/or Data from CERF All-Breeds Report, 2005.

3. Kijas JW, Zanger B, Miller B, et al. Cloning of the canine ABCA4 gene and evaluation in canine cone-rod dystrophies and progressive retinal atrophies. *Mol Vis*. 2004;10:223-232.

4. Goldstein O, Mezey JG, Boyko AR, et al. An *ADAM9* mutation in canine cone-rod dystrophy 3 establishes homology with human cone-rod dystrophy 9. *Mol Vis*. 2010;16:1549-1569.

5. Kropatsch R, Petrasch-Parwez E, Seelow D, et al. Generalized progressive retinal atrophy in the Irish Glen of Imaal Terrier is associated with a deletion in the ADAM9 gene. *Mol Cell Probes*. 2010;24:357-363.

OCULAR DISORDERS REPORT
GLEN OF IMAAL TERRIER

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 73 #	%	2000-2009 322 #	%	2010-2016 259 #	%
GLOBE							
0.110	microphthalmia	0		1	0.3%	0	
EYELIDS							
21.000	entropion, unspecified	0		2	0.6%	0	
25.110	distichiasis	2	2.7%	9	2.8%	12	4.6%
UVEA							
93.720	persistent pupillary membranes, iris to lens	0		1	0.3%	0	
93.999	uveal cysts	0		0		2	0.8%
97.150	chorioretinal coloboma, congenital	0		0		1	0.4%
LENS							
100.210	cataract, suspect not inherited	14	19.2%	25	7.8%	17	6.6%
100.301	punctate cataract, anterior cortex	1	1.4%	2	0.6%	2	0.8%
100.302	punctate cataract, posterior cortex	1	1.4%	0		0	
100.303	punctate cataract, equatorial cortex	2	2.7%	1	0.3%	3	1.2%
100.306	punctate cataract, nucleus	0		2	0.6%	0	
100.307	punctate cataract, capsular	0		2	0.6%	1	0.4%
100.311	incipient cataract, anterior cortex	0		3	0.9%	2	0.8%
100.313	incipient cataract, equatorial cortex	0		2	0.6%	4	1.5%
100.314	incipient cataract, anterior sutures	0		1	0.3%	0	
100.315	incipient cataract, posterior sutures	0		2	0.6%	0	
100.316	incipient cataract, nucleus	0		1	0.3%	0	
100.321	incomplete cataract, anterior cortex	0		0		1	0.4%
100.322	incomplete cataract, posterior cortex	0		0		1	0.4%
100.330	generalized/complete cataract	0		0		1	0.4%
100.375	subluxation/luxation, unspecified	2	2.7%	1	0.3%	0	
100.999	*significant cataracts (summary)*	*4*	*5.5%*	*16*	*5.0%*	*15*	*5.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	1.4%	0		0	
110.320	vitreal degeneration	0		2	0.6%	0	
RETINA							
120.170	retinal dysplasia, folds	0		4	1.2%	3	1.2%
120.180	retinal dysplasia, geographic	0		3	0.9%	1	0.4%
120.310	generalized progressive retinal atrophy (PRA)	1	1.4%	15	4.7%	7	2.7%
120.960	retinopathy	0		0		1	0.4%
OPTIC NERVE							
130.120	optic nerve hypoplasia	0		0		1	0.4%
130.150	optic disc coloboma	3	4.1%	1	0.3%	1	0.4%
OTHER							
900.000	other, unspecified	0		3	0.9%	9	3.5%
900.100	other, not inherited	0		12	3.7%	13	5.0%
900.110	other, suspected as inherited	13	17.8%	1	0.3%	0	

OCULAR DISORDERS REPORT
GLEN OF IMAAL TERRIER

	1991-1999	2000-2009	2010-2016
NORMAL			
0.000 normal globe	52 71.2%	271 84.2%	205 79.2%

OCULAR DISORDERS REPORT

GOLDEN RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1	NO
B.	Entropion	Not defined	1	Breeder option
C.	Distichiasis	Not defined	1	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
E.	Uveal cysts	Not defined	1-4	Breeder option
F.	Pigmentary uveitis	Not defined	1-6	NO
G.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1, 7 8	 Breeder option Passes with no notation
H.	Cataract	Not defined	1, 9-14	NO
I.	Persistent hyaloid artery	Not defined	8	Breeder option
J.	Vitreous degeneration	Not defined	8	Breeder option
K.	Retinal atrophy - generalized * three different DNA tests are available	Autosomal recessive	1, 15-17	NO
L.	Retinal dysplasia - folds	Not defined	1, 18	Breeder option
M.	Retinal dysplasia - geographic/ detached	Not defined	1, 18, 19	NO
N.	Limbal melanoma	Not defined	20	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine screening exam for certification.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that reduces or eliminates the likelihood of the defect.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

This disorder may be observed in any breed but retriever breeds tend to be predisposed. There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

F. Pigmentary uveitis

A unique uveitis observed in the Golden Retriever that is not associated with other ocular or systemic disorders. Adhesions develop between iris and lens and the peripheral iris and cornea. Pigment dispersion (exfoliation) occurs across the anterior lens capsule from the pigmented cells of the posterior iris. Other complications include secondary cataract and obstructive glaucoma. Onset is usually between 5-10 years of age.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The most common cataract reported in the Golden Retriever is a posterior polar (posterior cortical) cataract. These are generally bilateral, although an occasional unilateral affliction may be observed. These focal opacities will occasionally remain stationary. These cataracts are usually observed between 9 months and 3 years of age. A more generalized cataract is also observed in this breed and is not always associated with the previously mentioned polar cataract. There are also cataract changes involving the Y sutures which may or may not progress.

The existence of cataracts in the Golden Retriever, often with limited clinical significance, presents problems with breeder recognition as the majority of these dogs do not evidence visual impairment. It is strongly recommended that all Golden Retrievers that are used in breeding programs be examined annually as cataract changes have been observed in multiple locations of the lens and variable age of onset.

OCULAR DISORDERS REPORT

I. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

J. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

K. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Golden Retriever is PRCD which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

In addition, two other known mutations that cause PRA are present in the breed. Golden Retriever PRA 1 (GR PRA1) is an autosomal recessive trait and is the predominant form in European lines of Golden Retrievers. Golden Retriever PRA 2 (GR PRA2) has also been identified within the breed. Therefore three different DNA tests are available. However these tests will only detect these three mutations.

L. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

M. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth; however, in the Golden Retriever, Labrador Retriever, and German Shepherd it has been demonstrated that the geographic form of retinal dysplasia may not be apparent before dogs are 10 weeks of age.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

N. Limbal melanoma

Most limbal melanomas are really epibulbar melanocytomas, but there is a possibility of an extension of an intraocular melanoma extending outward and presenting as a limbal melanoma. An epibulbar melanocytoma originates from the superficial pigment lining the limbus and the lesion may eventually extend into the eye. Metastasis has not been documented and the mass is characterized by large epithelioid cells. The lesion presents as a subconjunctival smooth mass most commonly in the dorsolateral limbal region and extends later into the cornea and posterior on the sclera. Breed predispositions have been noted in the German Shepherd Dog, and Labrador and Golden Retrievers.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

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OCULAR DISORDERS REPORT
GOLDEN RETRIEVER

	TOTAL DOGS EXAMINED	1991-1999 50489		2000-2009 62695		2010-2016 52268	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	31	0.1%	13	0.0%	8	0.0%
10.000	glaucoma	26	0.1%	4	0.0%	2	0.0%
EYELIDS							
20.110	eyelid dermoid	3	0.0%	0		0	
20.140	ectopic cilia	24	0.0%	20	0.0%	10	0.0%
20.160	macropalpebral fissure	4	0.0%	16	0.0%	2	0.0%
21.000	entropion, unspecified	171	0.3%	136	0.2%	75	0.1%
22.000	ectropion, unspecified	43	0.1%	43	0.1%	22	0.0%
25.110	distichiasis	5979	11.8%	6624	10.6%	5039	9.6%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	9	0.0%	0		27	0.1%
40.910	keratoconjunctivitis sicca	1	0.0%	0		4	0.0%
NICTITANS							
50.210	pannus of third eyelid	0		0		2	0.0%
51.100	third eyelid cartilage anomaly	3	0.0%	2	0.0%	11	0.0%
52.110	prolapsed gland of the third eyelid	1	0.0%	2	0.0%	39	0.1%
CORNEA							
70.210	corneal pannus	8	0.0%	2	0.0%	1	0.0%
70.220	pigmentary keratitis	2	0.0%	4	0.0%	13	0.0%
70.700	corneal dystrophy	207	0.4%	247	0.4%	226	0.4%
70.730	corneal endothelial degeneration	23	0.0%	9	0.0%	7	0.0%
UVEA							
90.250	pigmentary uveitis	0		211	0.3%	861	1.6%
93.110	iris hypoplasia	0		0		5	0.0%
93.140	corneal endothelial pigment without PPM	0		8	0.0%	9	0.0%
93.150	iris coloboma	4	0.0%	11	0.0%	5	0.0%
93.710	persistent pupillary membranes, iris to iris	621	1.2%	1520	2.4%	1491	2.9%
93.720	persistent pupillary membranes, iris to lens	53	0.1%	52	0.1%	13	0.0%
93.730	persistent pupillary membranes, iris to cornea	34	0.1%	35	0.1%	17	0.0%
93.740	persistent pupillary membranes, iris sheets	43	0.1%	65	0.1%	3	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		13	0.0%	512	1.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		5	0.0%	41	0.1%
93.810	uveal melanoma	0		4	0.0%	24	0.0%
93.999	uveal cysts	1255	2.5%	3137	5.0%	4115	7.9%
97.150	chorioretinal coloboma, congenital	0		0		2	0.0%
LENS							
100.200	cataract, unspecified	951	1.9%	0		1	0.0%
100.210	cataract, suspect not inherited	1942	3.8%	3995	6.4%	4145	7.9%
100.301	punctate cataract, anterior cortex	167	0.3%	262	0.4%	350	0.7%
100.302	punctate cataract, posterior cortex	722	1.4%	914	1.5%	721	1.4%
100.303	punctate cataract, equatorial cortex	118	0.2%	177	0.3%	189	0.4%
100.304	punctate cataract, anterior sutures	41	0.1%	32	0.1%	36	0.1%
100.305	punctate cataract, posterior sutures	334	0.7%	302	0.5%	189	0.4%

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GOLDEN RETRIEVER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.306	punctate cataract, nucleus	62	0.1%	77	0.1%	99	0.2%
100.307	punctate cataract, capsular	25	0.0%	172	0.3%	156	0.3%
100.311	incipient cataract, anterior cortex	195	0.4%	369	0.6%	360	0.7%
100.312	incipient cataract, posterior cortex	1008	2.0%	1370	2.2%	895	1.7%
100.313	incipient cataract, equatorial cortex	194	0.4%	416	0.7%	382	0.7%
100.314	incipient cataract, anterior sutures	20	0.0%	30	0.0%	18	0.0%
100.315	incipient cataract, posterior sutures	280	0.6%	310	0.5%	170	0.3%
100.316	incipient cataract, nucleus	89	0.2%	123	0.2%	140	0.3%
100.317	incipient cataract, capsular	19	0.0%	136	0.2%	158	0.3%
100.321	incomplete cataract, anterior cortex	0		0		38	0.1%
100.322	incomplete cataract, posterior cortex	0		0		83	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		16	0.0%
100.324	incomplete cataract, anterior sutures	0		0		1	0.0%
100.325	incomplete cataract, posterior sutures	0		0		10	0.0%
100.326	incomplete cataract, nucleus	0		0		15	0.0%
100.327	incomplete cataract, capsular	0		0		9	0.0%
100.330	generalized/complete cataract	158	0.3%	127	0.2%	73	0.1%
100.340	resorbing/hypermature cataract	0		0		4	0.0%
100.375	subluxation/luxation, unspecified	12	0.0%	16	0.0%	4	0.0%
100.999	*significant cataracts (summary)*	*4383*	*8.7%*	*4817*	*7.7%*	*4113*	*7.9%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	52	0.1%	54	0.1%	58	0.1%
110.135	PHPV/PTVL	15	0.0%	13	0.0%	9	0.0%
110.320	vitreal degeneration	49	0.1%	119	0.2%	123	0.2%
FUNDUS							
97.110	choroidal hypoplasia	6	0.0%	3	0.0%	0	
97.120	coloboma	7	0.0%	1	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	481	1.0%	950	1.5%	622	1.2%
120.180	retinal dysplasia, geographic	153	0.3%	382	0.6%	296	0.6%
120.190	retinal dysplasia, detached	10	0.0%	21	0.0%	7	0.0%
120.310	generalized progressive retinal atrophy (PRA)	77	0.2%	72	0.1%	26	0.0%
120.400	retinal hemorrhage	14	0.0%	4	0.0%	0	
120.910	retinal detachment without dialysis	17	0.0%	8	0.0%	3	0.0%
120.920	retinal detachment with dialysis	0		0		3	0.0%
120.960	retinopathy	0		0		39	0.1%
OPTIC NERVE							
130.110	micropapilla	1	0.0%	3	0.0%	7	0.0%
130.120	optic nerve hypoplasia	27	0.1%	7	0.0%	4	0.0%
130.150	optic disc coloboma	33	0.1%	18	0.0%	6	0.0%
OTHER							
900.000	other, unspecified	0		464	0.7%	1319	2.5%
900.100	other, not inherited	217	0.4%	2738	4.4%	1625	3.1%
900.110	other, suspected as inherited	498	1.0%	328	0.5%	77	0.1%
NORMAL							
0.000	normal globe	37879	75.0%	49346	78.7%	36836	70.5%

GORDON SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ectropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	2	Breeder option
C.	Uveal cysts	Not defined	2	Breeder option
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1, 2 3	 Breeder option Passes with no notation
E.	Cataract	Not defined	1	NO
F.	Retinal atrophy - generalized	Not defined	4-6	NO
G.	Retinal atrophy - rod-cone dysplasia type 4 (*rcd4*) * a DNA test is available	Autosomal recessive	7	NO
H.	Cone degeneration – achromatopsia	Not defined	8	NO
I.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

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B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Uveal cysts

A pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions is various breeds.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

G. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

H. Cone degeneration – achromatopsia

Suspected inherited retinopathy characterized by degeneration of the cone receptors and loss of vision in bright light. Age of onset is variable. Ophthalmoscopic examination is normal. The ERG abnormalities are more suggestive of a cone-rod dystrophy. The mode of inheritance and genetic mutation are not yet known.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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OCULAR DISORDERS REPORT
GORDON SETTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 735 #	%	2000-2009 905 #	%	2010-2016 652 #	%
GLOBE							
0.110	microphthalmia	1	0.1%	0		1	0.2%
EYELIDS							
20.140	ectopic cilia	1	0.1%	0		0	
20.160	macropalpebral fissure	3	0.4%	5	0.6%	1	0.2%
21.000	entropion, unspecified	5	0.7%	6	0.7%	5	0.8%
22.000	ectropion, unspecified	27	3.7%	13	1.4%	14	2.1%
25.110	distichiasis	9	1.2%	24	2.7%	11	1.7%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		1	0.1%	2	0.3%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		1	0.2%
CORNEA							
70.210	corneal pannus	1	0.1%	0		2	0.3%
70.700	corneal dystrophy	4	0.5%	2	0.2%	2	0.3%
UVEA							
93.710	persistent pupillary membranes, iris to iris	26	3.5%	53	5.9%	35	5.4%
93.720	persistent pupillary membranes, iris to lens	5	0.7%	1	0.1%	1	0.2%
93.730	persistent pupillary membranes, iris to cornea	2	0.3%	2	0.2%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.1%	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.1%	16	2.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.1%	3	0.5%
93.999	uveal cysts	1	0.1%	15	1.7%	4	0.6%
LENS							
100.200	cataract, unspecified	9	1.2%	0		0	
100.210	cataract, suspect not inherited	24	3.3%	29	3.2%	30	4.6%
100.301	punctate cataract, anterior cortex	1	0.1%	2	0.2%	2	0.3%
100.302	punctate cataract, posterior cortex	1	0.1%	3	0.3%	6	0.9%
100.303	punctate cataract, equatorial cortex	0		2	0.2%	1	0.2%
100.305	punctate cataract, posterior sutures	0		1	0.1%	3	0.5%
100.306	punctate cataract, nucleus	1	0.1%	4	0.4%	1	0.2%
100.307	punctate cataract, capsular	0		0		1	0.2%
100.311	incipient cataract, anterior cortex	0		6	0.7%	1	0.2%
100.312	incipient cataract, posterior cortex	3	0.4%	7	0.8%	5	0.8%
100.313	incipient cataract, equatorial cortex	2	0.3%	2	0.2%	4	0.6%
100.315	incipient cataract, posterior sutures	0		0		2	0.3%
100.316	incipient cataract, nucleus	1	0.1%	2	0.2%	1	0.2%
100.317	incipient cataract, capsular	0		3	0.3%	2	0.3%
100.327	incomplete cataract, capsular	0		0		1	0.2%
100.330	generalized/complete cataract	6	0.8%	3	0.3%	1	0.2%
100.999	*significant cataracts (summary)*	*24*	*3.3%*	*35*	*3.9%*	*31*	*4.8%*

OCULAR DISORDERS REPORT
GORDON SETTER

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	6	0.8%	3	0.3%	5	0.8%
110.135	PHPV/PTVL	0		5	0.6%	2	0.3%
110.320	vitreal degeneration	0		4	0.4%	1	0.2%
RETINA							
120.170	retinal dysplasia, folds	14	1.9%	12	1.3%	13	2.0%
120.180	retinal dysplasia, geographic	3	0.4%	0		1	0.2%
120.190	retinal dysplasia, detached	1	0.1%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	13	1.8%	3	0.3%	1	0.2%
120.910	retinal detachment without dialysis	2	0.3%	0		0	
OPTIC NERVE							
130.110	micropapilla	2	0.3%	5	0.6%	1	0.2%
130.120	optic nerve hypoplasia	7	1.0%	1	0.1%	0	
130.150	optic disc coloboma	0		1	0.1%	0	
OTHER							
900.000	other, unspecified	0		13	1.4%	27	4.1%
900.100	other, not inherited	2	0.3%	55	6.1%	23	3.5%
900.110	other, suspected as inherited	6	0.8%	4	0.4%	2	0.3%
NORMAL							
0.000	normal globe	596	81.1%	759	83.9%	503	77.1%

OCULAR DISORDERS REPORT

GRAND BASSET GRIFFON VENDEEN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to cornea	Not defined	1	NO
	- endothelial opacity/no strands	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Grand Basset Griffon Vendeen breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report,, 2010-2016.

OCULAR DISORDERS REPORT
GRAND BASSET GRIFFON VENDEEN

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 # %	2000-2009 3 # %	2010-2016 77 # %
EYELIDS				
25.110	distichiasis	0	0	1 1.3%
UVEA				
93.710	persistent pupillary membranes, iris to iris	0	0	4 5.2%
93.730	persistent pupillary membranes, iris to cornea	0	0	5 6.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0	0	5 6.5%
LENS				
100.210	cataract, suspect not inherited	0	0	3 3.9%
100.327	incomplete cataract, capsular	0	0	1 1.3%
100.999	*significant cataracts (summary)*	*0*	*0*	*1 1.3%*
VITREOUS				
110.135	PHPV/PTVL	0	0	1 1.3%
RETINA				
120.170	retinal dysplasia, folds	0	0	1 1.3%
120.310	generalized progressive retinal atrophy (PRA)	0	0	1 1.3%
OTHER				
900.000	other, unspecified	0	0	2 2.6%
900.110	other, suspected as inherited	0	0	1 1.3%
NORMAL				
0.000	normal globe	0	3 100.0%	58 75.3%

OCULAR DISORDERS REPORT

GREAT DANE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects associated with partial Albinism	Presumed autosomal dominant	1, 2	NO
B.	Glaucoma	Not defined	1, 3, 4	NO
C.	Entropion	Not defined	1	Breeder option
D.	Ectropion	Not defined	1	Breeder option
E.	Eury/macroblepharon	Not defined	4	Breeder option
F.	Distichiasis	Not defined	1	Breeder option
G.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option
H.	Prolapsed gland of the third eyelid	Not defined	5	Breeder option
I.	Uveal cysts	Not defined	4, 6	Breeder option
J.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder option
K.	Cataract	Not defined	1	NO
L.	Persistent hyperplastic primary vitreous/ persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Not defined	7	NO
M.	Retinal atrophy - generalized	Not defined	1	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Microphthalmia with multiple ocular defects associated with partial albinism

Multiple ocular defects are seen associated with partial albinism (white or light coat color) and deafness in Great Danes. The abnormalities are thought to stem from a common developmental defect. Ocular defects are anterior segment dysgenesis, equatorial staphylomas, microphthalmia, cortical cataracts, lens luxation, spherophakia, iris coloboma, and blue irides. An autosomal dominant mode of inheritance is suspected. The hearing loss is attributable to cochlea-saccular degeneration.

B. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine screening exam for certification.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion and ectropion often occur together in this breed, associated with an abnormally large palpebral fissure.

D. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

E. Eury/macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation. This condition is no longer listed on the CAER form. Please mark other conditions suspected as inherited and describe in the comments section.

OCULAR DISORDERS REPORT

F. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

G. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

H. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

Great Danes were overrepresented in a study of prolapsed gland of the third eyelid. In the study, 83% of the prolapsed glands in Great Danes occurred before 1 year of age. Great Danes were also more likely to develop bilateral prolapsed glands that occurred either simultaneously with the first prolapse or with a short time interval between prolapses.

I. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs. In the Great Dane, pigmented cysts may also arise from pigmented epithelial cells of the ciliary body. Ciliary body cysts may predispose to glaucoma in the Great Dane.

J. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

K. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

L. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with **persistent hyperplastic tunica vasculosa lentis (PHTVL)** which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The majority of affected dogs have a retrolental fibrovascular plaque and variable lenticular defects which include posterior lenticonus/globus, colobomata, intralenticular hemorrhage and/or secondary cataracts. Vision impairment may result.

M. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Gwin RM, Wyman M, Lim DJ, et al. Multiple ocular defects associated with partial albinism and deafness in the dog. *J Am Anim Hosp Assoc*. 1981;17:401-408.

3. Wood JL, Lakhani KH, Mason IK, et al. Relationship of the degree of goniodysgenesis and other ocular measurements to glaucoma in Great Danes. *Am J Vet Res*. 2001;62:1493-1499.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. Mazzucchelli S, Vaillant MD, Weverberg F, et al. Retrospective study of 155 cases of prolapse of the nictitating membrane gland in dogs. *Vet Rec*. 2012;170:443.

6. Spiess BM, Bolliger JO, Guscetti F, et al. Multiple ciliary body cysts and secondary glaucoma in the Great Dane: a report of nine cases. *Vet Ophthalmol*. 1998;1:41-45.

7. ACVO Genetics Committee, 2014 and Data from OFA All-Breeds Report, 2013-2014.

8. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

OCULAR DISORDERS REPORT
GREAT DANE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1010 #	%	2000-2009 3263 #	%	2010-2016 3020 #	%
GLOBE							
0.110	microphthalmia	10	1.0%	12	0.4%	3	0.1%
10.000	glaucoma	0		2	0.1%	0	
EYELIDS							
20.160	macropalpebral fissure	5	0.5%	91	2.8%	28	0.9%
21.000	entropion, unspecified	22	2.2%	81	2.5%	92	3.0%
22.000	ectropion, unspecified	22	2.2%	154	4.7%	116	3.8%
25.110	distichiasis	54	5.3%	172	5.3%	167	5.5%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		6	0.2%
40.910	keratoconjunctivitis sicca	0		1	0.0%	0	
NICTITANS							
51.100	third eyelid cartilage anomaly	4	0.4%	57	1.7%	91	3.0%
52.110	prolapsed gland of the third eyelid	1	0.1%	5	0.2%	9	0.3%
CORNEA							
70.210	corneal pannus	1	0.1%	1	0.0%	0	
70.220	pigmentary keratitis	0		1	0.0%	6	0.2%
70.700	corneal dystrophy	5	0.5%	15	0.5%	8	0.3%
UVEA							
90.250	pigmentary uveitis	0		1	0.0%	0	
93.110	iris hypoplasia	0		3	0.1%	4	0.1%
93.140	corneal endothelial pigment without PPM	0		1	0.0%	1	0.0%
93.150	iris coloboma	6	0.6%	8	0.2%	4	0.1%
93.710	persistent pupillary membranes, iris to iris	22	2.2%	33	1.0%	19	0.6%
93.720	persistent pupillary membranes, iris to lens	3	0.3%	9	0.3%	3	0.1%
93.730	persistent pupillary membranes, iris to cornea	3	0.3%	4	0.1%	1	0.0%
93.740	persistent pupillary membranes, iris sheets	0		4	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		23	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		2	0.1%
93.810	uveal melanoma	0		2	0.1%	2	0.1%
93.999	uveal cysts	5	0.5%	41	1.3%	49	1.6%
LENS							
100.200	cataract, unspecified	15	1.5%	0		0	
100.210	cataract, suspect not inherited	20	2.0%	143	4.4%	91	3.0%
100.301	punctate cataract, anterior cortex	6	0.6%	12	0.4%	10	0.3%
100.302	punctate cataract, posterior cortex	15	1.5%	37	1.1%	22	0.7%
100.303	punctate cataract, equatorial cortex	3	0.3%	5	0.2%	9	0.3%
100.304	punctate cataract, anterior sutures	1	0.1%	1	0.0%	2	0.1%
100.305	punctate cataract, posterior sutures	6	0.6%	13	0.4%	9	0.3%
100.306	punctate cataract, nucleus	3	0.3%	7	0.2%	4	0.1%
100.307	punctate cataract, capsular	0		9	0.3%	4	0.1%
100.311	incipient cataract, anterior cortex	13	1.3%	35	1.1%	21	0.7%
100.312	incipient cataract, posterior cortex	40	4.0%	72	2.2%	48	1.6%
100.313	incipient cataract, equatorial cortex	8	0.8%	26	0.8%	12	0.4%

OCULAR DISORDERS REPORT
GREAT DANE

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.314	incipient cataract, anterior sutures	1	0.1%	5	0.2%	0	
100.315	incipient cataract, posterior sutures	6	0.6%	10	0.3%	4	0.1%
100.316	incipient cataract, nucleus	8	0.8%	23	0.7%	2	0.1%
100.317	incipient cataract, capsular	1	0.1%	14	0.4%	10	0.3%
100.321	incomplete cataract, anterior cortex	0		0		6	0.2%
100.322	incomplete cataract, posterior cortex	0		0		8	0.3%
100.326	incomplete cataract, nucleus	0		0		2	0.1%
100.327	incomplete cataract, capsular	0		0		2	0.1%
100.330	generalized/complete cataract	25	2.5%	22	0.7%	5	0.2%
100.375	subluxation/luxation, unspecified	4	0.4%	3	0.1%	3	0.1%
100.999	*significant cataracts (summary)*	*151*	*15.0%*	*291*	*8.9%*	*180*	*6.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.1%	4	0.1%	7	0.2%
110.135	PHPV/PTVL	3	0.3%	4	0.1%	9	0.3%
110.320	vitreal degeneration	3	0.3%	23	0.7%	18	0.6%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.0%	0	
97.120	coloboma	2	0.2%	0		0	
RETINA							
120.170	retinal dysplasia, folds	10	1.0%	10	0.3%	3	0.1%
120.180	retinal dysplasia, geographic	0		2	0.1%	1	0.0%
120.190	retinal dysplasia, detached	0		0		2	0.1%
120.310	generalized progressive retinal atrophy (PRA)	4	0.4%	3	0.1%	0	
120.910	retinal detachment without dialysis	0		1	0.0%	0	
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		2	0.1%
OPTIC NERVE							
130.110	micropapilla	0		1	0.0%	0	
130.120	optic nerve hypoplasia	1	0.1%	2	0.1%	1	0.0%
130.150	optic disc coloboma	1	0.1%	0		1	0.0%
OTHER							
900.000	other, unspecified	0		16	0.5%	44	1.5%
900.100	other, not inherited	1	0.1%	126	3.9%	71	2.4%
900.110	other, suspected as inherited	14	1.4%	19	0.6%	14	0.5%
NORMAL							
0.000	normal globe	745	73.8%	2620	80.3%	2334	77.3%

GREAT PYRENEES

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	2	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	3	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1, 2, 4	Breeder option
E.	Cataract	Not defined	1, 4	NO
F.	Retinal atrophy - generalized	Presumed autosomal recessive	1	NO
G.	Multifocal retinopathy - *cmr1* * a DNA test is available	Autosomal recessive	5-7	Breeder option
H.	Retinal dysplasia - geographic/ detached	Not defined	2	NO

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Great Pyrenees, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

G. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous sub-retinal fluid, or accumulation of sub-retinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of

the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

H. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

References

There are few references providing detailed descriptions of hereditary ocular conditions of the Great Pyrenees breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2003-2004 and/or Data from CERF All-Breeds Report, 2005.

3. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

4. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

5. Guziewicz KE, Zangerl B, Lindauer SJ, et al. Bestrophin gene mutations cause canine multifocal retinopathy: a novel animal model for best disease. *Invest Ophthalmol Vis Sci*. 2007;48:1959-1967.

6. Grahn BH, Philibert H, Cullen CL, et al. Multifocal retinopathy of Great Pyrenees dogs. *Vet Ophthalmol*. 1998;1:211-221.

7. Grahn BH, Cullen CL. Retinopathy of Great Pyrenees dogs: fluorescein angiography, light microscopy and transmitting and scanning electron microscopy. *Vet Ophthalmol*. 2001;4:191-199.

OCULAR DISORDERS REPORT
GREAT PYRENEES

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 308 #	%	2000-2009 735 #	%	2010-2016 222 #	%
GLOBE								
0.110	microphthalmia		0		2	0.3%	0	
EYELIDS								
20.160	macropalpebral fissure		0		3	0.4%	0	
21.000	entropion, unspecified		7	2.3%	7	1.0%	1	0.5%
22.000	ectropion, unspecified		0		3	0.4%	0	
25.110	distichiasis		5	1.6%	11	1.5%	0	
NASOLACRIMAL								
32.110	imperforate lower nasolacrimal punctum		0		0		1	0.5%
CORNEA								
70.210	corneal pannus		0		0		1	0.5%
70.700	corneal dystrophy		2	0.6%	9	1.2%	3	1.4%
70.730	corneal endothelial degeneration		0		3	0.4%	0	
UVEA								
93.110	iris hypoplasia		0		0		1	0.5%
93.150	iris coloboma		0		0		1	0.5%
93.710	persistent pupillary membranes, iris to iris		73	23.7%	185	25.2%	56	25.2%
93.720	persistent pupillary membranes, iris to lens		2	0.6%	6	0.8%	3	1.4%
93.730	persistent pupillary membranes, iris to cornea		2	0.6%	4	0.5%	1	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		2	0.9%
93.810	uveal melanoma		0		0		1	0.5%
93.999	uveal cysts		1	0.3%	2	0.3%	3	1.4%
LENS								
100.200	cataract, unspecified		3	1.0%	0		0	
100.210	cataract, suspect not inherited		15	4.9%	25	3.4%	13	5.9%
100.301	punctate cataract, anterior cortex		3	1.0%	7	1.0%	1	0.5%
100.302	punctate cataract, posterior cortex		6	1.9%	6	0.8%	0	
100.303	punctate cataract, equatorial cortex		2	0.6%	4	0.5%	0	
100.304	punctate cataract, anterior sutures		0		3	0.4%	0	
100.305	punctate cataract, posterior sutures		0		3	0.4%	0	
100.306	punctate cataract, nucleus		1	0.3%	2	0.3%	1	0.5%
100.307	punctate cataract, capsular		0		1	0.1%	0	
100.311	incipient cataract, anterior cortex		8	2.6%	14	1.9%	2	0.9%
100.312	incipient cataract, posterior cortex		0		16	2.2%	3	1.4%
100.313	incipient cataract, equatorial cortex		8	2.6%	12	1.6%	0	
100.315	incipient cataract, posterior sutures		0		4	0.5%	1	0.5%
100.316	incipient cataract, nucleus		1	0.3%	0		0	
100.317	incipient cataract, capsular		0		4	0.5%	0	
100.330	generalized/complete cataract		1	0.3%	4	0.5%	0	
100.375	subluxation/luxation, unspecified		0		1	0.1%	0	
100.999	*significant cataracts (summary)*		*33*	*10.7%*	*80*	*10.9%*	*8*	*3.6%*
VITREOUS								
110.135	PHPV/PTVL		0		1	0.1%	0	

OCULAR DISORDERS REPORT
GREAT PYRENEES

		1991-1999		2000-2009		2010-2016	
FUNDUS							
97.110	choroidal hypoplasia	0		2	0.3%	0	
97.120	coloboma	0		1	0.1%	0	
RETINA							
120.170	retinal dysplasia, folds	3	1.0%	5	0.7%	1	0.5%
120.180	retinal dysplasia, geographic	1	0.3%	11	1.5%	3	1.4%
120.190	retinal dysplasia, detached	1	0.3%	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	0.6%	3	0.4%	0	
120.910	retinal detachment without dialysis	0		4	0.5%	0	
120.960	retinopathy	0		0		7	3.2%
OPTIC NERVE							
130.110	micropapilla	0		6	0.8%	0	
130.120	optic nerve hypoplasia	0		5	0.7%	0	
130.150	optic disc coloboma	1	0.3%	0		1	0.5%
OTHER							
900.000	other, unspecified	0		2	0.3%	5	2.3%
900.100	other, not inherited	1	0.3%	34	4.6%	6	2.7%
900.110	other, suspected as inherited	7	2.3%	5	0.7%	0	
NORMAL							
0.000	normal globe	183	59.4%	493	67.1%	162	73.0%

OCULAR DISORDERS REPORT

GREATER SWISS MOUNTAIN DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Entropion	Not defined	2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	3-5	Breeder option
D.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion and ectropion often occur together in this breed, associated with an abnormally large palpebral fissure.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Greater Swiss Mountain Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

5. ACVO Genetics Committee, 2003-2004 and/or Data from CERF All-Breeds Report, 2005.

OCULAR DISORDERS REPORT
GREATER SWISS MOUNTAIN DOG

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 386 #	 %	2000-2009 1831 #	 %	2010-2016 957 #	 %
GLOBE							
0.110	microphthalmia	0		0		1	0.1%
EYELIDS							
20.140	ectopic cilia	0		1	0.1%	0	
20.160	macropalpebral fissure	0		1	0.1%	0	
21.000	entropion, unspecified	3	0.8%	7	0.4%	10	1.0%
22.000	ectropion, unspecified	1	0.3%	0		2	0.2%
25.110	distichiasis	139	36.0%	628	34.3%	278	29.0%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		2	0.1%	3	0.3%
CORNEA							
70.210	corneal pannus	0		1	0.1%	1	0.1%
70.220	pigmentary keratitis	0		0		1	0.1%
70.700	corneal dystrophy	0		10	0.5%	3	0.3%
70.730	corneal endothelial degeneration	0		1	0.1%	0	
UVEA							
93.150	iris coloboma	0		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	9	2.3%	69	3.8%	27	2.8%
93.720	persistent pupillary membranes, iris to lens	2	0.5%	0		4	0.4%
93.730	persistent pupillary membranes, iris to cornea	0		5	0.3%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	2	0.5%	3	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.1%	0	
93.999	uveal cysts	0		2	0.1%	3	0.3%
LENS							
100.210	cataract, suspect not inherited	17	4.4%	191	10.4%	71	7.4%
100.301	punctate cataract, anterior cortex	4	1.0%	34	1.9%	18	1.9%
100.302	punctate cataract, posterior cortex	1	0.3%	30	1.6%	22	2.3%
100.303	punctate cataract, equatorial cortex	3	0.8%	16	0.9%	8	0.8%
100.304	punctate cataract, anterior sutures	0		1	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures	0		8	0.4%	3	0.3%
100.306	punctate cataract, nucleus	1	0.3%	3	0.2%	1	0.1%
100.307	punctate cataract, capsular	0		10	0.5%	1	0.1%
100.311	incipient cataract, anterior cortex	8	2.1%	33	1.8%	19	2.0%
100.312	incipient cataract, posterior cortex	8	2.1%	59	3.2%	21	2.2%
100.313	incipient cataract, equatorial cortex	4	1.0%	49	2.7%	14	1.5%
100.314	incipient cataract, anterior sutures	0		2	0.1%	0	
100.315	incipient cataract, posterior sutures	0		7	0.4%	5	0.5%
100.316	incipient cataract, nucleus	1	0.3%	7	0.4%	0	
100.317	incipient cataract, capsular	0		8	0.4%	3	0.3%
100.321	incomplete cataract, anterior cortex	0		0		3	0.3%
100.322	incomplete cataract, posterior cortex	0		0		1	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.1%
100.326	incomplete cataract, nucleus	0		0		1	0.1%
100.327	incomplete cataract, capsular	0		0		1	0.1%

OCULAR DISORDERS REPORT
GREATER SWISS MOUNTAIN DOG

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.330	generalized/complete cataract	0		6	0.3%	1	0.1%
100.375	subluxation/luxation, unspecified	0		2	0.1%	1	0.1%
100.999	*significant cataracts (summary)*	*30*	*7.8%*	*273*	*14.9%*	*124*	*13.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		6	0.3%	4	0.4%
110.135	PHPV/PTVL	0		2	0.1%	2	0.2%
110.320	vitreal degeneration	0		0		3	0.3%
RETINA							
120.170	retinal dysplasia, folds	1	0.3%	11	0.6%	5	0.5%
120.180	retinal dysplasia, geographic	1	0.3%	3	0.2%	3	0.3%
120.190	retinal dysplasia, detached	0		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	0.5%	1	0.1%	0	
OPTIC NERVE							
130.110	micropapilla	0		7	0.4%	0	
130.120	optic nerve hypoplasia	0		4	0.2%	1	0.1%
OTHER							
900.000	other, unspecified	0		16	0.9%	13	1.4%
900.100	other, not inherited	6	1.6%	63	3.4%	21	2.2%
900.110	other, suspected as inherited	3	0.8%	7	0.4%	2	0.2%
NORMAL							
0.000	normal globe	217	56.2%	1036	56.6%	588	61.4%

OCULAR DISORDERS REPORT

GREYHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Chronic superficial keratitis/pannus	Not defined	1, 2	NO
B.	Cataract	Not defined	3	NO
C.	Persistent hyperplastic primary vitreous (PHPV)	Not defined	4	NO
D.	Vitreous degeneration	Not defined	5	Breeder option
E.	Retinal atrophy - generalized	Not defined	6	NO

Description and Comments

A. Chronic superficial keratitis/Pannus

A bilateral disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Persistent hyperplastic primary vitreous (PHPV)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

PRA in the Greyhound may begin as early as 12 months of age, and affected dogs may progress to complete blindness at a relatively young age. In contrast to PRA in other dog breeds, nyctalopia (night blindness) is not an initial finding. In the early stages, the fundus has a characteristic “moth-eaten” appearance with patches of tapetal hyper-reflectivity alternating between areas of decreased reflectivity. In advanced stages, tapetal hyper-reflectivity is more diffuse.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Peiffer RL, Jr., Gelatt KN, Gwin RM. Chronic superficial keratitis. *Vet Med Small Anim Clin*. 1977;72:35-37.

3. ACVO Genetics Committee, 2003-2004 and/or Data from CERF All-Breeds Report, 2005.

4. Grimes TD, Mullaney J. Persistent hyperplastic primary vitreous in a Greyhound. *Vet Rec*. 1969;85:607-610.

5. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

6. Slatter DH, Blogg JR, Constable IJ. Retinal degeneration in Greyhounds. *Aust Vet J*. 1980;56:106-115.

OCULAR DISORDERS REPORT
GREYHOUND

	TOTAL DOGS EXAMINED	1991-1999 276		2000-2009 240		2010-2016 165	
	Diagnostic Name	**#**	**%**	**#**	**%**	**#**	**%**
GLOBE							
0.110	microphthalmia	1	0.4%	0		0	
EYELIDS							
25.110	distichiasis	0		0		2	1.2%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		1	0.4%	0	
NICTITANS							
51.100	third eyelid cartilage anomaly	1	0.4%	0		1	0.6%
CORNEA							
70.210	corneal pannus	7	2.5%	8	3.3%	6	3.6%
70.700	corneal dystrophy	3	1.1%	2	0.8%	0	
70.730	corneal endothelial degeneration	0		1	0.4%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		1	0.4%	1	0.6%
93.730	persistent pupillary membranes, iris to cornea	2	0.7%	0		0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.6%
LENS							
100.200	cataract, unspecified	2	0.7%	0		0	
100.210	cataract, suspect not inherited	11	4.0%	6	2.5%	4	2.4%
100.301	punctate cataract, anterior cortex	3	1.1%	2	0.8%	0	
100.302	punctate cataract, posterior cortex	0		0		2	1.2%
100.304	punctate cataract, anterior sutures	0		0		2	1.2%
100.306	punctate cataract, nucleus	0		1	0.4%	1	0.6%
100.307	punctate cataract, capsular	1	0.4%	0		0	
100.311	incipient cataract, anterior cortex	2	0.7%	1	0.4%	3	1.8%
100.312	incipient cataract, posterior cortex	3	1.1%	3	1.2%	4	2.4%
100.313	incipient cataract, equatorial cortex	2	0.7%	2	0.8%	2	1.2%
100.314	incipient cataract, anterior sutures	0		1	0.4%	0	
100.316	incipient cataract, nucleus	1	0.4%	1	0.4%	0	
100.317	incipient cataract, capsular	0		1	0.4%	1	0.6%
100.322	incomplete cataract, posterior cortex	0		0		1	0.6%
100.330	generalized/complete cataract	0		1	0.4%	0	
100.375	subluxation/luxation, unspecified	0		2	0.8%	0	
100.999	*significant cataracts (summary)*	*14*	*5.1%*	*13*	*5.4%*	*16*	*9.7%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.4%	1	0.6%
110.320	vitreal degeneration	5	1.8%	10	4.2%	1	0.6%
RETINA							
120.170	retinal dysplasia, folds	1	0.4%	2	0.8%	0	
120.180	retinal dysplasia, geographic	0		1	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	0.7%	4	1.7%	0	
120.920	retinal detachment with dialysis	0		0		1	0.6%

OCULAR DISORDERS REPORT
GREYHOUND

	1991-1999	2000-2009	2010-2016
OPTIC NERVE			
130.110 micropapilla	2 0.7%	0	0
130.120 optic nerve hypoplasia	1 0.4%	0	1 0.6%
OTHER			
900.000 other, unspecified	0	2 0.8%	6 3.6%
900.100 other, not inherited	2 0.7%	11 4.6%	17 10.3%
900.110 other, suspected as inherited	10 3.6%	2 0.8%	1 0.6%
NORMAL			
0.000 normal globe	234 84.8%	200 83.3%	121 73.3%

HARRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
B.	Cataract	Not defined	3	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Harrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
HARRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 106 #	 %	2000-2009 262 #	 %	2010-2016 41 #	 %
EYELIDS							
21.000	entropion, unspecified	1	0.9%	0		0	
25.110	distichiasis	1	0.9%	1	0.4%	0	
CORNEA							
70.210	corneal pannus	0		1	0.4%	0	
70.700	corneal dystrophy	0		0		1	2.4%
UVEA							
93.710	persistent pupillary membranes, iris to iris	7	6.6%	5	1.9%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.9%	0		0	
93.740	persistent pupillary membranes, iris sheets	0		1	0.4%	0	
LENS							
100.210	cataract, suspect not inherited	3	2.8%	4	1.5%	1	2.4%
100.302	punctate cataract, posterior cortex	0		2	0.8%	0	
100.306	punctate cataract, nucleus	0		1	0.4%	0	
100.311	incipient cataract, anterior cortex	0		4	1.5%	0	
100.312	incipient cataract, posterior cortex	0		3	1.1%	0	
100.322	incomplete cataract, posterior cortex	0		0		1	2.4%
100.999	*significant cataracts (summary)*	*0*		*10*	*3.8%*	*1*	*2.4%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		0		1	2.4%
FUNDUS							
97.120	coloboma	1	0.9%	0		0	
RETINA							
120.310	generalized progressive retinal atrophy (PRA)	0		3	1.1%	0	
OPTIC NERVE							
130.150	optic disc coloboma	1	0.9%	0		0	
OTHER							
900.000	other, unspecified	0		1	0.4%	1	2.4%
900.100	other, not inherited	0		11	4.2%	2	4.9%
900.110	other, suspected as inherited	2	1.9%	1	0.4%	0	
NORMAL							
0.000	normal globe	93	87.7%	246	93.9%	37	90.2%

OCULAR DISORDERS REPORT

HAVANA SILK DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 3	Breeder option
D.	Cataract	Not defined	1, 5	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane,

persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. The exact frequency and significance of cataracts in the breed is not known.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

5. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
HAVANA SILK DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 139 #	%	2010-2016 534 #	%
EYELIDS							
25.110	distichiasis	0		8	5.8%	25	4.7%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		3	0.6%
CORNEA							
70.700	corneal dystrophy	0		2	1.4%	8	1.5%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		14	10.1%	21	3.9%
93.740	persistent pupillary membranes, iris sheets	0		0		1	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.2%
LENS							
100.210	cataract, suspect not inherited	0		2	1.4%	17	3.2%
100.301	punctate cataract, anterior cortex	0		1	0.7%	0	
100.304	punctate cataract, anterior sutures	0		1	0.7%	0	
100.311	incipient cataract, anterior cortex	0		1	0.7%	1	0.2%
100.312	incipient cataract, posterior cortex	0		1	0.7%	2	0.4%
100.313	incipient cataract, equatorial cortex	0		1	0.7%	0	
100.316	incipient cataract, nucleus	0		0		1	0.2%
100.330	generalized/complete cataract	0		2	1.4%	0	
100.375	subluxation/luxation, unspecified	0		0		1	0.2%
100.999	*significant cataracts (summary)*	*0*		*7*	*5.0%*	*4*	*0.7%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		0		2	0.4%
110.320	vitreal degeneration	0		3	2.2%	4	0.7%
RETINA							
120.170	retinal dysplasia, folds	0		0		1	0.2%
OTHER							
900.000	other, unspecified	0		0		7	1.3%
900.100	other, not inherited	0		1	0.7%	7	1.3%
NORMAL							
0.000	normal globe	0		119	85.6%	461	86.3%

OCULAR DISORDERS REPORT

HAVANESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Prolapsed gland of third eyelid	Not defined	6	Breeder option
C.	Corneal dystrophy	Not defined	6	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
E.	Cataract	Not defined	1, 3	NO
F.	Vitreous degeneration	Not defined	1, 4	Breeder option
G.	Retinal dysplasia - folds	Not defined	5	Breeder option
H.	Retinal atrophy - generalized	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin, which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

OCULAR DISORDERS REPORT

C. Corneal dystrophy

Non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. The exact frequency and significance of cataracts in the breed is not known.

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached), which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait. To date all reports of PRA in the Havanese to CERF or the OFA have been listed as “suspicious” and not affected. Breeder concern has caused the listing here.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. Starr AN, Famula TR, Markward NJ, et al. Hereditary evaluation of multiple developmental abnormalities in the Havanese dog breed. *J Hered.* 2007;98:510-517.

4. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

5. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
HAVANESE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1557 #	 %	2000-2009 17485 #	 %	2010-2016 9909 #	 %
GLOBE							
0.110	microphthalmia	0		3	0.0%	3	0.0%
EYELIDS							
20.140	ectopic cilia	1	0.1%	5	0.0%	4	0.0%
21.000	entropion, unspecified	2	0.1%	15	0.1%	1	0.0%
22.000	ectropion, unspecified	1	0.1%	3	0.0%	0	
25.110	distichiasis	60	3.9%	844	4.8%	537	5.4%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		9	0.1%
40.910	keratoconjunctivitis sicca	1	0.1%	2	0.0%	6	0.1%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		2	0.0%	0	
52.110	prolapsed gland of the third eyelid	6	0.4%	67	0.4%	58	0.6%
CORNEA							
70.210	corneal pannus	1	0.1%	0		0	
70.220	pigmentary keratitis	0		1	0.0%	4	0.0%
70.700	corneal dystrophy	4	0.3%	60	0.3%	51	0.5%
70.730	corneal endothelial degeneration	0		1	0.0%	2	0.0%
UVEA							
90.250	pigmentary uveitis	0		1	0.0%	0	
93.110	iris hypoplasia	0		0		1	0.0%
93.140	corneal endothelial pigment without PPM	0		3	0.0%	0	
93.150	iris coloboma	0		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	70	4.5%	1179	6.7%	531	5.4%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	21	0.1%	5	0.1%
93.730	persistent pupillary membranes, iris to cornea	0		12	0.1%	2	0.0%
93.740	persistent pupillary membranes, iris sheets	0		18	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.0%	32	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		5	0.1%
93.810	uveal melanoma	0		2	0.0%	1	0.0%
93.999	uveal cysts	0		3	0.0%	1	0.0%
LENS							
100.200	cataract, unspecified	22	1.4%	0		0	
100.210	cataract, suspect not inherited	78	5.0%	985	5.6%	610	6.2%
100.301	punctate cataract, anterior cortex	6	0.4%	64	0.4%	64	0.6%
100.302	punctate cataract, posterior cortex	11	0.7%	56	0.3%	36	0.4%
100.303	punctate cataract, equatorial cortex	3	0.2%	24	0.1%	9	0.1%
100.304	punctate cataract, anterior sutures	0		13	0.1%	16	0.2%
100.305	punctate cataract, posterior sutures	10	0.6%	118	0.7%	79	0.8%
100.306	punctate cataract, nucleus	0		12	0.1%	8	0.1%
100.307	punctate cataract, capsular	2	0.1%	24	0.1%	18	0.2%
100.311	incipient cataract, anterior cortex	10	0.6%	74	0.4%	38	0.4%
100.312	incipient cataract, posterior cortex	14	0.9%	133	0.8%	74	0.7%
100.313	incipient cataract, equatorial cortex	6	0.4%	29	0.2%	12	0.1%

OCULAR DISORDERS REPORT
HAVANESE

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.314	incipient cataract, anterior sutures	2	0.1%	4	0.0%	9	0.1%
100.315	incipient cataract, posterior sutures	3	0.2%	60	0.3%	34	0.3%
100.316	incipient cataract, nucleus	1	0.1%	12	0.1%	8	0.1%
100.317	incipient cataract, capsular	0		41	0.2%	8	0.1%
100.321	incomplete cataract, anterior cortex	0		0		5	0.1%
100.322	incomplete cataract, posterior cortex	0		0		13	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.0%
100.325	incomplete cataract, posterior sutures	0		0		1	0.0%
100.326	incomplete cataract, nucleus	0		0		2	0.0%
100.327	incomplete cataract, capsular	0		0		1	0.0%
100.330	generalized/complete cataract	21	1.3%	86	0.5%	16	0.2%
100.340	resorbing/hypermature cataract	0		0		3	0.0%
100.375	subluxation/luxation, unspecified	0		10	0.1%	2	0.0%
100.999	*significant cataracts (summary)*	*111*	*7.1%*	*750*	*4.3%*	*455*	*4.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	0.2%	20	0.1%	8	0.1%
110.135	PHPV/PTVL	0		2	0.0%	1	0.0%
110.320	vitreal degeneration	23	1.5%	320	1.8%	183	1.8%
FUNDUS							
97.110	choroidal hypoplasia	0		2	0.0%	0	
97.120	coloboma	0		4	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	8	0.5%	92	0.5%	40	0.4%
120.180	retinal dysplasia, geographic	0		14	0.1%	10	0.1%
120.190	retinal dysplasia, detached	0		1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	15	1.0%	78	0.4%	14	0.1%
120.400	retinal hemorrhage	0		1	0.0%	0	
120.910	retinal detachment without dialysis	5	0.3%	6	0.0%	1	0.0%
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		14	0.1%
OPTIC NERVE							
130.110	micropapilla	0		0		1	0.0%
130.120	optic nerve hypoplasia	0		3	0.0%	0	
130.150	optic disc coloboma	1	0.1%	4	0.0%	2	0.0%
OTHER							
900.000	other, unspecified	0		75	0.4%	182	1.8%
900.100	other, not inherited	10	0.6%	543	3.1%	192	1.9%
900.110	other, suspected as inherited	8	0.5%	46	0.3%	6	0.1%
NORMAL							
0.000	normal globe	1257	80.7%	14699	84.1%	7967	80.4%

OCULAR DISORDERS REPORT

HOKKAIDO DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma * a DNA test is available	Autosomal recessive	1	NO

Description and Comments

A. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

A DNA test is available and may not be predictive of all populations. As the genotype-phenotype correlation is complex, and not always straightforward, one should refer to http://www.optigen.com/opt9_coloboma_res.html for a summary and more details of the molecular studies of CEA.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Hokkaido Dog. The conditions listed above are currently noted solely due to the availability of a genetic test for the disease.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
HOKKAIDO DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 0 #	%	2010-2017 1 #	%	2013-2017 1 #	%
NORMAL									
0.000 normal globe		0		0		1	100.0%	1	100.0%

OCULAR DISORDERS REPORT

IBIZAN HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy – epithelial/stromal	Not defined	1	Breeder Option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	2	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
C.	Cataract	Not defined	4	NO

Description and Comments

A. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Ibizan Hound breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2009.

4. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
IBIZAN HOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 165 #	%	2000-2009 571 #	%	2010-2016 683 #	%
GLOBE								
0.110	microphthalmia		0		2	0.4%	2	0.3%
EYELIDS								
25.110	distichiasis		2	1.2%	2	0.4%	0	
NASOLACRIMAL								
40.910	keratoconjunctivitis sicca		1	0.6%	0		0	
NICTITANS								
51.100	third eyelid cartilage anomaly		0		1	0.2%	0	
52.110	prolapsed gland of the third eyelid		0		0		1	0.1%
CORNEA								
70.700	corneal dystrophy		1	0.6%	2	0.4%	6	0.9%
UVEA								
93.140	corneal endothelial pigment without PPM		0		0		1	0.1%
93.150	iris coloboma		0		0		1	0.1%
93.710	persistent pupillary membranes, iris to iris		12	7.3%	49	8.6%	105	15.4%
93.720	persistent pupillary membranes, iris to lens		0		0		1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	0.2%	12	1.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		5	0.9%	0	
93.999	uveal cysts		0		2	0.4%	2	0.3%
97.150	chorioretinal coloboma, congenital		0		0		1	0.1%
LENS								
100.200	cataract, unspecified		4	2.4%	0		0	
100.210	cataract, suspect not inherited		14	8.5%	28	4.9%	40	5.9%
100.301	punctate cataract, anterior cortex		1	0.6%	1	0.2%	1	0.1%
100.302	punctate cataract, posterior cortex		0		0		2	0.3%
100.303	punctate cataract, equatorial cortex		0		0		1	0.1%
100.304	punctate cataract, anterior sutures		0		0		1	0.1%
100.305	punctate cataract, posterior sutures		0		0		1	0.1%
100.306	punctate cataract, nucleus		0		4	0.7%	3	0.4%
100.307	punctate cataract, capsular		0		1	0.2%	3	0.4%
100.311	incipient cataract, anterior cortex		1	0.6%	4	0.7%	1	0.1%
100.312	incipient cataract, posterior cortex		0		6	1.1%	3	0.4%
100.313	incipient cataract, equatorial cortex		0		3	0.5%	2	0.3%
100.314	incipient cataract, anterior sutures		0		0		1	0.1%
100.316	incipient cataract, nucleus		1	0.6%	11	1.9%	10	1.5%
100.317	incipient cataract, capsular		0		1	0.2%	1	0.1%
100.322	incomplete cataract, posterior cortex		0		0		1	0.1%
100.327	incomplete cataract, capsular		0		0		1	0.1%
100.330	generalized/complete cataract		0		2	0.4%	0	
100.375	subluxation/luxation, unspecified		0		0		3	0.4%
100.999	*significant cataracts (summary)*		*7*	*4.2%*	*33*	*5.8%*	*32*	*4.7%*

OCULAR DISORDERS REPORT
IBIZAN HOUND

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.2%	2	0.3%
110.320	vitreal degeneration	2	1.2%	7	1.2%	7	1.0%
FUNDUS							
97.110	choroidal hypoplasia	0		0		1	0.1%
RETINA							
120.170	retinal dysplasia, folds	4	2.4%	5	0.9%	2	0.3%
120.180	retinal dysplasia, geographic	0		2	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.6%	1	0.2%	2	0.3%
120.910	retinal detachment without dialysis	0		1	0.2%	0	
120.960	retinopathy	0		0		1	0.1%
OPTIC NERVE							
130.150	optic disc coloboma	0		2	0.4%	1	0.1%
OTHER							
900.000	other, unspecified	0		4	0.7%	20	2.9%
900.100	other, not inherited	1	0.6%	17	3.0%	19	2.8%
900.110	other, suspected as inherited	0		1	0.2%	2	0.3%
NORMAL							
0.000	normal globe	128	77.6%	487	85.3%	519	76.0%

ICELANDIC SHEEPDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	2	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Icelandic Sheepdog breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

OCULAR DISORDERS REPORT
ICELANDIC SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 23 #	 %	2000-2009 865 #	 %	2010-2016 1207 #	 %
EYELIDS							
21.000	entropion, unspecified	0		5	0.6%	0	
25.110	distichiasis	1	4.3%	9	1.0%	8	0.7%
CORNEA							
70.220	pigmentary keratitis	0		0		1	0.1%
70.700	corneal dystrophy	0		2	0.2%	7	0.6%
UVEA							
93.110	iris hypoplasia	0		0		2	0.2%
93.710	persistent pupillary membranes, iris to iris	0		55	6.4%	53	4.4%
93.720	persistent pupillary membranes, iris to lens	0		1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	0		3	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.1%
LENS							
100.210	cataract, suspect not inherited	2	8.7%	14	1.6%	37	3.1%
100.301	punctate cataract, anterior cortex	0		0		5	0.4%
100.302	punctate cataract, posterior cortex	0		1	0.1%	4	0.3%
100.303	punctate cataract, equatorial cortex	0		1	0.1%	0	
100.304	punctate cataract, anterior sutures	0		0		1	0.1%
100.305	punctate cataract, posterior sutures	0		0		9	0.7%
100.311	incipient cataract, anterior cortex	1	4.3%	0		2	0.2%
100.312	incipient cataract, posterior cortex	1	4.3%	3	0.3%	10	0.8%
100.313	incipient cataract, equatorial cortex	1	4.3%	1	0.1%	1	0.1%
100.315	incipient cataract, posterior sutures	0		4	0.5%	4	0.3%
100.317	incipient cataract, capsular	0		1	0.1%	1	0.1%
100.321	incomplete cataract, anterior cortex	0		0		1	0.1%
100.322	incomplete cataract, posterior cortex	0		0		3	0.2%
100.330	generalized/complete cataract	0		1	0.1%	0	
100.999	*significant cataracts (summary)*	*3*	*13.0%*	*12*	*1.4%*	*41*	*3.4%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.1%	2	0.2%
110.320	vitreal degeneration	0		1	0.1%	3	0.2%
RETINA							
120.170	retinal dysplasia, folds	1	4.3%	7	0.8%	1	0.1%
120.180	retinal dysplasia, geographic	0		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		0		1	0.1%
OPTIC NERVE							
130.150	optic disc coloboma	0		0		2	0.2%
OTHER							
900.000	other, unspecified	0		9	1.0%	16	1.3%
900.100	other, not inherited	0		31	3.6%	33	2.7%
900.110	other, suspected as inherited	0		1	0.1%	0	

OCULAR DISORDERS REPORT
ICELANDIC SHEEPDOG

	1991-1999	2000-2009	2010-2016
NORMAL			
0.000 normal globe	18 78.3%	805 93.1%	1076 89.1%

IRISH RED AND WHITE SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Retinal atrophy - rod-cone dysplasia, type 1 (*rcd1*) * a DNA test is available	Autosomal recessive	**	NO
D.	Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*) * a DNA test is available	Autosomal recessive	3	NO
E.	Retinal dysplasia - folds	Not defined	1	Breeder option
F.	Cataract	Not defined	4	NO

*see numerous *rcd1* PRA references under Irish Setters

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment.

C. Retinal atrophy - rod-cone dysplasia, type 1 (*rcd1*)

A form of PRA identified in Irish Setters and Irish Red and White Setters. Clinical night blindness is observed as early as 6 weeks of age progressing to total blindness by one year. It may be diagnosed as early as 24 days with an ERG. Histologically the disease can be detected by 6 weeks. The disorder is caused by a mutation present in exon 21/codon 807 of the *PDE6B* gene. A DNA test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

D. Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

3. Downs LM, Bell JS, Freeman J, et al. Late-onset progressive retinal atrophy in the Gordon and Irish Setter breeds is associated with a frameshift mutation in C2orf71. *Anim Genet*. 2012 Jun 12.

4. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
IRISH RED & WHITE SETTER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 65 #	%	2000-2009 167 #	%	2010-2016 276 #	%
EYELIDS								
21.000	entropion, unspecified		0		0		1	0.4%
25.110	distichiasis		6	9.2%	8	4.8%	9	3.3%
CORNEA								
70.210	corneal pannus		0		2	1.2%	0	
70.700	corneal dystrophy		0		0		1	0.4%
70.730	corneal endothelial degeneration		0		0		1	0.4%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		5	3.0%	2	0.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		1	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		1	0.4%
93.999	uveal cysts		0		1	0.6%	2	0.7%
LENS								
100.210	cataract, suspect not inherited		3	4.6%	6	3.6%	11	4.0%
100.301	punctate cataract, anterior cortex		0		2	1.2%	1	0.4%
100.302	punctate cataract, posterior cortex		0		2	1.2%	4	1.4%
100.304	punctate cataract, anterior sutures		0		1	0.6%	0	
100.307	punctate cataract, capsular		0		0		2	0.7%
100.311	incipient cataract, anterior cortex		0		1	0.6%	3	1.1%
100.312	incipient cataract, posterior cortex		0		1	0.6%	6	2.2%
100.315	incipient cataract, posterior sutures		1	1.5%	0		0	
100.316	incipient cataract, nucleus		0		0		2	0.7%
100.321	incomplete cataract, anterior cortex		0		0		1	0.4%
100.322	incomplete cataract, posterior cortex		0		0		1	0.4%
100.375	subluxation/luxation, unspecified		0		1	0.6%	0	
100.999	*significant cataracts (summary)*		*1*	*1.5%*	*7*	*4.2%*	*20*	*7.2%*
VITREOUS								
110.135	PHPV/PTVL		0		1	0.6%	0	
110.320	vitreal degeneration		0		0		5	1.8%
RETINA								
120.170	retinal dysplasia, folds		1	1.5%	1	0.6%	2	0.7%
120.180	retinal dysplasia, geographic		0		2	1.2%	0	
120.310	generalized progressive retinal atrophy (PRA)		0		1	0.6%	2	0.7%
120.960	retinopathy		0		0		1	0.4%
OTHER								
900.000	other, unspecified		0		1	0.6%	4	1.4%
900.100	other, not inherited		1	1.5%	6	3.6%	16	5.8%
900.110	other, suspected as inherited		1	1.5%	0		0	
NORMAL								
0.000	normal globe		54	83.1%	146	87.4%	226	81.9%

OCULAR DISORDERS REPORT

IRISH SETTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	2	Passes with no notation
E.	Cataract	Not defined	1	NO
F.	Persistent hyaloid artery	Not defined	1	Breeder option
G.	Retinal dysplasia - folds	Not defined	3	Breeder option
H.	Retinal atrophy - generalized	Presumed autosomal recessive	1, 4-24	NO
I.	Retinal atrophy - rod-cone dysplasia, type 1 (rcd1) * a DNA test is available	Autosomal recessive	1, 4-23	NO
J.	Retinal atrophy - rod-cone dysplasia type 4 (*rcd4*) * a DNA test is available	Autosomal recessive	25	NO
K.	Amblyopia with quadriplegia	Autosomal recessive	26, 27	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In the Irish Setter, the entropion usually involves the lower eyelids.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Retinal dystrophy – folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and the more severe forms of retinal dysplasia is undetermined.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

In the Irish Setter, a later form of progressive retinal atrophy has been observed by several ophthalmologists at 4-5 years of age. Cases seen in this category appear to advance more rapidly than those with rod-cone dysplasia.

I. Retinal atrophy - rod-cone dysplasia, type 1 (*rcd1*)

A form of PRA identified in Irish Setters. Clinical night blindness is observed as early as 6 weeks of age progressing to total blindness by one year. It may be diagnosed as early as 24 days with an ERG. Histologically the disease can be detected by 6 weeks. The disorder is caused by a mutation present in exon 21/codon 807 of the *PDE6B* gene. A DNA test is available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

J. Retinal atrophy - rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A DNA test is available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and will not identify other forms of PRA.

K. Amblyopia with quadriplegia

A congenital quadriplegia and amblyopia. The main symptoms include inability to stand or walk, amblyopia, tremor, nystagmus and possible seizures. Pathologic lesions are confined to the cerebellum. The condition was shown to be due to a fully penetrant autosomal recessive gene that is post-natally lethal in the homozygote.

References

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OCULAR DISORDERS REPORT
IRISH SETTER

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	1032		600		492	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	0		1	0.2%	1	0.2%
10.000	glaucoma	1	0.1%	0		0	
EYELIDS							
20.140	ectopic cilia	1	0.1%	0		0	
20.160	macropalpebral fissure	2	0.2%	0		0	
21.000	entropion, unspecified	31	3.0%	10	1.7%	13	2.6%
22.000	ectropion, unspecified	6	0.6%	2	0.3%	1	0.2%
25.110	distichiasis	53	5.1%	41	6.8%	24	4.9%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.1%	0		0	
40.910	keratoconjunctivitis sicca	0		0		1	0.2%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		3	0.6%
CORNEA							
70.210	corneal pannus	0		1	0.2%	0	
70.220	pigmentary keratitis	1	0.1%	0		0	
70.700	corneal dystrophy	3	0.3%	1	0.2%	2	0.4%
70.730	corneal endothelial degeneration	0		0		1	0.2%
UVEA							
93.140	corneal endothelial pigment without PPM	0		1	0.2%	1	0.2%
93.710	persistent pupillary membranes, iris to iris	28	2.7%	37	6.2%	22	4.5%
93.720	persistent pupillary membranes, iris to lens	3	0.3%	3	0.5%	1	0.2%
93.730	persistent pupillary membranes, iris to cornea	5	0.5%	0		1	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.2%	26	5.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		3	0.6%
93.810	uveal melanoma	0		1	0.2%	0	
93.999	uveal cysts	0		2	0.3%	1	0.2%
LENS							
100.200	cataract, unspecified	31	3.0%	0		0	
100.210	cataract, suspect not inherited	40	3.9%	39	6.5%	28	5.7%
100.301	punctate cataract, anterior cortex	2	0.2%	1	0.2%	6	1.2%
100.302	punctate cataract, posterior cortex	4	0.4%	3	0.5%	5	1.0%
100.303	punctate cataract, equatorial cortex	2	0.2%	1	0.2%	1	0.2%
100.304	punctate cataract, anterior sutures	0		0		1	0.2%
100.305	punctate cataract, posterior sutures	1	0.1%	1	0.2%	0	
100.306	punctate cataract, nucleus	3	0.3%	1	0.2%	0	
100.307	punctate cataract, capsular	0		5	0.8%	5	1.0%
100.311	incipient cataract, anterior cortex	9	0.9%	6	1.0%	5	1.0%
100.312	incipient cataract, posterior cortex	7	0.7%	7	1.2%	6	1.2%
100.313	incipient cataract, equatorial cortex	1	0.1%	3	0.5%	1	0.2%
100.314	incipient cataract, anterior sutures	2	0.2%	1	0.2%	1	0.2%
100.315	incipient cataract, posterior sutures	3	0.3%	0		1	0.2%
100.316	incipient cataract, nucleus	1	0.1%	7	1.2%	0	

OCULAR DISORDERS REPORT
IRISH SETTER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.317	incipient cataract, capsular	0		1	0.2%	3	0.6%
100.321	incomplete cataract, anterior cortex	0		0		1	0.2%
100.322	incomplete cataract, posterior cortex	0		0		1	0.2%
100.325	incomplete cataract, posterior sutures	0		0		1	0.2%
100.330	generalized/complete cataract	9	0.9%	7	1.2%	2	0.4%
100.340	resorbing/hypermature cataract	0		0		1	0.2%
100.375	subluxation/luxation, unspecified	0		1	0.2%	0	
100.999	*significant cataracts (summary)*	*75*	*7.3%*	*44*	*7.3%*	*41*	*8.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	15	1.5%	5	0.8%	4	0.8%
110.135	PHPV/PTVL	4	0.4%	5	0.8%	1	0.2%
110.320	vitreal degeneration	3	0.3%	1	0.2%	0	
RETINA							
120.170	retinal dysplasia, folds	4	0.4%	1	0.2%	5	1.0%
120.180	retinal dysplasia, geographic	1	0.1%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	10	1.0%	6	1.0%	2	0.4%
OPTIC NERVE							
130.120	optic nerve hypoplasia	4	0.4%	0		0	
130.150	optic disc coloboma	1	0.1%	0		0	
OTHER							
900.000	other, unspecified	0		5	0.8%	14	2.8%
900.100	other, not inherited	2	0.2%	35	5.8%	24	4.9%
900.110	other, suspected as inherited	15	1.5%	3	0.5%	1	0.2%
NORMAL							
0.000	normal globe	801	77.6%	483	80.5%	336	68.3%

IRISH TERRIER

DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE

Description and Comments

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Irish Terrier breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

OCULAR DISORDERS REPORT

IRISH WATER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Irish Water Spaniel breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

OCULAR DISORDERS REPORT
IRISH WATER SPANIEL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 197 #	 %	2000-2009 507 #	 %	2010-2016 431 #	 %
EYELIDS							
20.140	ectopic cilia	0		1	0.2%	0	
21.000	entropion, unspecified	2	1.0%	4	0.8%	4	0.9%
22.000	ectropion, unspecified	0		2	0.4%	1	0.2%
25.110	distichiasis	55	27.9%	117	23.1%	117	27.1%
CORNEA							
70.700	corneal dystrophy	0		2	0.4%	2	0.5%
UVEA							
93.150	iris coloboma	0		0		1	0.2%
93.710	persistent pupillary membranes, iris to iris	1	0.5%	13	2.6%	35	8.1%
93.730	persistent pupillary membranes, iris to cornea	1	0.5%	1	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		3	0.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.2%
93.999	uveal cysts	0		1	0.2%	1	0.2%
LENS							
100.200	cataract, unspecified	3	1.5%	0		0	
100.210	cataract, suspect not inherited	7	3.6%	44	8.7%	54	12.5%
100.301	punctate cataract, anterior cortex	0		7	1.4%	9	2.1%
100.302	punctate cataract, posterior cortex	0		6	1.2%	3	0.7%
100.303	punctate cataract, equatorial cortex	0		1	0.2%	3	0.7%
100.305	punctate cataract, posterior sutures	0		1	0.2%	0	
100.306	punctate cataract, nucleus	0		0		1	0.2%
100.311	incipient cataract, anterior cortex	1	0.5%	11	2.2%	2	0.5%
100.312	incipient cataract, posterior cortex	0		21	4.1%	2	0.5%
100.313	incipient cataract, equatorial cortex	1	0.5%	5	1.0%	4	0.9%
100.314	incipient cataract, anterior sutures	0		2	0.4%	0	
100.315	incipient cataract, posterior sutures	0		1	0.2%	1	0.2%
100.316	incipient cataract, nucleus	0		3	0.6%	3	0.7%
100.317	incipient cataract, capsular	0		4	0.8%	1	0.2%
100.326	incomplete cataract, nucleus	0		0		1	0.2%
100.330	generalized/complete cataract	0		0		1	0.2%
100.999	*significant cataracts (summary)*	*5*	*2.5%*	*62*	*12.2%*	*31*	*7.2%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		2	0.4%	0	
110.320	vitreal degeneration	0		2	0.4%	0	
RETINA							
120.170	retinal dysplasia, folds	1	0.5%	2	0.4%	2	0.5%
120.180	retinal dysplasia, geographic	0		1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.5%	4	0.8%	0	
120.910	retinal detachment without dialysis	0		1	0.2%	0	
120.960	retinopathy	0		0		2	0.5%
OTHER							
900.000	other, unspecified	0		5	1.0%	15	3.5%
900.100	other, not inherited	0		15	3.0%	10	2.3%

OCULAR DISORDERS REPORT
IRISH WATER SPANIEL

OTHER CONTINUED	1991-1999	2000-2009	2010-2016
900.110 other, suspected as inherited	4 2.0%	0	0
NORMAL			
0.000 normal globe	139 70.6%	355 70.0%	274 63.6%

OCULAR DISORDERS REPORT

IRISH WOLFHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Nictitans cartilage anomaly/eversion	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	2	Breeder option
	- iris to cornea	Not defined	2	NO
E.	Uveal cysts	Not defined	1	Breeder option
F.	Cataract	Not defined	1	NO
G.	Retinal atrophy - generalized	Presumed autosomal recessive	4	NO
H.	Retinal dysplasia - folds	Not defined	2	Breeder option
I.	Retinal dysplasia - geographic	Not defined	3	NO
J.	Optic nerve hypoplasia	Not defined	4	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

OCULAR DISORDERS REPORT

B. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally in the neonatal period. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

H. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

I. Retinal dysplasia - geographic

Abnormal development of the retina present at birth. Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

J. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Irish Wolfhound breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

4. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

OCULAR DISORDERS REPORT
IRISH WOLFHOUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 511 #	%	2000-2009 750 #	%	2010-2016 665 #	%
GLOBE							
0.110	microphthalmia	0		1	0.1%	0	
EYELIDS							
20.140	ectopic cilia	0		0		1	0.2%
21.000	entropion, unspecified	4	0.8%	2	0.3%	0	
25.110	distichiasis	14	2.7%	53	7.1%	28	4.2%
NICTITANS							
50.210	pannus of third eyelid	0		0		2	0.3%
51.100	third eyelid cartilage anomaly	5	1.0%	7	0.9%	7	1.1%
CORNEA							
70.220	pigmentary keratitis	0		0		1	0.2%
70.700	corneal dystrophy	9	1.8%	19	2.5%	10	1.5%
70.730	corneal endothelial degeneration	2	0.4%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	8	1.6%	8	1.1%	5	0.8%
93.720	persistent pupillary membranes, iris to lens	3	0.6%	1	0.1%	3	0.5%
93.730	persistent pupillary membranes, iris to cornea	5	1.0%	4	0.5%	2	0.3%
93.740	persistent pupillary membranes, iris sheets	3	0.6%	1	0.1%	1	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		2	0.3%
93.810	uveal melanoma	0		0		1	0.2%
93.999	uveal cysts	11	2.2%	51	6.8%	44	6.6%
LENS							
100.200	cataract, unspecified	12	2.3%	0		0	
100.210	cataract, suspect not inherited	13	2.5%	41	5.5%	32	4.8%
100.301	punctate cataract, anterior cortex	2	0.4%	4	0.5%	4	0.6%
100.302	punctate cataract, posterior cortex	8	1.6%	10	1.3%	6	0.9%
100.303	punctate cataract, equatorial cortex	0		2	0.3%	0	
100.304	punctate cataract, anterior sutures	1	0.2%	0		0	
100.305	punctate cataract, posterior sutures	5	1.0%	3	0.4%	0	
100.306	punctate cataract, nucleus	1	0.2%	2	0.3%	2	0.3%
100.307	punctate cataract, capsular	0		2	0.3%	2	0.3%
100.311	incipient cataract, anterior cortex	4	0.8%	2	0.3%	6	0.9%
100.312	incipient cataract, posterior cortex	15	2.9%	13	1.7%	9	1.4%
100.313	incipient cataract, equatorial cortex	2	0.4%	4	0.5%	2	0.3%
100.314	incipient cataract, anterior sutures	1	0.2%	0		0	
100.315	incipient cataract, posterior sutures	6	1.2%	4	0.5%	3	0.5%
100.316	incipient cataract, nucleus	2	0.4%	7	0.9%	0	
100.317	incipient cataract, capsular	0		1	0.1%	0	
100.322	incomplete cataract, posterior cortex	0		0		1	0.2%
100.326	incomplete cataract, nucleus	0		0		1	0.2%
100.330	generalized/complete cataract	3	0.6%	1	0.1%	1	0.2%
100.999	*significant cataracts (summary)*	*62*	*12.1%*	*55*	*7.3%*	*37*	*5.6%*

OCULAR DISORDERS REPORT
IRISH WOLFHOUND

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.2%	4	0.5%	1	0.2%
110.320	vitreal degeneration	1	0.2%	5	0.7%	0	
RETINA							
120.170	retinal dysplasia, folds	5	1.0%	14	1.9%	9	1.4%
120.180	retinal dysplasia, geographic	2	0.4%	7	0.9%	2	0.3%
120.190	retinal dysplasia, detached	1	0.2%	1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.2%	1	0.1%	0	
120.400	retinal hemorrhage	1	0.2%	0		0	
120.910	retinal detachment without dialysis	1	0.2%	0		0	
120.960	retinopathy	0		0		1	0.2%
OPTIC NERVE							
130.110	micropapilla	2	0.4%	6	0.8%	4	0.6%
130.120	optic nerve hypoplasia	16	3.1%	5	0.7%	7	1.1%
130.150	optic disc coloboma	1	0.2%	0		1	0.2%
OTHER							
900.000	other, unspecified	0		5	0.7%	17	2.6%
900.100	other, not inherited	4	0.8%	54	7.2%	29	4.4%
900.110	other, suspected as inherited	10	2.0%	3	0.4%	1	0.2%
NORMAL							
0.000	normal globe	382	74.8%	582	77.6%	494	74.3%

OCULAR DISORDERS REPORT

ITALIAN GREYHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO
B.	Lens luxation	Not defined	2	NO
C.	Persistent hyaloid artery	Not defined	3	Breeder option
D.	Vitreous degeneration	Not defined	1, 2, 4, 5	Breeder option
E.	Retinal atrophy - generalized (IG-PRA1) * a DNA test is available	Not defined	1, 5	NO
F.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma * a DNA test is available	Not defined	5	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Italian Greyhound, posterior subcapsular and cortical cataracts at two to three years of age appear to be the more common location of occurrence, with progression noted in an undetermined percentage of dogs.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness.

C. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - generalized (IG-PRA1)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Italian Greyhound PRA (IG-PRA1) is considered a “late onset” PRA with clinical signs detected between 3-5 years of age. Dogs initially lose night vision followed by decreased vision in bright light conditions. Clinically increases in tapetal reflectivity and retinal vessel attenuation are noted. The risk allele is known, but the genetic mutation has not been determined. The disease has been presumed to be inherited as an autosomal recessive trait. However some affected dogs had only one copy of the risk allele suggesting an autosomal dominant with incomplete penetrance mode of inheritance. A DNA test is available for the risk allele. At least one other form of PRA appears to be present in the breed and will not be detected with this test.

F. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a

recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

A DNA test is available and may not be predictive of all populations. As the genotype-phenotype correlation is complex, and not always straightforward, one should refer to http://www.optigen.com/opt9_coloboma_res.html for a summary and more details of the molecular studies of CEA.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Italian Greyhound breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

5. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
ITALIAN GREYHOUND

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	1689		4284		1760	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	0		0		1	0.1%
EYELIDS							
25.110	distichiasis	4	0.2%	9	0.2%	9	0.5%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		1	0.0%	2	0.1%
CORNEA							
70.210	corneal pannus	2	0.1%	2	0.0%	3	0.2%
70.220	pigmentary keratitis	0		2	0.0%	0	
70.700	corneal dystrophy	3	0.2%	14	0.3%	2	0.1%
UVEA							
93.110	iris hypoplasia	0		0		1	0.1%
93.140	corneal endothelial pigment without PPM	0		3	0.1%	0	
93.150	iris coloboma	1	0.1%	5	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	5	0.3%	35	0.8%	12	0.7%
93.720	persistent pupillary membranes, iris to lens	4	0.2%	2	0.0%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	4	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	3	0.2%	2	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.0%	6	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.0%	4	0.2%
93.999	uveal cysts	0		1	0.0%	1	0.1%
LENS							
100.200	cataract, unspecified	17	1.0%	0		0	
100.210	cataract, suspect not inherited	51	3.0%	195	4.6%	93	5.3%
100.301	punctate cataract, anterior cortex	20	1.2%	45	1.1%	25	1.4%
100.302	punctate cataract, posterior cortex	11	0.7%	40	0.9%	34	1.9%
100.303	punctate cataract, equatorial cortex	4	0.2%	16	0.4%	6	0.3%
100.304	punctate cataract, anterior sutures	0		3	0.1%	2	0.1%
100.305	punctate cataract, posterior sutures	0		10	0.2%	7	0.4%
100.306	punctate cataract, nucleus	0		5	0.1%	2	0.1%
100.307	punctate cataract, capsular	2	0.1%	8	0.2%	1	0.1%
100.311	incipient cataract, anterior cortex	25	1.5%	108	2.5%	39	2.2%
100.312	incipient cataract, posterior cortex	23	1.4%	104	2.4%	48	2.7%
100.313	incipient cataract, equatorial cortex	28	1.7%	51	1.2%	20	1.1%
100.314	incipient cataract, anterior sutures	4	0.2%	2	0.0%	1	0.1%
100.315	incipient cataract, posterior sutures	2	0.1%	10	0.2%	4	0.2%
100.316	incipient cataract, nucleus	5	0.3%	7	0.2%	3	0.2%
100.317	incipient cataract, capsular	0		12	0.3%	5	0.3%
100.321	incomplete cataract, anterior cortex	0		0		9	0.5%
100.322	incomplete cataract, posterior cortex	0		0		8	0.5%
100.323	incomplete cataract, equatorial cortex	0		0		3	0.2%
100.326	incomplete cataract, nucleus	0		0		1	0.1%
100.330	generalized/complete cataract	9	0.5%	33	0.8%	7	0.4%
100.375	subluxation/luxation, unspecified	15	0.9%	19	0.4%	2	0.1%
100.999	*significant cataracts (summary)*	*150*	*8.9%*	*454*	*10.6%*	*225*	*12.8%*

OCULAR DISORDERS REPORT
ITALIAN GREYHOUND

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	0.2%	19	0.4%	0	
110.135	PHPV/PTVL	1	0.1%	2	0.0%	0	
110.320	vitreal degeneration	322	19.1%	1648	38.5%	756	43.0%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.0%	21	1.2%
RETINA							
120.170	retinal dysplasia, folds	4	0.2%	10	0.2%	11	0.6%
120.180	retinal dysplasia, geographic	1	0.1%	3	0.1%	0	
120.190	retinal dysplasia, detached	0		1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	48	2.8%	154	3.6%	45	2.6%
120.400	retinal hemorrhage	0		0		19	1.1%
120.910	retinal detachment without dialysis	2	0.1%	4	0.1%	2	0.1%
120.920	retinal detachment with dialysis	0		0		1	0.1%
120.960	retinopathy	0		0		7	0.4%
OPTIC NERVE							
130.110	micropapilla	0		15	0.4%	5	0.3%
130.120	optic nerve hypoplasia	12	0.7%	18	0.4%	4	0.2%
130.150	optic disc coloboma	1	0.1%	1	0.0%	2	0.1%
OTHER							
900.000	other, unspecified	0		25	0.6%	38	2.2%
900.100	other, not inherited	11	0.7%	123	2.9%	39	2.2%
900.110	other, suspected as inherited	22	1.3%	38	0.9%	4	0.2%
NORMAL							
0.000	normal globe	1221	72.3%	2767	64.6%	1072	60.9%

OCULAR DISORDERS REPORT

JACK RUSSELL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	1, 3	NO
D.	Lens luxation * a DNA test is available	Not defined	1, 4-9	NO
E.	Vitreous degeneration	Not defined	3, 4	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from its normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

4. Lawson DD. Luxation of the crystalline lens in the dog. *J Small Anim Pract*. 1969;10:461-463.

5. Curtis R, Barnett KC. Primary lens luxation in the dog. *J Small Anim Pract*. 1980;21:657-668.

6. Curtis R, Barnett KC, Lewis SJ. Clinical and pathological observations concerning the aetiology of primary lens luxation in the dog. *Vet Rec*. 1983;112:238-246.

7. Oberbauer AM, Hollingsworth SR, Belanger JM, et al. Inheritance of cataracts and primary lens luxation in Jack Russell Terriers. *Am J Vet Res*. 2008;69:222-227.

8. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

9. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
JACK RUSSELL TERRIER

	TOTAL DOGS EXAMINED	1991-1999 2309		2000-2009 10898		2010-2016 2474	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	1	0.0%	4	0.0%	0	
10.000	glaucoma	2	0.1%	1	0.0%	0	
EYELIDS							
20.140	ectopic cilia	0		2	0.0%	0	
20.160	macropalpebral fissure	0		1	0.0%	0	
21.000	entropion, unspecified	2	0.1%	1	0.0%	0	
25.110	distichiasis	71	3.1%	242	2.2%	48	1.9%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		2	0.1%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		1	0.0%
CORNEA							
70.210	corneal pannus	1	0.0%	0		0	
70.220	pigmentary keratitis	4	0.2%	3	0.0%	2	0.1%
70.700	corneal dystrophy	9	0.4%	46	0.4%	5	0.2%
70.730	corneal endothelial degeneration	3	0.1%	4	0.0%	3	0.1%
UVEA							
93.140	corneal endothelial pigment without PPM	0		0		1	0.0%
93.150	iris coloboma	1	0.0%	2	0.0%	1	0.0%
93.710	persistent pupillary membranes, iris to iris	153	6.6%	454	4.2%	102	4.1%
93.720	persistent pupillary membranes, iris to lens	8	0.3%	31	0.3%	1	0.0%
93.730	persistent pupillary membranes, iris to cornea	9	0.4%	9	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	5	0.2%	5	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.0%	11	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		6	0.2%
93.999	uveal cysts	1	0.0%	4	0.0%	2	0.1%
LENS							
100.200	cataract, unspecified	4	0.2%	0		0	
100.210	cataract, suspect not inherited	41	1.8%	420	3.9%	81	3.3%
100.301	punctate cataract, anterior cortex	9	0.4%	57	0.5%	12	0.5%
100.302	punctate cataract, posterior cortex	10	0.4%	60	0.6%	8	0.3%
100.303	punctate cataract, equatorial cortex	1	0.0%	18	0.2%	2	0.1%
100.304	punctate cataract, anterior sutures	4	0.2%	8	0.1%	3	0.1%
100.305	punctate cataract, posterior sutures	6	0.3%	37	0.3%	8	0.3%
100.306	punctate cataract, nucleus	2	0.1%	14	0.1%	5	0.2%
100.307	punctate cataract, capsular	2	0.1%	12	0.1%	7	0.3%
100.311	incipient cataract, anterior cortex	31	1.3%	139	1.3%	17	0.7%
100.312	incipient cataract, posterior cortex	48	2.1%	287	2.6%	42	1.7%
100.313	incipient cataract, equatorial cortex	12	0.5%	48	0.4%	5	0.2%
100.314	incipient cataract, anterior sutures	0		8	0.1%	0	
100.315	incipient cataract, posterior sutures	27	1.2%	92	0.8%	19	0.8%
100.316	incipient cataract, nucleus	8	0.3%	19	0.2%	3	0.1%
100.317	incipient cataract, capsular	0		23	0.2%	4	0.2%

OCULAR DISORDERS REPORT
JACK RUSSELL TERRIER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.321	incomplete cataract, anterior cortex	0		0		1	0.0%
100.322	incomplete cataract, posterior cortex	0		0		6	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.0%
100.325	incomplete cataract, posterior sutures	0		0		1	0.0%
100.330	generalized/complete cataract	10	0.4%	72	0.7%	13	0.5%
100.375	subluxation/luxation, unspecified	16	0.7%	61	0.6%	4	0.2%
100.999	*significant cataracts (summary)*	*174*	*7.5%*	*894*	*8.2%*	*157*	*6.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	5	0.2%	12	0.1%	1	0.0%
110.135	PHPV/PTVL	0		3	0.0%	1	0.0%
110.320	vitreal degeneration	28	1.2%	172	1.6%	34	1.4%
FUNDUS							
97.120	coloboma	0		2	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	11	0.5%	41	0.4%	6	0.2%
120.180	retinal dysplasia, geographic	3	0.1%	15	0.1%	2	0.1%
120.190	retinal dysplasia, detached	0		4	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	7	0.3%	73	0.7%	5	0.2%
120.400	retinal hemorrhage	2	0.1%	2	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	5	0.0%	2	0.1%
120.960	retinopathy	0		0		2	0.1%
OPTIC NERVE							
130.110	micropapilla	1	0.0%	5	0.0%	1	0.0%
130.120	optic nerve hypoplasia	3	0.1%	5	0.0%	4	0.2%
130.150	optic disc coloboma	0		1	0.0%	0	
OTHER							
900.000	other, unspecified	0		42	0.4%	71	2.9%
900.100	other, not inherited	37	1.6%	606	5.6%	64	2.6%
900.110	other, suspected as inherited	29	1.3%	35	0.3%	2	0.1%
NORMAL							
0.000	normal globe	1832	79.3%	9043	83.0%	2091	84.5%

OCULAR DISORDERS REPORT

JAGDTERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Lens luxation * a DNA test is available	Not defined	1	NO

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Jagdterrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
JAGDTERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 0 #	%	2010-2017 2 #	%	2013-2017 2 #	%
NORMAL									
0.000 normal globe		0		0		2	100.0%	2	100.0%

OCULAR DISORDERS REPORT

JAMTHUND

(Swedish Elkhound)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - generalized (prcd) * a DNA test is available	Autosomal recessive	1	NO

Description and Comments

A. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Swedish Lapphund is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Jamthund. The conditions listed above are currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563.

OCULAR DISORDERS REPORT

JAPANESE CHIN
(JAPANESE SPANIEL)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Eury/Macroblepharon	Not defined	7	Breeder option
C.	Distichiasis	Not defined	2, 3	Breeder option
D.	Exposure/pigmentary keratitis	Not defined	1	Breeder option
E.	Persistent pupillary membranes			
	- iris to iris	Not defined	2, 3	Breeder option
	- iris sheets	Not defined	4	NO
	- iris to lens	Not defined	5	NO
F.	Cataract	Not defined	1	NO
G.	Persistent hyperplastic primary vitreous /persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Not defined	4	NO
H.	Persistent hyaloid artery	Not defined	1	Breeder option
I.	Vitreous degeneration	Not defined	3	Breeder option
J.	Retinal atrophy - generalized	Not defined	6	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or more of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Eury/macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

A specific designation does not exist on the CAER form for this condition. We ask examiners to mark other – unlisted conditions suspected as inherited. Then in the comments box please write eury/macroblepharon.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Exposure keratopathy/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane,

persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Persistent hyperplastic primary vitreous (PHPV)/persistent hyperplastic tunica vasculosa lentis (PHTVL)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

H. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

I. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

J. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Japanese Chin breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2008 and/or Data from CERF All Breeds Report, 2003-2007.

5. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

6. ACVO Genetics Committee, 2013-2014 and/or Data from OFA All-Breeds Report, 2013-2014.

7. ACVO Genetics Committee, 2017 and/or DATA from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
JAPANESE CHIN

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**129**		**587**		**463**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
EYELIDS							
20.160	macropalpebral fissure	1	0.8%	4	0.7%	8	1.7%
21.000	entropion, unspecified	14	10.9%	58	9.9%	16	3.5%
22.000	ectropion, unspecified	0		0		1	0.2%
25.110	distichiasis	8	6.2%	28	4.8%	20	4.3%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.2%
40.910	keratoconjunctivitis sicca	0		0		1	0.2%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		2	0.4%
CORNEA							
70.210	corneal pannus	3	2.3%	6	1.0%	0	
70.220	pigmentary keratitis	7	5.4%	18	3.1%	21	4.5%
70.700	corneal dystrophy	0		1	0.2%	2	0.4%
70.730	corneal endothelial degeneration	1	0.8%	1	0.2%	1	0.2%
UVEA							
93.150	iris coloboma	0		1	0.2%	0	
93.710	persistent pupillary membranes, iris to iris	1	0.8%	76	12.9%	45	9.7%
93.720	persistent pupillary membranes, iris to lens	0		6	1.0%	0	
93.730	persistent pupillary membranes, iris to cornea	0		7	1.2%	0	
93.740	persistent pupillary membranes, iris sheets	0		6	1.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.2%
93.999	uveal cysts	0		0		1	0.2%
LENS							
100.200	cataract, unspecified	1	0.8%	0		0	
100.210	cataract, suspect not inherited	2	1.6%	33	5.6%	20	4.3%
100.301	punctate cataract, anterior cortex	5	3.9%	5	0.9%	10	2.2%
100.302	punctate cataract, posterior cortex	2	1.6%	5	0.9%	1	0.2%
100.303	punctate cataract, equatorial cortex	1	0.8%	5	0.9%	0	
100.304	punctate cataract, anterior sutures	0		3	0.5%	1	0.2%
100.305	punctate cataract, posterior sutures	0		3	0.5%	1	0.2%
100.306	punctate cataract, nucleus	0		1	0.2%	0	
100.307	punctate cataract, capsular	0		2	0.3%	0	
100.311	incipient cataract, anterior cortex	8	6.2%	18	3.1%	13	2.8%
100.312	incipient cataract, posterior cortex	3	2.3%	18	3.1%	7	1.5%
100.313	incipient cataract, equatorial cortex	3	2.3%	16	2.7%	6	1.3%
100.314	incipient cataract, anterior sutures	0		0		1	0.2%
100.315	incipient cataract, posterior sutures	1	0.8%	6	1.0%	0	
100.316	incipient cataract, nucleus	1	0.8%	2	0.3%	2	0.4%
100.317	incipient cataract, capsular	0		8	1.4%	3	0.6%
100.321	incomplete cataract, anterior cortex	0		0		2	0.4%
100.330	generalized/complete cataract	0		7	1.2%	0	
100.375	subluxation/luxation, unspecified	1	0.8%	5	0.9%	0	
100.999	*significant cataracts (summary)*	*25*	*19.4%*	*99*	*16.9%*	*47*	*10.2%*

OCULAR DISORDERS REPORT
JAPANESE CHIN

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	2.3%	12	2.0%	0	
110.135	PHPV/PTVL	0		12	2.0%	1	0.2%
110.320	vitreal degeneration	2	1.6%	19	3.2%	35	7.6%
FUNDUS							
97.120	coloboma	0		1	0.2%	0	
RETINA							
120.170	retinal dysplasia, folds	0		1	0.2%	0	
120.180	retinal dysplasia, geographic	0		2	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	5	3.9%	6	1.0%	4	0.9%
120.910	retinal detachment without dialysis	1	0.8%	0		0	
120.920	retinal detachment with dialysis	0		0		1	0.2%
OPTIC NERVE							
130.110	micropapilla	0		1	0.2%	0	
130.150	optic disc coloboma	0		2	0.3%	0	
OTHER							
900.000	other, unspecified	0		9	1.5%	19	4.1%
900.100	other, not inherited	0		38	6.5%	25	5.4%
900.110	other, suspected as inherited	5	3.9%	6	1.0%	7	1.5%
NORMAL							
0.000	normal globe	70	54.3%	384	65.4%	309	66.7%

KARELIAN BEAR DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - generalized * a DNA test is available	Autosomal recessive	1-3	NO

Description and Comments

A. Retinal atrophy- generalized (PRA)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait. A genetic test is available to detect the progressive rod cone degeneration form of PRA caused by a mutation in the *prcd*-gene. A second form of PRA is also present in the Karelian Bear Dog for which the causative mutation is not yet known.

References

1. Ahonen S, Lohi H, editors. Progressive retinal atrophy in the Karelian Bear Dog: A large animal model for retinitis pigmentosa. ARVO 2014 Annual Meeting; 2014; Orlando, FL. Program number: 3270.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563. Epub 2006/08/30.

OCULAR DISORDERS REPORT
KARELIAN BEAR DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 41 #	 %	2000-2009 39 #	 %	2010-2016 25 #	 %
EYELIDS							
25.110	distichiasis	0		1	2.6%	1	4.0%
CORNEA							
70.700	corneal dystrophy	2	4.9%	2	5.1%	0	
70.730	corneal endothelial degeneration	0		1	2.6%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	8	19.5%	1	2.6%	1	4.0%
93.730	persistent pupillary membranes, iris to cornea	2	4.9%	1	2.6%	0	
LENS							
100.210	cataract, suspect not inherited	1	2.4%	0		0	
100.307	punctate cataract, capsular	2	4.9%	0		0	
100.311	incipient cataract, anterior cortex	2	4.9%	1	2.6%	0	
100.312	incipient cataract, posterior cortex	0		0		4	16.0%
100.317	incipient cataract, capsular	0		1	2.6%	0	
100.999	*significant cataracts (summary)*	*4*	*9.8%*	*2*	*5.1%*	*4*	*16.0%*
RETINA							
120.170	retinal dysplasia, folds	1	2.4%	2	5.1%	1	4.0%
120.310	generalized progressive retinal atrophy (PRA)	0		1	2.6%	0	
120.960	retinopathy	0		0		1	4.0%
OTHER							
900.000	other, unspecified	0		0		1	4.0%
900.100	other, not inherited	0		1	2.6%	1	4.0%
NORMAL							
0.000	normal globe	29	70.7%	33	84.6%	18	72.0%

KEESHOND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located in the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Keeshond breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

OCULAR DISORDERS REPORT
KEESHOND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 918 #	1991-1999 918 %	2000-2009 1413 #	2000-2009 1413 %	2010-2016 989 #	2010-2016 989 %
GLOBE							
0.110	microphthalmia	0		0		1	0.1%
EYELIDS							
21.000	entropion, unspecified	0		9	0.6%	0	
25.110	distichiasis	39	4.2%	83	5.9%	74	7.5%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.1%	0		0	
CORNEA							
70.220	pigmentary keratitis	0		0		1	0.1%
70.700	corneal dystrophy	4	0.4%	2	0.1%	6	0.6%
70.730	corneal endothelial degeneration	0		1	0.1%	1	0.1%
UVEA							
93.150	iris coloboma	0		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	4	0.4%	13	0.9%	16	1.6%
93.720	persistent pupillary membranes, iris to lens	1	0.1%	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	0		2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.1%
93.999	uveal cysts	1	0.1%	1	0.1%	0	
LENS							
100.200	cataract, unspecified	18	2.0%	0		0	
100.210	cataract, suspect not inherited	47	5.1%	114	8.1%	135	13.7%
100.301	punctate cataract, anterior cortex	6	0.7%	4	0.3%	2	0.2%
100.302	punctate cataract, posterior cortex	4	0.4%	10	0.7%	2	0.2%
100.303	punctate cataract, equatorial cortex	3	0.3%	7	0.5%	1	0.1%
100.304	punctate cataract, anterior sutures	0		0		2	0.2%
100.305	punctate cataract, posterior sutures	12	1.3%	27	1.9%	16	1.6%
100.306	punctate cataract, nucleus	0		1	0.1%	0	
100.307	punctate cataract, capsular	0		1	0.1%	3	0.3%
100.311	incipient cataract, anterior cortex	2	0.2%	2	0.1%	3	0.3%
100.312	incipient cataract, posterior cortex	13	1.4%	11	0.8%	11	1.1%
100.313	incipient cataract, equatorial cortex	1	0.1%	8	0.6%	0	
100.314	incipient cataract, anterior sutures	0		0		1	0.1%
100.315	incipient cataract, posterior sutures	7	0.8%	8	0.6%	4	0.4%
100.316	incipient cataract, nucleus	1	0.1%	6	0.4%	6	0.6%
100.317	incipient cataract, capsular	0		1	0.1%	3	0.3%
100.325	incomplete cataract, posterior sutures	0		0		1	0.1%
100.326	incomplete cataract, nucleus	0		0		1	0.1%
100.327	incomplete cataract, capsular	0		0		1	0.1%
100.330	generalized/complete cataract	5	0.5%	2	0.1%	0	
100.375	subluxation/luxation, unspecified	1	0.1%	0		0	
100.999	*significant cataracts (summary)*	*72*	*7.8%*	*88*	*6.2%*	*57*	*5.8%*

OCULAR DISORDERS REPORT
KEESHOND

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.1%	0		0	
110.320	vitreal degeneration	2	0.2%	2	0.1%	5	0.5%
FUNDUS							
97.120	coloboma	0		1	0.1%	0	
RETINA							
120.170	retinal dysplasia, folds	4	0.4%	1	0.1%	1	0.1%
120.180	retinal dysplasia, geographic	0		2	0.1%	0	
120.190	retinal dysplasia, detached	1	0.1%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.1%	5	0.4%	4	0.4%
120.400	retinal hemorrhage	1	0.1%	0		0	
120.910	retinal detachment without dialysis	2	0.2%	0		0	
120.960	retinopathy	0		0		3	0.3%
OPTIC NERVE							
130.110	micropapilla	0		5	0.4%	2	0.2%
130.120	optic nerve hypoplasia	5	0.5%	5	0.4%	2	0.2%
130.150	optic disc coloboma	1	0.1%	0		0	
OTHER							
900.000	other, unspecified	0		5	0.4%	16	1.6%
900.100	other, not inherited	6	0.7%	37	2.6%	25	2.5%
900.110	other, suspected as inherited	6	0.7%	1	0.1%	1	0.1%
NORMAL							
0.000	normal globe	753	82.0%	1174	83.1%	732	74.0%

KERRY BLUE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- all other forms	Not defined	1	NO
C.	Cataract	Not defined	2	NO
D.	Vitreous degeneration	Not defined	3	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Kerry Blue Terrier breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
KERRY BLUE TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 243 #	 %	2000-2009 366 #	 %	2010-2016 133 #	 %
EYELIDS								
25.110	distichiasis		1	0.4%	4	1.1%	7	5.3%
CORNEA								
70.210	corneal pannus		0		1	0.3%	0	
70.700	corneal dystrophy		0		2	0.5%	1	0.8%
UVEA								
93.710	persistent pupillary membranes, iris to iris		2	0.8%	5	1.4%	4	3.0%
93.720	persistent pupillary membranes, iris to lens		2	0.8%	0		0	
93.730	persistent pupillary membranes, iris to cornea		0		1	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		1	0.8%
LENS								
100.200	cataract, unspecified		6	2.5%	0		0	
100.210	cataract, suspect not inherited		5	2.1%	20	5.5%	4	3.0%
100.301	punctate cataract, anterior cortex		1	0.4%	12	3.3%	2	1.5%
100.302	punctate cataract, posterior cortex		0		2	0.5%	1	0.8%
100.306	punctate cataract, nucleus		0		0		3	2.3%
100.312	incipient cataract, posterior cortex		0		4	1.1%	0	
100.313	incipient cataract, equatorial cortex		1	0.4%	1	0.3%	1	0.8%
100.330	generalized/complete cataract		1	0.4%	5	1.4%	0	
100.999	*significant cataracts (summary)*		*9*	*3.7%*	*24*	*6.6%*	*7*	*5.3%*
VITREOUS								
110.320	vitreal degeneration		3	1.2%	5	1.4%	2	1.5%
RETINA								
120.310	generalized progressive retinal atrophy (PRA)		0		2	0.5%	0	
OTHER								
900.000	other, unspecified		0		0		1	0.8%
900.100	other, not inherited		1	0.4%	20	5.5%	1	0.8%
900.110	other, suspected as inherited		2	0.8%	0		0	
NORMAL								
0.000	normal globe		226	93.0%	316	86.3%	113	85.0%

OCULAR DISORDERS REPORT

KOMONDOR

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Appears to be relatively young age for onset in the Komondor (<4yr) and mainly anterior cortical.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Komondor breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
KOMONDOR

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 91 #	 %	2000-2009 170 #	 %	2010-2016 87 #	 %
EYELIDS								
21.000	entropion, unspecified		0		1	0.6%	0	
22.000	ectropion, unspecified		1	1.1%	0		0	
NICTITANS								
51.100	third eyelid cartilage anomaly		0		1	0.6%	0	
CORNEA								
70.700	corneal dystrophy		0		0		1	1.1%
UVEA								
93.710	persistent pupillary membranes, iris to iris		1	1.1%	3	1.8%	1	1.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		2	2.3%
LENS								
100.200	cataract, unspecified		14	15.4%	0		0	
100.210	cataract, suspect not inherited		8	8.8%	13	7.6%	6	6.9%
100.303	punctate cataract, equatorial cortex		1	1.1%	1	0.6%	0	
100.306	punctate cataract, nucleus		0		0		4	4.6%
100.307	punctate cataract, capsular		0		2	1.2%	0	
100.312	incipient cataract, posterior cortex		0		3	1.8%	0	
100.313	incipient cataract, equatorial cortex		0		4	2.4%	1	1.1%
100.314	incipient cataract, anterior sutures		0		1	0.6%	0	
100.315	incipient cataract, posterior sutures		0		3	1.8%	1	1.1%
100.316	incipient cataract, nucleus		1	1.1%	1	0.6%	3	3.4%
100.326	incomplete cataract, nucleus		0		0		1	1.1%
100.330	generalized/complete cataract		1	1.1%	0		0	
100.999	*significant cataracts (summary)*		*17*	*18.7%*	*15*	*8.8%*	*10*	*11.5%*
RETINA								
120.170	retinal dysplasia, folds		0		1	0.6%	0	
OTHER								
900.000	other, unspecified		0		3	1.8%	4	4.6%
900.100	other, not inherited		0		6	3.5%	0	
900.110	other, suspected as inherited		1	1.1%	0		0	
NORMAL								
0.000	normal globe		69	75.8%	147	86.5%	68	78.2%

OCULAR DISORDERS REPORT

KUVASZ

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Corneal dystrophy - endothelial	Not defined	3	NO
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 4	Breeder option
	- all other forms	Not defined	4	NO
E.	Cataract	Not defined	1	NO
F.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1, 5	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

OCULAR DISORDERS REPORT

C. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. In the Kuvasz, cataracts reported are predominantly posterior cortical, punctate.

F. Retinal atrophy, generalized *(prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the form of PRA in the Kuvasz is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. ACVO Genetics Committee, 2006 and/or Data from CERF All Breeds Report, 2001-2005.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

OCULAR DISORDERS REPORT
KUVASZ

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 310 #	 %	2000-2009 200 #	 %	2010-2016 38 #	 %
GLOBE							
0.110	microphthalmia	1	0.3%	0		1	2.6%
EYELIDS							
20.140	ectopic cilia	1	0.3%	0		0	
20.160	macropalpebral fissure	0		0		1	2.6%
22.000	ectropion, unspecified	2	0.6%	0		0	
25.110	distichiasis	12	3.9%	9	4.5%	0	
NICTITANS							
51.100	third eyelid cartilage anomaly	1	0.3%	0		0	
CORNEA							
70.700	corneal dystrophy	1	0.3%	5	2.5%	0	
70.730	corneal endothelial degeneration	0		1	0.5%	0	
UVEA							
93.150	iris coloboma	2	0.6%	0		0	
93.710	persistent pupillary membranes, iris to iris	16	5.2%	7	3.5%	0	
93.720	persistent pupillary membranes, iris to lens	3	1.0%	0		0	
93.730	persistent pupillary membranes, iris to cornea	2	0.6%	1	0.5%	0	
LENS							
100.200	cataract, unspecified	2	0.6%	0		0	
100.210	cataract, suspect not inherited	6	1.9%	7	3.5%	2	5.3%
100.301	punctate cataract, anterior cortex	0		1	0.5%	0	
100.302	punctate cataract, posterior cortex	1	0.3%	0		0	
100.303	punctate cataract, equatorial cortex	1	0.3%	0		0	
100.305	punctate cataract, posterior sutures	1	0.3%	0		0	
100.312	incipient cataract, posterior cortex	0		1	0.5%	0	
100.313	incipient cataract, equatorial cortex	1	0.3%	0		0	
100.316	incipient cataract, nucleus	2	0.6%	0		1	2.6%
100.330	generalized/complete cataract	2	0.6%	3	1.5%	0	
100.999	*significant cataracts (summary)*	*10*	*3.2%*	*5*	*2.5%*	*1*	*2.6%*
VITREOUS							
110.320	vitreal degeneration	0		1	0.5%	0	
RETINA							
120.310	generalized progressive retinal atrophy (PRA)	2	0.6%	2	1.0%	0	
OTHER							
900.000	other, unspecified	0		1	0.5%	0	
900.100	other, not inherited	1	0.3%	11	5.5%	1	2.6%
900.110	other, suspected as inherited	1	0.3%	1	0.5%	0	
NORMAL							
0.000	normal globe	258	83.2%	167	83.5%	35	92.1%

LABRADOODLE

(Australian Labradoodle, Australian Cobber Dog)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
D.	Cataract		1	

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In Labrador Retrievers in Europe, one form of corneal dystrophy has been shown to be caused by accumulations of glycosaminoglycans in the corneal stroma. This form of corneal dystrophy is caused by a mutation in the CHST6 gene.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

In the Labrador Retriever, this is a potentially serious problem as many of the PPM's identified on routine screening examinations bridge from the iris to the cornea and/or from iris sheets bridging the pupils. These forms may cause vision impairment.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The most frequently reported cataracts in the Labradoodle (Australian) are bilateral or unilateral, focal, posterior polar (posterior cortical)/subcapsular cataracts, which usually present between 1-3 years of age. These are generally stationary or very slowly progressive and generally do not interfere with vision. It has been suggested that these cataracts are inherited as dominant with incomplete penetrance, but definitive breeding studies are still required to verify this hypothesis.

A second type of cataract is a progressive cortical cataract which may involve the entire lens. It is not clear whether this is a distinct entity, or an aberrant form of the posterior polar cataract.

References

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
LABRADOODLE

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 397 #	%	2010-2016 4980 #	%
EYELIDS								
21.000	entropion, unspecified		0		0		1	0.0%
25.110	distichiasis		0		0		65	1.3%
NASOLACRIMAL								
32.110	imperforate lower nasolacrimal punctum		0		0		1	0.0%
NICTITANS								
51.100	third eyelid cartilage anomaly		0		0		2	0.0%
CORNEA								
70.210	corneal pannus		0		0		2	0.0%
70.700	corneal dystrophy		0		0		88	1.8%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		0		225	4.5%
93.720	persistent pupillary membranes, iris to lens		0		0		6	0.1%
93.730	persistent pupillary membranes, iris to cornea		0		0		2	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		102	2.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		1	0.0%
93.810	uveal melanoma		0		0		1	0.0%
97.150	chorioretinal coloboma, congenital		0		0		1	0.0%
LENS								
100.210	cataract, suspect not inherited		0		0		130	2.6%
100.301	punctate cataract, anterior cortex		0		0		20	0.4%
100.302	punctate cataract, posterior cortex		0		0		4	0.1%
100.303	punctate cataract, equatorial cortex		0		0		4	0.1%
100.304	punctate cataract, anterior sutures		0		0		2	0.0%
100.305	punctate cataract, posterior sutures		0		0		22	0.4%
100.306	punctate cataract, nucleus		0		0		5	0.1%
100.307	punctate cataract, capsular		0		0		5	0.1%
100.311	incipient cataract, anterior cortex		0		0		9	0.2%
100.312	incipient cataract, posterior cortex		0		0		5	0.1%
100.313	incipient cataract, equatorial cortex		0		0		3	0.1%
100.314	incipient cataract, anterior sutures		0		0		1	0.0%
100.315	incipient cataract, posterior sutures		0		0		1	0.0%
100.316	incipient cataract, nucleus		0		0		3	0.1%
100.317	incipient cataract, capsular		0		0		4	0.1%
100.321	incomplete cataract, anterior cortex		0		0		2	0.0%
100.322	incomplete cataract, posterior cortex		0		0		1	0.0%
100.323	incomplete cataract, equatorial cortex		0		0		3	0.1%
100.325	incomplete cataract, posterior sutures		0		0		3	0.1%
100.326	incomplete cataract, nucleus		0		0		1	0.0%
100.330	generalized/complete cataract		0		0		1	0.0%
100.375	subluxation/luxation, unspecified		0		0		1	0.0%
100.999	*significant cataracts (summary)*		*0*		*0*		*99*	*2.0%*

OCULAR DISORDERS REPORT
LABRADOODLE

	1991-1999	2000-2009	2010-2016	
VITREOUS				
110.120 persistent hyaloid artery/remnant	0	0	9	0.2%
110.135 PHPV/PTVL	0	0	2	0.0%
110.320 vitreal degeneration	0	0	5	0.1%
RETINA				
120.170 retinal dysplasia, folds	0	0	38	0.8%
120.960 retinopathy	0	0	4	0.1%
OPTIC NERVE				
130.110 micropapilla	0	0	11	0.2%
OTHER				
900.100 other, not inherited	0	0	126	2.5%
900.110 other, suspected as inherited	0	0	4	0.1%
NORMAL				
0.000 normal globe	0	0	2687	54.0%

OCULAR DISORDERS REPORT

LABRADOR RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1	NO
B.	Entropion	Not defined	2-4	Breeder option
C.	Ectropion	Not defined	2	Breeder option
D.	Distichiasis	Not defined	2	Breeder option
E.	Corneal dystrophy - epithelial/stromal	Not defined	2, 5	Breeder option
F.	Uveal cysts	Not defined	6	Breeder option
G.	Persistent pupillary membranes			
	- iris to iris	Not defined	2, 6	Breeder option
	- iris to cornea	Not defined	7	NO
	- iris sheets	Not defined	6	NO
H.	Cataract			
		Presumed dominant with incomplete penetrance	2-4, 8-10	NO
		Autosomal recessive	11	NO
		Not defined	12	NO
I.	Persistent hyperplastic primary vitreous/ persistent hyperplastic tunica vasculosa lentis (PHPV/PHTVL)	Not defined	2	NO
J.	Persistent hyaloid artery	Not defined	2	Breeder option
K.	Vitreous degeneration	Not defined	1, 3	Breeder option
L.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	2, 14-18	NO

OCULAR DISORDERS REPORT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
M.	Achromatopsia Type 2 (ACHM – Type 2) * a DNA test is available	Autosomal recessive	19, 20	NO
N.	Retinal dysplasia - folds * a DNA test is available	Presumed autosomal recessive	2, 21-29	NO (Breeder option with “Normal” DNA test for folds)
O.	Retinal dysplasia - geographic/ detached (without skeletal defects)	Presumed autosomal recessive	2, 21-29	NO
P.	Retinal dysplasia - folds/geographic/ detached (with skeletal defects) * a DNA test is available	Autosomal recessive with incomplete dominance for the eyes	2, 21-30	NO
Q.	Limbal melanoma	Not defined	31	NO

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening examination.

B Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward a head conformation that reduces or eliminates the likelihood of the defect.

C. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In Labrador Retrievers in Europe, one form of corneal dystrophy has been shown to be caused by accumulations of glycosaminoglycans in the corneal stroma. This form of corneal dystrophy is caused by a mutation in the CHST6 gene.

F. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

This disorder may be observed in any breed but retriever breeds tend to be predisposed. There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Labrador Retriever, this is a potentially serious problem as many of the ppm's identified on routine screening examinations bridge from the iris to the cornea and/or from iris sheets bridging the pupils. These forms may cause vision impairment.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The most frequently reported cataracts in the Labrador Retriever are bilateral or unilateral, focal, posterior polar (posterior cortical)/subcapsular cataracts which usually present between 1-3 years of age. These are generally stationary or very slowly progressive and generally do not interfere with vision. It has been suggested that these cataracts are inherited as dominant with incomplete penetrance, but definitive breeding studies are still required to verify this hypothesis.

A second type of cataract is a progressive cortical cataract which may involve the entire lens. It is not clear whether this is a distinct entity, or an aberrant form of the posterior polar cataract.

I. Persistent hyperplastic primary vitreous (PHPV)/Persistent hyperplastic tunica vasculosa lentis (PHTVL)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with **persistent hyperplastic tunica vasculosa lentis (PHTVL)** which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The majority of affected dogs have a retrolental fibrovascular plaque and variable lenticular defects which include posterior lenticonus/globus, colobomata, intralenticular hemorrhage and/or secondary cataracts. Vision impairment may result.

J. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA) or as a non-vascular strand that appears gray-white (**persistent hyaloid remnant**).

K. Vitreous degeneration

Liquefaction of the vitreous gel, which may predispose to retinal detachment.

L. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent

clinically. With limited exceptions, most PRAs are recessively inherited.
Studies have shown that the principal form of PRA in the Labrador Retriever is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

M. Achromatopsia Type 2 (ACHM – Type 2)

A congenital form of day blindness. Visual deficits become apparent between 8-10 weeks of age. Normal vision is present in low light conditions. Clinical examination is normal. Cone responses are absent on an electroretinogram. The causative genetic mutation has been determined, but not yet published. A DNA test is available.

N. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness.

In the Labrador Retriever, the presence of retinal folds may be seen in the heterozygous state described in “R” below, thus the recommendation against breeding.

The breeding advice for Labrador Retrievers and Samoyeds diagnosed with "retinal dysplasia - folds" will be changed from "No" to "Breeder option" if the owner of the dog provides the registering office with results of the DNA test for the affected dog, showing that it is not a carrier of the *COL9A3* mutation.

O. Retinal dysplasia - geographic, detached without skeletal defects

Abnormal development of the retina present at birth; however, in the Golden Retriever, Labrador Retriever, and German Shepherd it has been demonstrated that the geographic form of retinal dysplasia may not be apparent before dogs are 10 weeks of age.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is

known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds

In Europe, this condition has been documented as an autosomal recessive condition and results in early retinal detachment and blindness. Lens and corneal opacities can also be present, but skeletal abnormalities (see below) are not present. The condition of generalized retinal dysplasia with retinal detachment but without skeletal abnormalities has been reported primarily in Europe, and is rarely if ever seen in the United States.

In the United States, the milder forms of retinal dysplasia (folds/geographic) are seen in Labradors. These may represent the heterozygous form of the condition in which the homozygote also displays skeletal malformations (see “R” below) or it may represent a genetically distinct entity with an undetermined mode of inheritance. It is not possible clinically to make this distinction. Thus, Labradors with any form of retinal dysplasia should not be used for breeding.

P. Retinal dysplasia - folds or detachment with skeletal defects

This condition is also known as oculo-skeletal dysplasia (OSD) or dwarfism with retinal dysplasia type 1 (DRD1) in the Labrador Retriever. A similar condition, DRD2, occurs in the Samoyed. The condition is autosomal recessive and homozygous affected dogs have shortened forelimbs (“downhill” conformation) with valgus deformity. They have severe ocular defects including cataract, retinal folds/multifocal retinal dysplasia, vitreal degeneration and retinal detachment. The ocular abnormalities result in blindness in most dogs. Heterozygous dogs can have either a normal ocular exam or have multiple retinal folds, vitreal membranes, or vitreal degeneration suggesting a semi-dominant mechanism with respect to the eyes. It is important to note that generally the retinal folds present in heterozygous dogs tend to cluster around the major superior blood vessels of the central tapetal region. The condition is caused by a 1 base pair insertion of *COL9A3.* A DNA test is available.

Q. Limbal melanoma

Most limbal melanomas are really epibulbar melanocytomas, but there is a possibility of an extension of an intraocular melanoma extending outward and presenting as a limbal melanoma. An epibulbar melanocytoma originates from the superficial pigment lining the limbus and the lesion may eventually extend into the eye. Metastasis has not been documented and the mass is characterized by large epithelioid cells. The lesion presents as a subconjunctival smooth mass most commonly in the dorsolateral limbal region and extends later into the cornea and posterior on the sclera. Breed predisposition have been noted in the German Shepherd, Labrador and Golden Retriever.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for Labrador Retriever. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost

vision. CPRA occurred in England, but was uncommon elsewhere.

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OCULAR DISORDERS REPORT
LABRADOR RETRIEVER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 75917 #	%	2000-2009 106986 #	%	2010-2016 55345 #	%
GLOBE							
0.110	microphthalmia	36	0.0%	19	0.0%	6	0.0%
10.000	glaucoma	16	0.0%	4	0.0%	8	0.0%
EYELIDS							
20.140	ectopic cilia	11	0.0%	5	0.0%	0	
20.160	macropalpebral fissure	28	0.0%	43	0.0%	15	0.0%
21.000	entropion, unspecified	361	0.5%	431	0.4%	235	0.4%
22.000	ectropion, unspecified	190	0.3%	224	0.2%	86	0.2%
25.110	distichiasis	877	1.2%	984	0.9%	472	0.9%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	5	0.0%	4	0.0%	16	0.0%
40.910	keratoconjunctivitis sicca	3	0.0%	0		5	0.0%
NICTITANS							
51.100	third eyelid cartilage anomaly	4	0.0%	3	0.0%	4	0.0%
52.110	prolapsed gland of the third eyelid	11	0.0%	10	0.0%	17	0.0%
CORNEA							
70.210	corneal pannus	6	0.0%	2	0.0%	1	0.0%
70.220	pigmentary keratitis	3	0.0%	9	0.0%	7	0.0%
70.700	corneal dystrophy	650	0.9%	1033	1.0%	665	1.2%
70.730	corneal endothelial degeneration	45	0.1%	29	0.0%	8	0.0%
UVEA							
90.250	pigmentary uveitis	0		1	0.0%	1	0.0%
93.110	iris hypoplasia	0		0		7	0.0%
93.140	corneal endothelial pigment without PPM	0		7	0.0%	5	0.0%
93.150	iris coloboma	2	0.0%	9	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	1395	1.8%	3601	3.4%	2129	3.8%
93.720	persistent pupillary membranes, iris to lens	53	0.1%	79	0.1%	16	0.0%
93.730	persistent pupillary membranes, iris to cornea	57	0.1%	84	0.1%	19	0.0%
93.740	persistent pupillary membranes, iris sheets	65	0.1%	109	0.1%	2	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		12	0.0%	337	0.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		4	0.0%	28	0.1%
93.810	uveal melanoma	0		12	0.0%	45	0.1%
93.999	uveal cysts	68	0.1%	198	0.2%	154	0.3%
LENS							
100.200	cataract, unspecified	727	1.0%	0		1	0.0%
100.210	cataract, suspect not inherited	2569	3.4%	5134	4.8%	2669	4.8%
100.301	punctate cataract, anterior cortex	341	0.4%	379	0.4%	257	0.5%
100.302	punctate cataract, posterior cortex	527	0.7%	535	0.5%	263	0.5%
100.303	punctate cataract, equatorial cortex	62	0.1%	81	0.1%	37	0.1%
100.304	punctate cataract, anterior sutures	38	0.1%	52	0.0%	29	0.1%
100.305	punctate cataract, posterior sutures	277	0.4%	285	0.3%	174	0.3%
100.306	punctate cataract, nucleus	53	0.1%	74	0.1%	59	0.1%
100.307	punctate cataract, capsular	12	0.0%	149	0.1%	110	0.2%
100.311	incipient cataract, anterior cortex	220	0.3%	369	0.3%	133	0.2%

OCULAR DISORDERS REPORT
LABRADOR RETRIEVER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.312	incipient cataract, posterior cortex	636	0.8%	896	0.8%	418	0.8%
100.313	incipient cataract, equatorial cortex	173	0.2%	245	0.2%	82	0.1%
100.314	incipient cataract, anterior sutures	21	0.0%	33	0.0%	8	0.0%
100.315	incipient cataract, posterior sutures	192	0.3%	195	0.2%	85	0.2%
100.316	incipient cataract, nucleus	96	0.1%	155	0.1%	55	0.1%
100.317	incipient cataract, capsular	12	0.0%	162	0.2%	77	0.1%
100.321	incomplete cataract, anterior cortex	0		0		16	0.0%
100.322	incomplete cataract, posterior cortex	0		0		57	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		17	0.0%
100.324	incomplete cataract, anterior sutures	0		0		1	0.0%
100.325	incomplete cataract, posterior sutures	0		0		7	0.0%
100.326	incomplete cataract, nucleus	0		0		12	0.0%
100.327	incomplete cataract, capsular	0		0		8	0.0%
100.330	generalized/complete cataract	147	0.2%	161	0.2%	45	0.1%
100.340	resorbing/hypermature cataract	0		0		3	0.0%
100.375	subluxation/luxation, unspecified	21	0.0%	22	0.0%	10	0.0%
100.999	*significant cataracts (summary)*	*3534*	*4.7%*	*3771*	*3.5%*	*1954*	*3.5%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	242	0.3%	254	0.2%	104	0.2%
110.135	PHPV/PTVL	42	0.1%	71	0.1%	40	0.1%
110.320	vitreal degeneration	296	0.4%	354	0.3%	200	0.4%
FUNDUS							
97.110	choroidal hypoplasia	4	0.0%	9	0.0%	1	0.0%
97.120	coloboma	6	0.0%	5	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	2033	2.7%	2290	2.1%	802	1.4%
120.180	retinal dysplasia, geographic	814	1.1%	908	0.8%	304	0.5%
120.190	retinal dysplasia, detached	85	0.1%	86	0.1%	14	0.0%
120.310	generalized progressive retinal atrophy (PRA)	490	0.6%	419	0.4%	79	0.1%
120.400	retinal hemorrhage	18	0.0%	15	0.0%	1	0.0%
120.910	retinal detachment without dialysis	47	0.1%	23	0.0%	3	0.0%
120.920	retinal detachment with dialysis	0		0		6	0.0%
120.960	retinopathy	0		0		66	0.1%
OPTIC NERVE							
130.110	micropapilla	7	0.0%	58	0.1%	40	0.1%
130.120	optic nerve hypoplasia	53	0.1%	30	0.0%	4	0.0%
130.150	optic disc coloboma	25	0.0%	12	0.0%	7	0.0%
OTHER							
900.000	other, unspecified	0		496	0.5%	1201	2.2%
900.100	other, not inherited	311	0.4%	3961	3.7%	1366	2.5%
900.110	other, suspected as inherited	626	0.8%	283	0.3%	53	0.1%
NORMAL							
0.000	normal globe	64261	84.6%	93663	87.5%	46901	84.7%

OCULAR DISORDERS REPORT

LAGOTTO ROMAGNOLO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary conditions of the Lagotto Romagnolo breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

OCULAR DISORDERS REPORT
LAGOTTO ROMAGNOLO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 19 #	%	2010-2016 348 #	%
EYELIDS							
25.110	distichiasis	0		3	15.8%	30	8.6%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		1	0.3%
52.110	prolapsed gland of the third eyelid	0		0		1	0.3%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		12	3.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		3	0.9%
93.999	uveal cysts	0		0		1	0.3%
LENS							
100.210	cataract, suspect not inherited	0		0		8	2.3%
100.301	punctate cataract, anterior cortex	0		1	5.3%	1	0.3%
100.302	punctate cataract, posterior cortex	0		0		1	0.3%
100.303	punctate cataract, equatorial cortex	0		0		3	0.9%
100.305	punctate cataract, posterior sutures	0		1	5.3%	0	
100.313	incipient cataract, equatorial cortex	0		0		2	0.6%
100.321	incomplete cataract, anterior cortex	0		0		1	0.3%
100.322	incomplete cataract, posterior cortex	0		0		1	0.3%
100.326	incomplete cataract, nucleus	0		0		1	0.3%
100.999	*significant cataracts (summary)*	*0*		*2*	*10.5%*	*10*	*2.9%*
RETINA							
120.170	retinal dysplasia, folds	0		0		2	0.6%
OPTIC NERVE							
130.110	micropapilla	0		0		1	0.3%
OTHER							
900.000	other, unspecified	0		2	10.5%	1	0.3%
900.100	other, not inherited	0		0		8	2.3%
NORMAL							
0.000	normal globe	0		16	84.2%	291	83.6%

LAKELAND TERRIER
(aka Lakeland Heeler)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	2	Breeder Option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
C.	Lens luxation * a DNA test is available	Not defined	4	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

4. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
LAKELAND TERRIER

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 85 #	 %	2000-2009 88 #	 %	2010-2016 63 #	 %
EYELIDS							
25.110	distichiasis	4	4.7%	0		5	7.9%
CORNEA							
70.700	corneal dystrophy	0		0		1	1.6%
70.730	corneal endothelial degeneration	2	2.4%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	15	17.6%	12	13.6%	6	9.5%
93.720	persistent pupillary membranes, iris to lens	0		1	1.1%	1	1.6%
93.730	persistent pupillary membranes, iris to cornea	4	4.7%	0		0	
93.740	persistent pupillary membranes, iris sheets	1	1.2%	0		0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		8	12.7%
LENS							
100.210	cataract, suspect not inherited	2	2.4%	1	1.1%	2	3.2%
100.311	incipient cataract, anterior cortex	2	2.4%	0		1	1.6%
100.312	incipient cataract, posterior cortex	1	1.2%	2	2.3%	1	1.6%
100.330	generalized/complete cataract	0		1	1.1%	2	3.2%
100.999	*significant cataracts (summary)*	*3*	*3.5%*	*3*	*3.4%*	*4*	*6.3%*
RETINA							
120.180	retinal dysplasia, geographic	0		1	1.1%	0	
OTHER							
900.000	other, unspecified	0		0		2	3.2%
900.100	other, not inherited	0		6	6.8%	0	
NORMAL							
0.000	normal globe	61	71.8%	74	84.1%	45	71.4%

LANCASHIRE HEELER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membrane			
	- iris to iris	Not defined	1	Breeder option
	- all other forms	Not defined	1	NO
B.	Lens luxation * a DNA test is available	Not defined	2-4	NO
C.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma * a DNA test is available	Autosomal recessive	5-7	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

C. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

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4. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

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OCULAR DISORDERS REPORT
LANCASHIRE HEELER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 131 #	%	2010-2016 10 #	%
EYELIDS								
25.110	distichiasis		0		1	0.8%	0	
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		55	42.0%	3	30.0%
93.720	persistent pupillary membranes, iris to lens		0		0		1	10.0%
93.730	persistent pupillary membranes, iris to cornea		0		2	1.5%	0	
LENS								
100.210	cataract, suspect not inherited		0		1	0.8%	0	
100.317	incipient cataract, capsular		0		1	0.8%	0	
100.375	subluxation/luxation, unspecified		0		0		1	10.0%
100.999	*significant cataracts (summary)*		*0*		*1*	*0.8%*	*0*	
VITREOUS								
110.120	persistent hyaloid artery/remnant		0		2	1.5%	0	
110.320	vitreal degeneration		0		4	3.1%	1	10.0%
RETINA								
120.170	retinal dysplasia, folds		0		1	0.8%	0	
120.310	generalized progressive retinal atrophy (PRA)		0		1	0.8%	0	
NORMAL								
0.000	normal globe		0		85	64.9%	8	80.0%

LAPPONIAN HERDER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - generalized (*prcd*) * a DNA test is available.	Autosomal recessive	1	NO
B.	Multifocal retinopathy - *cmr3* * a DNA test is available	Autosomal recessive	2	NO

Description and Comments

A. Retinal atrophy- generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky and Samoyed, in most breeds studied to date, PRA is inherited as an autosomal recessive trait. A genetic test is available to detect the progressive rod cone degeneration form of PRA caused by a mutation in the *prcd* gene.

B. Multifocal retinopathy (cmr3)

Canine Multi-focal Retinopathy type 3 (cmr3) is characterized by numerous distinct (i.e. multi-focal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Clinically the disease is similar to that seen in the Bullmastiff and Coton deTulear, but the mutation in the Bestrophin 1 gene (*BEST1* alias *VMD2*) is different. The multifocal retinopathy seen in the Lapponian Herder is caused by a deletion at position 1,388 and a substitution at position 1,466 and is therefore called cmr3. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Lapponian Herder. The conditions listed above are currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

2. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis*. 2010;16:2791-2804.

OCULAR DISORDERS REPORT

LEONBERGER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Ectropion	Not defined	2	Breeder option
C.	Entropion	Not defined	1-3	Breeder option
D.	Eury/Macroblepharon	Not defined	1, 3	Breeder option
E.	Nictitans cartilage anomaly/eversion	Not defined	4	Breeder option
F.	Uveal cysts	Not defined	5	Breeder option
G.	Persistent pupillary membranes			
	- iris to iris	Not defined	2, 3	Breeder option
	- lens pigment foci/no strands	Not defined		Passes with no notation
H.	Cataract	Not defined	6	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

E. Nictitans cartilage anomaly/eversion

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

F. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. Heinrich CL, Lakhani KH, Featherstone HJ, et al. Cataract in the UK Leonberger population. *Vet Ophthalmol.* 2006 Sep-Oct;9:350-356.

4. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

5. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

6. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
LEONBERGER

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**285**		**881**		**789**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
EYELIDS							
20.160	macropalpebral fissure	5	1.8%	23	2.6%	7	0.9%
21.000	entropion, unspecified	7	2.5%	29	3.3%	29	3.7%
22.000	ectropion, unspecified	2	0.7%	16	1.8%	10	1.3%
25.110	distichiasis	5	1.8%	22	2.5%	23	2.9%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.1%
NICTITANS							
51.100	third eyelid cartilage anomaly	1	0.4%	5	0.6%	21	2.7%
52.110	prolapsed gland of the third eyelid	0		0		1	0.1%
CORNEA							
70.700	corneal dystrophy	0		3	0.3%	2	0.3%
UVEA							
93.110	iris hypoplasia	0		0		1	0.1%
93.710	persistent pupillary membranes, iris to iris	50	17.5%	187	21.2%	183	23.2%
93.720	persistent pupillary membranes, iris to lens	0		1	0.1%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	0		1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	0		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		12	1.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.1%
93.810	uveal melanoma	0		1	0.1%	0	
93.999	uveal cysts	1	0.4%	6	0.7%	8	1.0%
LENS							
100.200	cataract, unspecified	2	0.7%	0		0	
100.210	cataract, suspect not inherited	17	6.0%	79	9.0%	63	8.0%
100.301	punctate cataract, anterior cortex	4	1.4%	15	1.7%	7	0.9%
100.302	punctate cataract, posterior cortex	4	1.4%	11	1.2%	11	1.4%
100.303	punctate cataract, equatorial cortex	2	0.7%	1	0.1%	0	
100.304	punctate cataract, anterior sutures	2	0.7%	1	0.1%	0	
100.305	punctate cataract, posterior sutures	1	0.4%	7	0.8%	7	0.9%
100.306	punctate cataract, nucleus	3	1.1%	1	0.1%	5	0.6%
100.307	punctate cataract, capsular	0		3	0.3%	2	0.3%
100.311	incipient cataract, anterior cortex	1	0.4%	6	0.7%	2	0.3%
100.312	incipient cataract, posterior cortex	5	1.8%	16	1.8%	14	1.8%
100.313	incipient cataract, equatorial cortex	0		0		1	0.1%
100.314	incipient cataract, anterior sutures	2	0.7%	3	0.3%	0	
100.315	incipient cataract, posterior sutures	5	1.8%	2	0.2%	1	0.1%
100.316	incipient cataract, nucleus	7	2.5%	9	1.0%	3	0.4%
100.317	incipient cataract, capsular	0		0		6	0.8%
100.322	incomplete cataract, posterior cortex	0		0		1	0.1%
100.326	incomplete cataract, nucleus	0		0		1	0.1%
100.330	generalized/complete cataract	0		3	0.3%	1	0.1%
100.375	subluxation/luxation, unspecified	2	0.7%	0		4	0.5%
100.999	*significant cataracts (summary)*	*38*	*13.3%*	*78*	*8.9%*	*62*	*7.9%*

OCULAR DISORDERS REPORT
LEONBERGER

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.4%	1	0.1%	1	0.1%
110.135	PHPV/PTVL	0		0		4	0.5%
110.320	vitreal degeneration	1	0.4%	5	0.6%	0	
RETINA							
120.170	retinal dysplasia, folds	1	0.4%	4	0.5%	4	0.5%
120.180	retinal dysplasia, geographic	0		1	0.1%	3	0.4%
120.310	generalized progressive retinal atrophy (PRA)	1	0.4%	4	0.5%	0	
120.960	retinopathy	0		0		1	0.1%
OPTIC NERVE							
130.110	micropapilla	0		1	0.1%	0	
130.120	optic nerve hypoplasia	1	0.4%	0		1	0.1%
130.150	optic disc coloboma	0		1	0.1%	0	
OTHER							
900.000	other, unspecified	0		7	0.8%	25	3.2%
900.100	other, not inherited	5	1.8%	45	5.1%	17	2.2%
900.110	other, suspected as inherited	3	1.1%	5	0.6%	3	0.4%
NORMAL							
0.000	normal globe	171	60.0%	597	67.8%	503	63.8%

OCULAR DISORDERS REPORT

LHASA APSO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Keratoconjunctivitis sicca	Not defined	1	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Prolapsed gland of third eyelid	Not defined	1, 2	Breeder option
D.	Exposure/pigmentary keratitis	Not defined	1	Breeder option
E.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
F.	Cataract	Not defined	3	NO

Description and Comments

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

D. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Morgan RV, Duddy JM, McClurg K. Prolapse of the gland of the third eyelid in the dog: A retrospective study of 89 cases (1980-1990). *J Am Anim Hosp Assoc*. 1993;29:56-60.

3. Gelatt KN, Mackay EO. Prevalence of primary breed-related cataracts in the dog in North America. *Vet Ophthalmol*. 2005;8:101-111.

OCULAR DISORDERS REPORT
LHASA APSO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 447 #	 %	2000-2009 298 #	 %	2010-2016 72 #	 %
GLOBE							
0.110	microphthalmia	1	0.2%	0		0	
EYELIDS							
20.160	macropalpebral fissure	2	0.4%	0		1	1.4%
21.000	entropion, unspecified	6	1.3%	4	1.3%	2	2.8%
25.110	distichiasis	19	4.3%	8	2.7%	5	6.9%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.2%	0		0	
40.910	keratoconjunctivitis sicca	2	0.4%	1	0.3%	0	
NICTITANS							
51.100	third eyelid cartilage anomaly	1	0.2%	0		0	
52.110	prolapsed gland of the third eyelid	1	0.2%	3	1.0%	0	
CORNEA							
70.210	corneal pannus	5	1.1%	3	1.0%	0	
70.220	pigmentary keratitis	7	1.6%	11	3.7%	3	4.2%
70.700	corneal dystrophy	6	1.3%	8	2.7%	2	2.8%
UVEA							
93.110	iris hypoplasia	0		1	0.3%	0	
93.710	persistent pupillary membranes, iris to iris	6	1.3%	4	1.3%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.2%	0		0	
93.999	uveal cysts	0		1	0.3%	0	
LENS							
100.200	cataract, unspecified	6	1.3%	0		0	
100.210	cataract, suspect not inherited	17	3.8%	8	2.7%	3	4.2%
100.301	punctate cataract, anterior cortex	5	1.1%	1	0.3%	0	
100.302	punctate cataract, posterior cortex	3	0.7%	1	0.3%	1	1.4%
100.303	punctate cataract, equatorial cortex	3	0.7%	0		0	
100.306	punctate cataract, nucleus	1	0.2%	0		0	
100.311	incipient cataract, anterior cortex	4	0.9%	8	2.7%	1	1.4%
100.312	incipient cataract, posterior cortex	9	2.0%	5	1.7%	0	
100.313	incipient cataract, equatorial cortex	1	0.2%	2	0.7%	0	
100.314	incipient cataract, anterior sutures	3	0.7%	1	0.3%	0	
100.315	incipient cataract, posterior sutures	1	0.2%	1	0.3%	0	
100.316	incipient cataract, nucleus	2	0.4%	1	0.3%	0	
100.330	generalized/complete cataract	15	3.4%	3	1.0%	0	
100.375	subluxation/luxation, unspecified	0		1	0.3%	0	
100.999	*significant cataracts (summary)*	*53*	*11.9%*	*23*	*7.7%*	*2*	*2.8%*
VITREOUS							
110.320	vitreal degeneration	2	0.4%	7	2.3%	1	1.4%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.3%	0	

OCULAR DISORDERS REPORT
LHASA APSO

	1991-1999	2000-2009	2010-2016
RETINA			
120.170 retinal dysplasia, folds	2 0.4%	2 0.7%	1 1.4%
120.180 retinal dysplasia, geographic	1 0.2%	2 0.7%	0
120.310 generalized progressive retinal atrophy (PRA)	3 0.7%	4 1.3%	0
OPTIC NERVE			
130.110 micropapilla	0	1 0.3%	0
130.120 optic nerve hypoplasia	1 0.2%	0	1 1.4%
130.150 optic disc coloboma	1 0.2%	0	0
OTHER			
900.100 other, not inherited	0	12 4.0%	2 2.8%
900.110 other, suspected as inherited	12 2.7%	7 2.3%	0
NORMAL			
0.000 normal globe	340 76.1%	231 77.5%	57 79.2%

OCULAR DISORDERS REPORT

LOUISIANA CATAHOULA LEOPARD DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Iris coloboma	Not defined	2	NO

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma and persistent pupillary membranes.

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Iris coloboma

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the OFA form.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Louisiana Catahoula Leopard Dog breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Report, 2013-2104.

OCULAR DISORDERS REPORT
LOUISIANA CATAHOULA LEOPARD DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 68 #	 %	2000-2009 158 #	 %	2010-2016 162 #	 %
GLOBE							
0.110	microphthalmia	2	2.9%	1	0.6%	2	1.2%
EYELIDS							
25.110	distichiasis	0		1	0.6%	3	1.9%
CORNEA							
70.700	corneal dystrophy	0		1	0.6%	0	
UVEA							
93.110	iris hypoplasia	0		0		3	1.9%
93.150	iris coloboma	4	5.9%	2	1.3%	6	3.7%
93.710	persistent pupillary membranes, iris to iris	1	1.5%	7	4.4%	30	18.5%
93.720	persistent pupillary membranes, iris to lens	0		1	0.6%	0	
97.150	chorioretinal coloboma, congenital	0		0		1	0.6%
LENS							
100.200	cataract, unspecified	1	1.5%	0		0	
100.210	cataract, suspect not inherited	0		2	1.3%	3	1.9%
100.302	punctate cataract, posterior cortex	0		1	0.6%	0	
100.311	incipient cataract, anterior cortex	1	1.5%	3	1.9%	0	
100.312	incipient cataract, posterior cortex	1	1.5%	0		1	0.6%
100.313	incipient cataract, equatorial cortex	0		0		2	1.2%
100.330	generalized/complete cataract	0		0		1	0.6%
100.999	*significant cataracts (summary)*	*3*	*4.4%*	*4*	*2.5%*	*4*	*2.5%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	1.5%	0		1	0.6%
110.320	vitreal degeneration	0		0		2	1.2%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.6%	0	
97.120	coloboma	1	1.5%	1	0.6%	0	
RETINA							
120.170	retinal dysplasia, folds	3	4.4%	3	1.9%	3	1.9%
120.910	retinal detachment without dialysis	1	1.5%	0		1	0.6%
120.920	retinal detachment with dialysis	0		0		1	0.6%
OPTIC NERVE							
130.150	optic disc coloboma	0		2	1.3%	0	
OTHER							
900.100	other, not inherited	0		3	1.9%	4	2.5%
900.110	other, suspected as inherited	0		9	5.7%	1	0.6%
NORMAL							
0.000	normal globe	60	88.2%	135	85.4%	122	75.3%

OCULAR DISORDERS REPORT

LOWCHEN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Exposure/Pigmentary keratitis	Not defined	2	NO
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Vitreous degeneration	Not defined	1	Breeder option
F.	Retinal atrophy - generalized	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment and/or glaucoma.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Lowchen breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
LOWCHEN

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**503**		**893**		**333**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
EYELIDS							
20.140	ectopic cilia	0		1	0.1%	0	
21.000	entropion, unspecified	0		1	0.1%	0	
25.110	distichiasis	13	2.6%	48	5.4%	20	6.0%
CORNEA							
70.210	corneal pannus	0		1	0.1%	0	
70.730	corneal endothelial degeneration	2	0.4%	0		0	
UVEA							
93.150	iris coloboma	0		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	23	4.6%	77	8.6%	35	10.5%
93.720	persistent pupillary membranes, iris to lens	1	0.2%	1	0.1%	1	0.3%
93.730	persistent pupillary membranes, iris to cornea	0		2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		7	2.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.3%
93.999	uveal cysts	0		0		2	0.6%
LENS							
100.200	cataract, unspecified	21	4.2%	0		0	
100.210	cataract, suspect not inherited	11	2.2%	32	3.6%	14	4.2%
100.301	punctate cataract, anterior cortex	1	0.2%	4	0.4%	3	0.9%
100.302	punctate cataract, posterior cortex	6	1.2%	5	0.6%	1	0.3%
100.303	punctate cataract, equatorial cortex	2	0.4%	2	0.2%	0	
100.304	punctate cataract, anterior sutures	0		1	0.1%	0	
100.305	punctate cataract, posterior sutures	2	0.4%	3	0.3%	1	0.3%
100.306	punctate cataract, nucleus	0		1	0.1%	1	0.3%
100.307	punctate cataract, capsular	0		1	0.1%	0	
100.311	incipient cataract, anterior cortex	8	1.6%	11	1.2%	2	0.6%
100.312	incipient cataract, posterior cortex	9	1.8%	13	1.5%	2	0.6%
100.313	incipient cataract, equatorial cortex	1	0.2%	3	0.3%	2	0.6%
100.314	incipient cataract, anterior sutures	1	0.2%	1	0.1%	0	
100.315	incipient cataract, posterior sutures	3	0.6%	1	0.1%	0	
100.316	incipient cataract, nucleus	0		1	0.1%	0	
100.317	incipient cataract, capsular	0		2	0.2%	0	
100.321	incomplete cataract, anterior cortex	0		0		1	0.3%
100.322	incomplete cataract, posterior cortex	0		0		1	0.3%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.3%
100.330	generalized/complete cataract	9	1.8%	5	0.6%	2	0.6%
100.375	subluxation/luxation, unspecified	1	0.2%	1	0.1%	0	
100.999	*significant cataracts (summary)*	*63*	*12.5%*	*54*	*6.0%*	*17*	*5.1%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	0.6%	0		0	
110.135	PHPV/PTVL	0		1	0.1%	0	
110.320	vitreal degeneration	15	3.0%	27	3.0%	11	3.3%
FUNDUS							
97.110	choroidal hypoplasia	2	0.4%	0		0	

OCULAR DISORDERS REPORT
LOWCHEN

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	1	0.2%	2	0.2%	0	
120.190	retinal dysplasia, detached	1	0.2%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	23	4.6%	13	1.5%	2	0.6%
120.910	retinal detachment without dialysis	2	0.4%	0		0	
120.960	retinopathy	0		0		5	1.5%
OPTIC NERVE							
130.110	micropapilla	1	0.2%	0		0	
130.150	optic disc coloboma	1	0.2%	0		0	
OTHER							
900.000	other, unspecified	0		6	0.7%	7	2.1%
900.100	other, not inherited	2	0.4%	35	3.9%	6	1.8%
900.110	other, suspected as inherited	2	0.4%	0		2	0.6%
NORMAL							
0.000	normal globe	384	76.3%	737	82.5%	262	78.7%

OCULAR DISORDERS REPORT

LUCAS TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Lens luxation * a DNA test is available	Not defined	1	NO

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Lucas Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

MALTESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	3, 4	NO
D.	Vitreous degeneration	Not defined	5	Breeder option
E.	Retinal atrophy - generalized	Presumed autosomal recessive	3	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

References

1. ACVO Genetics Committee, 2014, and/or Data from OFA All-Breeds Report, 2013-2104.

2. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. Gelatt KN and Mackay EO. Prevalence of primary breed-related cataracts in the dog in North America. *Vet Ophthalmol*. 2005 Mar-Apr;8:101-111.

5. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

OCULAR DISORDERS REPORT
MALTESE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 60 #	1991-1999 60 %	2000-2009 136 #	2000-2009 136 %	2010-2016 188 #	2010-2016 188 %
GLOBE							
0.110	microphthalmia	0		0		1	0.5%
EYELIDS							
21.000	entropion, unspecified	2	3.3%	2	1.5%	2	1.1%
25.110	distichiasis	2	3.3%	3	2.2%	7	3.7%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	1.7%	0		0	
40.910	keratoconjunctivitis sicca	0		1	0.7%	1	0.5%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		2	1.1%
CORNEA							
70.220	pigmentary keratitis	0		0		3	1.6%
70.700	corneal dystrophy	0		0		2	1.1%
UVEA							
93.710	persistent pupillary membranes, iris to iris	1	1.7%	10	7.4%	8	4.3%
93.999	uveal cysts	0		0		1	0.5%
LENS							
100.210	cataract, suspect not inherited	0		9	6.6%	8	4.3%
100.301	punctate cataract, anterior cortex	0		1	0.7%	2	1.1%
100.302	punctate cataract, posterior cortex	2	3.3%	1	0.7%	1	0.5%
100.303	punctate cataract, equatorial cortex	0		2	1.5%	0	
100.304	punctate cataract, anterior sutures	0		1	0.7%	0	
100.305	punctate cataract, posterior sutures	0		1	0.7%	1	0.5%
100.306	punctate cataract, nucleus	0		0		1	0.5%
100.307	punctate cataract, capsular	0		1	0.7%	0	
100.311	incipient cataract, anterior cortex	1	1.7%	5	3.7%	3	1.6%
100.312	incipient cataract, posterior cortex	2	3.3%	6	4.4%	1	0.5%
100.313	incipient cataract, equatorial cortex	1	1.7%	1	0.7%	0	
100.315	incipient cataract, posterior sutures	0		1	0.7%	0	
100.316	incipient cataract, nucleus	1	1.7%	1	0.7%	0	
100.317	incipient cataract, capsular	0		1	0.7%	0	
100.330	generalized/complete cataract	1	1.7%	2	1.5%	1	0.5%
100.999	*significant cataracts (summary)*	*8*	*13.3%*	*24*	*17.6%*	*10*	*5.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	1.7%	0		0	
110.320	vitreal degeneration	1	1.7%	1	0.7%	12	6.4%
RETINA							
120.170	retinal dysplasia, folds	0		2	1.5%	1	0.5%
120.180	retinal dysplasia, geographic	0		1	0.7%	4	2.1%
120.310	generalized progressive retinal atrophy (PRA)	3	5.0%	1	0.7%	0	

OCULAR DISORDERS REPORT
MALTESE

	1991-1999	2000-2009	2010-2016
OTHER			
900.000 other, unspecified	0	1 0.7%	7 3.7%
900.100 other, not inherited	0	5 3.7%	6 3.2%
900.110 other, suspected as inherited	0	0	1 0.5%
NORMAL			
0.000 normal globe	47 78.3%	104 76.5%	138 73.4%

OCULAR DISORDERS REPORT

MANCHESTER TERRIER

Standard & Toy Varieties

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Manchester Terrier breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
MANCHESTER TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 19 #	%	2010-2016 202 #	%
EYELIDS								
25.110	distichiasis		0		0		1	0.5%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		0		15	7.4%
93.730	persistent pupillary membranes, iris to cornea		0		0		1	0.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		4	2.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		2	1.0%
93.999	uveal cysts		0		0		1	0.5%
LENS								
100.210	cataract, suspect not inherited		0		0		6	3.0%
100.301	punctate cataract, anterior cortex		0		0		1	0.5%
100.302	punctate cataract, posterior cortex		0		1	5.3%	2	1.0%
100.303	punctate cataract, equatorial cortex		0		1	5.3%	0	
100.305	punctate cataract, posterior sutures		0		0		2	1.0%
100.307	punctate cataract, capsular		0		0		1	0.5%
100.311	incipient cataract, anterior cortex		0		0		2	1.0%
100.312	incipient cataract, posterior cortex		0		0		2	1.0%
100.313	incipient cataract, equatorial cortex		0		0		1	0.5%
100.317	incipient cataract, capsular		0		1	5.3%	1	0.5%
100.999	*significant cataracts (summary)*		*0*		*3*	*15.8%*	*12*	*5.9%*
VITREOUS								
110.135	PHPV/PTVL		0		0		3	1.5%
110.320	vitreal degeneration		0		1	5.3%	6	3.0%
RETINA								
120.170	retinal dysplasia, folds		0		0		1	0.5%
120.960	retinopathy		0		0		1	0.5%
OTHER								
900.000	other, unspecified		0		1	5.3%	5	2.5%
900.100	other, not inherited		0		0		4	2.0%
NORMAL								
0.000	normal globe		0		18	94.7%	167	82.7%

OCULAR DISORDERS REPORT

MAREMMA SHEEPDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Corneal dystrophy	Not defined	1	Breeder option
C.	Chronic superficial keratitis/pannus	Not defined	1	NO
D.	Cataract	Not defined	1	NO
E.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Chronic superficial keratitis/pannus

A bilateral inflammatory disease of the cornea which usually starts as a grayish haze to the ventral or ventrolateral cornea, followed by the formation of a vascularized subepithelial growth that begins to spread toward the central cornea; pigmentation follows the vascularization. If severe, vision impairment occurs. Pannus may be associated with plasma cell infiltration of the nictitans. This has been reported in the Italian population of the breed.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. This has been reported in the Italian population of the breed.

E. Retinal dysplasia – folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined. This has been reported in the Italian population of the breed.

References

1. Guandalini A, Di Girolamo N, Santillo D, Andreani V, Corvi R, Bandini M, and Peruccio C. (2017) Epidemiology of ocular disorders presumed to be inherited in three large Italian dog breeds in Italy. *Vet Ophthalmol*, 20: 420-426. doi:10.1111/vop.12442.

OCULAR DISORDERS REPORT
MAREMMA SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 3 #	%	2010-2016 23 #	%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		2	8.7%
LENS							
100.210	cataract, suspect not inherited	0		2	66.7%	1	4.3%
100.301	punctate cataract, anterior cortex	0		0		1	4.3%
100.999	*significant cataracts (summary)*	*0*		*0*		*1*	*4.3%*
VITREOUS							
110.320	vitreal degeneration	0		0		1	4.3%
OTHER							
900.000	other, unspecified	0		0		1	4.3%
NORMAL							
0.000	normal globe	0		1	33.3%	19	82.6%

MARKIESJE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1	NO

Description and Comments

A. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Australian Stumpy Tail Cattle Dog is *prcd*, which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Markiesje breed. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563.

OCULAR DISORDERS REPORT

MASTIFF

(English)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1, 2	Breeder option
B.	Ectropion	Not defined	1	Breeder option
C.	Macroblepharon/ macropalpebral fissure	Not defined	1	Breeder option
D.	Distichiasis	Not defined	3	Breeder option
E.	Uveal cysts	Not defined	4	Breeder option
F.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 3, 4	Breeder option
	- iris to cornea	Not defined	3	NO
	- endothelial opacity/no strands	Not defined	8	NO
G.	Cataract	Not defined	1	NO
H.	Retinal atrophy - generalized * a DNA test is available	Autosomal dominant	1, 5, 6	NO
I.	Multifocal retinopathy - *cmr1* * a DNA test is available	Autosomal recessive	7	Breeder option
J.	Retinal dysplasia - folds	Not defined	1	Breeder option

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of persistent pupillary membranes.

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Entropion in the Mastiff is severe and may require multiple surgical corrections.

B. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Macroblepharon/macropalpebral fissure

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Uveal cysts

Fluid filled sacs arising from the posterior surface of the iris, to which they may remain attached or break free and float into the anterior chamber. Usually occur in mature dogs.

There is usually no effect on vision unless the cysts are heavily clustered and impinge on the pupillary area. Less frequently, the cysts may rupture and adhere to the cornea or anterior lens capsule. Multiple cysts may occlude the iridocorneal angle and cause glaucoma.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Mastiff, the strands most often bridge from the iris to the cornea and may potentially cause vision impairment. Thus, the strong recommendations against breeding animals with any form of this abnormality.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. The ERG is normal at 3-6 months of age, but abnormal by 13 months of age. Increased exposure to bright light causes more rapid loss of neurons. PRA in the Mastiff is inherited as an autosomal dominant trait. The mutation is a single nucleotide transversion of the *RHO* gene. A DNA test is available.

I. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

J. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2001 and/or Data from CERF All-Breeds Report, 2001.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. Kijas JW, Miller BJ, Pearce-Kelling SE, et al. Canine models of ocular disease: outcross breedings define a dominant disorder present in the English mastiff and bull mastiff dog breeds. *J Hered*. 2003;94:27-30.

6. Miyadera K, Acland GM, Aguirre GD. Genetic and phenotypic variations of inherited retinal diseases in dogs: the power of within- and across-breed studies. *Mamm Genome*. 2012;23:40-61.

7. Guziewicz KE, Zangerl B, Lindauer SJ, et al. Bestrophin gene mutations cause canine multifocal retinopathy: a novel animal model for best disease. *Invest Ophthalmol Vis Sci*. 2007;48:1959-1967.

8. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
MASTIFF

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 3366 #	%	2000-2009 4005 #	%	2010-2016 1657 #	%
GLOBE							
0.110	microphthalmia	9	0.3%	9	0.2%	1	0.1%
10.000	glaucoma	1	0.0%	1	0.0%	0	
EYELIDS							
20.160	macropalpebral fissure	110	3.3%	200	5.0%	34	2.1%
21.000	entropion, unspecified	127	3.8%	199	5.0%	66	4.0%
22.000	ectropion, unspecified	248	7.4%	288	7.2%	102	6.2%
25.110	distichiasis	38	1.1%	40	1.0%	15	0.9%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	3	0.1%	1	0.0%	0	
NICTITANS							
51.100	third eyelid cartilage anomaly	3	0.1%	6	0.1%	2	0.1%
52.110	prolapsed gland of the third eyelid	4	0.1%	12	0.3%	2	0.1%
CORNEA							
70.210	corneal pannus	2	0.1%	1	0.0%	0	
70.220	pigmentary keratitis	2	0.1%	1	0.0%	1	0.1%
70.700	corneal dystrophy	14	0.4%	19	0.5%	4	0.2%
70.730	corneal endothelial degeneration	17	0.5%	29	0.7%	5	0.3%
UVEA							
90.250	pigmentary uveitis	0		0		1	0.1%
93.140	corneal endothelial pigment without PPM	0		7	0.2%	0	
93.150	iris coloboma	1	0.0%	2	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	75	2.2%	148	3.7%	55	3.3%
93.720	persistent pupillary membranes, iris to lens	31	0.9%	21	0.5%	7	0.4%
93.730	persistent pupillary membranes, iris to cornea	166	4.9%	223	5.6%	74	4.5%
93.740	persistent pupillary membranes, iris sheets	9	0.3%	10	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.0%	5	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		10	0.2%	36	2.2%
93.810	uveal melanoma	0		0		3	0.2%
93.999	uveal cysts	21	0.6%	48	1.2%	30	1.8%
LENS							
100.200	cataract, unspecified	19	0.6%	0		0	
100.210	cataract, suspect not inherited	161	4.8%	170	4.2%	84	5.1%
100.301	punctate cataract, anterior cortex	27	0.8%	25	0.6%	15	0.9%
100.302	punctate cataract, posterior cortex	5	0.1%	3	0.1%	4	0.2%
100.303	punctate cataract, equatorial cortex	4	0.1%	1	0.0%	1	0.1%
100.304	punctate cataract, anterior sutures	4	0.1%	6	0.1%	2	0.1%
100.305	punctate cataract, posterior sutures	0		5	0.1%	5	0.3%
100.306	punctate cataract, nucleus	5	0.1%	5	0.1%	3	0.2%
100.307	punctate cataract, capsular	3	0.1%	10	0.2%	3	0.2%
100.311	incipient cataract, anterior cortex	30	0.9%	29	0.7%	14	0.8%
100.312	incipient cataract, posterior cortex	16	0.5%	19	0.5%	7	0.4%
100.313	incipient cataract, equatorial cortex	10	0.3%	9	0.2%	2	0.1%
100.314	incipient cataract, anterior sutures	2	0.1%	6	0.1%	0	

OCULAR DISORDERS REPORT
MASTIFF

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.315	incipient cataract, posterior sutures	3	0.1%	3	0.1%	0	
100.316	incipient cataract, nucleus	12	0.4%	18	0.4%	7	0.4%
100.317	incipient cataract, capsular	0		7	0.2%	3	0.2%
100.321	incomplete cataract, anterior cortex	0		0		2	0.1%
100.326	incomplete cataract, nucleus	0		0		2	0.1%
100.327	incomplete cataract, capsular	0		0		1	0.1%
100.330	generalized/complete cataract	17	0.5%	22	0.5%	1	0.1%
100.340	resorbing/hypermature cataract	0		0		1	0.1%
100.375	subluxation/luxation, unspecified	4	0.1%	1	0.0%	0	
100.999	*significant cataracts (summary)*	*157*	*4.7%*	*168*	*4.2%*	*73*	*4.4%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	7	0.2%	2	0.0%	0	
110.135	PHPV/PTVL	2	0.1%	3	0.1%	0	
110.320	vitreal degeneration	4	0.1%	7	0.2%	0	
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	268	8.0%	311	7.8%	80	4.8%
120.180	retinal dysplasia, geographic	16	0.5%	30	0.7%	5	0.3%
120.190	retinal dysplasia, detached	3	0.1%	2	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	114	3.4%	37	0.9%	0	
120.910	retinal detachment without dialysis	1	0.0%	3	0.1%	0	
120.920	retinal detachment with dialysis	0		0		2	0.1%
120.960	retinopathy	0		0		9	0.5%
OPTIC NERVE							
130.110	micropapilla	1	0.0%	2	0.0%	1	0.1%
130.120	optic nerve hypoplasia	2	0.1%	0		0	
130.150	optic disc coloboma	2	0.1%	2	0.0%	0	
OTHER							
900.000	other, unspecified	0		22	0.5%	37	2.2%
900.100	other, not inherited	12	0.4%	149	3.7%	34	2.1%
900.110	other, suspected as inherited	43	1.3%	24	0.6%	5	0.3%
NORMAL							
0.000	normal globe	2191	65.1%	2776	69.3%	1183	71.4%

OCULAR DISORDERS REPORT

MI-KI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	2, 6	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	1, 6	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	3, 6	Breeder option
E.	Cataract	Not defined	3, 6	NO
F.	Vitreous degeneration	Not defined	3, 4, 6	Breeder option
G.	Retinal dysplasia - folds	Not defined	5	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make strong recommendations with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Mi-Ki, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Mi-Ki breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

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5. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Report, 2013-2014.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
MI-KI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 878 #	%	2010-2016 599 #	%
EYELIDS								
20.140	ectopic cilia		0		0		1	0.2%
20.160	macropalpebral fissure		0		2	0.2%	0	
21.000	entropion, unspecified		0		9	1.0%	1	0.2%
25.110	distichiasis		0		118	13.4%	86	14.4%
NASOLACRIMAL								
40.910	keratoconjunctivitis sicca		0		2	0.2%	2	0.3%
NICTITANS								
52.110	prolapsed gland of the third eyelid		0		1	0.1%	0	
CORNEA								
70.210	corneal pannus		0		1	0.1%	0	
70.220	pigmentary keratitis		0		2	0.2%	1	0.2%
70.700	corneal dystrophy		0		15	1.7%	11	1.8%
70.730	corneal endothelial degeneration		0		1	0.1%	0	
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		98	11.2%	76	12.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		2	0.3%
LENS								
100.200	cataract, unspecified		0		0		1	0.2%
100.210	cataract, suspect not inherited		0		77	8.8%	50	8.3%
100.301	punctate cataract, anterior cortex		0		4	0.5%	2	0.3%
100.302	punctate cataract, posterior cortex		0		3	0.3%	2	0.3%
100.303	punctate cataract, equatorial cortex		0		0		1	0.2%
100.305	punctate cataract, posterior sutures		0		11	1.3%	14	2.3%
100.311	incipient cataract, anterior cortex		0		2	0.2%	2	0.3%
100.312	incipient cataract, posterior cortex		0		2	0.2%	4	0.7%
100.313	incipient cataract, equatorial cortex		0		8	0.9%	3	0.5%
100.314	incipient cataract, anterior sutures		0		0		1	0.2%
100.315	incipient cataract, posterior sutures		0		12	1.4%	9	1.5%
100.316	incipient cataract, nucleus		0		0		2	0.3%
100.330	generalized/complete cataract		0		0		1	0.2%
100.999	*significant cataracts (summary)*		*0*		*42*	*4.8%*	*42*	*7.0%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		0		0		1	0.2%
110.135	PHPV/PTVL		0		0		1	0.2%
110.320	vitreal degeneration		0		80	9.1%	54	9.0%
FUNDUS								
97.110	choroidal hypoplasia		0		0		1	0.2%
RETINA								
120.170	retinal dysplasia, folds		0		5	0.6%	6	1.0%
120.180	retinal dysplasia, geographic		0		3	0.3%	5	0.8%
120.310	generalized progressive retinal atrophy (PRA)		0		3	0.3%	3	0.5%
120.920	retinal detachment with dialysis		0		0		2	0.3%

OCULAR DISORDERS REPORT
MI-KI

RETINA CONTINUED	1991-1999	2000-2009	2010-2016
120.960 retinopathy	0	0	9 1.5%
OPTIC NERVE			
130.110 micropapilla	0	2 0.2%	0
130.120 optic nerve hypoplasia	0	1 0.1%	1 0.2%
130.150 optic disc coloboma	0	2 0.2%	0
OTHER			
900.000 other, unspecified	0	6 0.7%	18 3.0%
900.100 other, not inherited	0	55 6.3%	31 5.2%
900.110 other, suspected as inherited	0	7 0.8%	2 0.3%
NORMAL			
0.000 normal globe	0	600 68.3%	340 56.8%

OCULAR DISORDERS REPORT

MINIATURE AMERICAN SHEPHERD (AKC)/ MINIATURE AUSTRALIAN SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Presumed autosomal recessive with incomplete penetrance	1-6	NO
B.	Distichiasis	Not defined	1, 7, 21	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	21	Breeder option
D.	Iris coloboma	Not defined	1, 21, 22	NO
E.	Iris hypoplasia	Not defined		Breeder option
F.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
G.	Cataract * a DNA test is available	Autosomal co-dominant	1, 10, 11	NO
H.	Persistent hyaloid artery	Not defined	8	Breeder option
I.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1, 9, 12, 13	NO
J.	Cone degeneration - day blindness * a DNA test is available	Autosomal recessive	14	NO

OCULAR DISORDERS REPORT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
K.	Multifocal retinopathy - cmr1 * a DNA test is available	Autosomal recessive	15	Breeder option
L.	Retinal dysplasia - folds	Not defined		Breeder option
M.	Choroidal hypoplasia (Collie Eye Anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma * a DNA test is available	Autosomal recessive	1, 7, 16-19	NO
N.	Coloboma/staphyloma without microphthalmia	Not defined	1	NO
O.	Micropapilla	Not defined	20	Breeder option

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma.

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye with associated defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (dysplasia). In the Australian Shepherd, microphthalmia has long been suspected to be associated with merled coat coloration but a definitive genetic relationship has not been established. The eyes of affected homozygous merle (usually white) dogs have extreme forms of this entity and are usually blind at birth. Affected heterozygous merle-coated dogs demonstrate less severe manifestations.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Iris coloboma

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the OFA form.

E. Iris hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Australian Shepherd, a mutation in *HSF4* (heat shock transcription factor 4), the HSF4-2 mutation, has been shown to increase the likelihood of cataract formation. The mutation is inherited in a co-dominant manner. Dogs with one copy of the mutation develop bilateral posterior cataracts and homozygotes develop a nuclear cataract that

typically progresses to a mature cataract. A DNA test is available for this mutation. Other genetic factors can contribute to cataract formation in this breed and will not be detected by this test.

H. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

I. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Australian Shepherd is PRCD which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

J. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day blindness, color blindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a mutation in the *CNGB3* gene. A DNA test is available.

K. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal

thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

L. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

M. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

N. Coloboma/staphyloma (unassociated with microphthalmia)

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia (entity "A" above).

O. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

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OCULAR DISORDERS REPORT
MINI AMERICAN MINI AUSTRALIAN SHEPHERD

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 856 #	%	2000-2009 7534 #	%	2010-2016 6106 #	%
GLOBE							
0.110	microphthalmia	1	0.1%	15	0.2%	3	0.0%
10.000	glaucoma	0		0		1	0.0%
EYELIDS							
25.110	distichiasis	41	4.8%	384	5.1%	240	3.9%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.0%
40.910	keratoconjunctivitis sicca	0		0		2	0.0%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		2	0.0%
CORNEA							
70.220	pigmentary keratitis	0		1	0.0%	1	0.0%
70.700	corneal dystrophy	2	0.2%	44	0.6%	76	1.2%
70.730	corneal endothelial degeneration	0		5	0.1%	0	
UVEA							
90.250	pigmentary uveitis	0		0		1	0.0%
93.110	iris hypoplasia	0		19	0.3%	50	0.8%
93.150	iris coloboma	9	1.1%	174	2.3%	104	1.7%
93.710	persistent pupillary membranes, iris to iris	24	2.8%	651	8.6%	655	10.7%
93.720	persistent pupillary membranes, iris to lens	2	0.2%	9	0.1%	13	0.2%
93.730	persistent pupillary membranes, iris to cornea	0		4	0.1%	3	0.0%
93.740	persistent pupillary membranes, iris sheets	2	0.2%	7	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	0.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		3	0.0%
93.810	uveal melanoma	0		0		1	0.0%
97.150	chorioretinal coloboma, congenital	0		0		5	0.1%
LENS							
100.210	cataract, suspect not inherited	11	1.3%	82	1.1%	74	1.2%
100.301	punctate cataract, anterior cortex	4	0.5%	7	0.1%	9	0.1%
100.302	punctate cataract, posterior cortex	1	0.1%	2	0.0%	5	0.1%
100.303	punctate cataract, equatorial cortex	1	0.1%	4	0.1%	1	0.0%
100.304	punctate cataract, anterior sutures	0		3	0.0%	0	
100.305	punctate cataract, posterior sutures	3	0.4%	4	0.1%	6	0.1%
100.306	punctate cataract, nucleus	0		4	0.1%	0	
100.307	punctate cataract, capsular	1	0.1%	4	0.1%	3	0.0%
100.311	incipient cataract, anterior cortex	3	0.4%	13	0.2%	7	0.1%
100.312	incipient cataract, posterior cortex	0		19	0.3%	8	0.1%
100.313	incipient cataract, equatorial cortex	0		6	0.1%	2	0.0%
100.315	incipient cataract, posterior sutures	0		1	0.0%	2	0.0%
100.316	incipient cataract, nucleus	0		2	0.0%	4	0.1%
100.317	incipient cataract, capsular	0		4	0.1%	2	0.0%
100.322	incomplete cataract, posterior cortex	0		0		1	0.0%
100.327	incomplete cataract, capsular	0		0		1	0.0%
100.330	generalized/complete cataract	0		4	0.1%	2	0.0%

OCULAR DISORDERS REPORT
MINI AMERICAN MINI AUSTRALIAN SHEPHERD

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.375	subluxation/luxation, unspecified	0		1	0.0%	0	
100.999	*significant cataracts (summary)*	*13*	*1.5%*	*77*	*1.0%*	*53*	*0.9%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	0.4%	19	0.3%	21	0.3%
110.135	PHPV/PTVL	0		6	0.1%	9	0.1%
110.320	vitreal degeneration	2	0.2%	40	0.5%	35	0.6%
FUNDUS							
97.110	choroidal hypoplasia	3	0.4%	12	0.2%	12	0.2%
97.120	coloboma	2	0.2%	5	0.1%	1	0.0%
RETINA							
120.170	retinal dysplasia, folds	1	0.1%	26	0.3%	20	0.3%
120.180	retinal dysplasia, geographic	0		1	0.0%	0	
120.190	retinal dysplasia, detached	0		0		1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	5	0.6%	16	0.2%	7	0.1%
120.910	retinal detachment without dialysis	0		1	0.0%	0	
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		2	0.0%
OPTIC NERVE							
130.110	micropapilla	0		28	0.4%	40	0.7%
130.120	optic nerve hypoplasia	2	0.2%	12	0.2%	6	0.1%
130.150	optic disc coloboma	6	0.7%	7	0.1%	13	0.2%
OTHER							
900.000	other, unspecified	0		30	0.4%	99	1.6%
900.100	other, not inherited	3	0.4%	175	2.3%	91	1.5%
900.110	other, suspected as inherited	3	0.4%	7	0.1%	4	0.1%
NORMAL							
0.000	normal globe	753	88.0%	6533	86.7%	4919	80.6%

OCULAR DISORDERS REPORT

MINIATURE BULL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - endothelial	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	2, 3	Breeder option
	- iris to lens	Not defined	4	NO
	- iris to cornea	Not defined	4	NO
	- iris sheets	Not defined	2	NO
	- lens pigment foci/no strands	Not defined	9	Passes with no notation
	- endothelial opacity/ no strands	Not defined	4	NO
C.	Cataract	Not defined	3	NO
D.	Lens luxation * a DNA test is available	Autosomal recessive	2, 5-8, 10	NO
E.	Vitreous degeneration	Not defined	1, 3, 4	Breeder option
F.	Retinal atrophy - generalized	Not defined	4	NO

Description and Comments

A. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

Although the total number of Miniature Bull Terriers presented for OFA/CERF examination is not large, the incidence of PPM in this breed is approximately 10% in recent years. Some of these PPM's have been iris to cornea and iris to lens. Considerable discretion should be used before breeding a dog with the latter more severe forms of PPM.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

Two loci with potentially enhancing effects on the ADAMTS17 mutation are associated with primary lens luxation (PLL) in Australian Miniature Bull Terriers. PLL associated allele of the BICF2G630420272 SNP increases the risk of PLL in the presence of the ADAMTS17 mutation. Candidate genes in the two regions of interest included CPE on chromosome 15 and CTCF on chromosome 1. The ADAMTS17 mutation is also associated with abnormal foot and nail shapes, pedal hyperkeratosis, and persistent pupillary membranes. Association of the ADAMTS17 mutation with possible pedal skeletal abnormalities in the Miniature Bull Terriers supports primary lens luxation in this breed and Marchesani syndrome-like disease in humans as being homologous diseases.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

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6. Sargan DR, Withers D, Pettitt L, et al. Mapping the mutation causing lens luxation in several Terrier breeds. *J Hered*. 2007;98:534-538.

7. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

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10. Gharanhkhani P, O'Leary CA, Duffy DL, Kyaw-Tanner M. Potential modifying loci associated with primary lens luxation, pedal hyperkeratosis, and ocular phenotypes in Miniature Bull Terriers. Invest. Ophthalmol. Vis. Sci. 2015; 56(13):8288-8296. doi:10.1167/iovs.15-18074.

OCULAR DISORDERS REPORT
MINIATURE BULL TERRIER

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**432**		**676**		**150**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
GLOBE							
0.110	microphthalmia	2	0.5%	1	0.1%	0	
10.000	glaucoma	1	0.2%	0		0	
EYELIDS							
22.000	ectropion, unspecified	0		1	0.1%	0	
25.110	distichiasis	0		0		1	0.7%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		4	0.6%	1	0.7%
CORNEA							
70.700	corneal dystrophy	1	0.2%	1	0.1%	3	2.0%
70.730	corneal endothelial degeneration	7	1.6%	6	0.9%	0	
UVEA							
93.140	corneal endothelial pigment without PPM	0		4	0.6%	0	
93.710	persistent pupillary membranes, iris to iris	41	9.5%	34	5.0%	5	3.3%
93.720	persistent pupillary membranes, iris to lens	22	5.1%	27	4.0%	3	2.0%
93.730	persistent pupillary membranes, iris to cornea	36	8.3%	45	6.7%	1	0.7%
93.740	persistent pupillary membranes, iris sheets	6	1.4%	2	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		3	0.4%	4	2.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		7	1.0%	7	4.7%
LENS							
100.200	cataract, unspecified	2	0.5%	0		0	
100.210	cataract, suspect not inherited	16	3.7%	28	4.1%	8	5.3%
100.301	punctate cataract, anterior cortex	7	1.6%	3	0.4%	1	0.7%
100.302	punctate cataract, posterior cortex	0		1	0.1%	0	
100.305	punctate cataract, posterior sutures	0		1	0.1%	0	
100.307	punctate cataract, capsular	0		4	0.6%	0	
100.311	incipient cataract, anterior cortex	7	1.6%	6	0.9%	2	1.3%
100.312	incipient cataract, posterior cortex	1	0.2%	3	0.4%	1	0.7%
100.313	incipient cataract, equatorial cortex	0		1	0.1%	0	
100.314	incipient cataract, anterior sutures	0		1	0.1%	0	
100.317	incipient cataract, capsular	0		10	1.5%	2	1.3%
100.330	generalized/complete cataract	1	0.2%	3	0.4%	0	
100.375	subluxation/luxation, unspecified	24	5.6%	25	3.7%	2	1.3%
100.999	*significant cataracts (summary)*	*18*	*4.2%*	*33*	*4.9%*	*6*	*4.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.1%	0	
110.320	vitreal degeneration	3	0.7%	16	2.4%	5	3.3%
RETINA							
120.170	retinal dysplasia, folds	0		3	0.4%	0	
120.180	retinal dysplasia, geographic	0		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	3	0.7%	10	1.5%	0	

OCULAR DISORDERS REPORT
MINIATURE BULL TERRIER

	1991-1999	2000-2009	2010-2016
OPTIC NERVE			
130.110 micropapilla	2 0.5%	9 1.3%	1 0.7%
130.120 optic nerve hypoplasia	2 0.5%	1 0.1%	0
130.150 optic disc coloboma	0	1 0.1%	0
OTHER			
900.000 other, unspecified	0	7 1.0%	2 1.3%
900.100 other, not inherited	1 0.2%	31 4.6%	5 3.3%
900.110 other, suspected as inherited	13 3.0%	5 0.7%	1 0.7%
NORMAL			
0.000 normal globe	302 69.9%	513 75.9%	119 79.3%

OCULAR DISORDERS REPORT

MINIATURE PINSCHER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder option
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
C.	Cataract	Not defined	1	NO
D.	Vitreous degeneration	Not defined	5	Breeder option
E.	Retinal atrophy - generalized	Presumed autosomal recessive	2	NO
F.	Optic nerve hypoplasia	Not defined	2	NO

Description and Comments

A. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume

cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

F. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Miniature Pinscher. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds, Report 2010-2015.

5. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
MINIATURE PINSCHER

	TOTAL DOGS EXAMINED	1991-1999 253		2000-2009 352		2010-2016 228	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	2	0.8%	1	0.3%	0	
EYELIDS							
20.140	ectopic cilia	0		0		1	0.4%
21.000	entropion, unspecified	2	0.8%	0		1	0.4%
22.000	ectropion, unspecified	1	0.4%	0		0	
25.110	distichiasis	3	1.2%	2	0.6%	0	
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		1	0.4%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		2	0.9%
CORNEA							
70.210	corneal pannus	1	0.4%	1	0.3%	0	
70.220	pigmentary keratitis	0		2	0.6%	2	0.9%
70.700	corneal dystrophy	20	7.9%	19	5.4%	5	2.2%
70.730	corneal endothelial degeneration	1	0.4%	0		1	0.4%
UVEA							
93.140	corneal endothelial pigment without PPM	0		1	0.3%	0	
93.710	persistent pupillary membranes, iris to iris	7	2.8%	17	4.8%	2	0.9%
93.720	persistent pupillary membranes, iris to lens	0		0		1	0.4%
93.730	persistent pupillary membranes, iris to cornea	0		0		1	0.4%
93.740	persistent pupillary membranes, iris sheets	0		0		1	0.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		9	3.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.3%	0	
LENS							
100.210	cataract, suspect not inherited	7	2.8%	19	5.4%	4	1.8%
100.301	punctate cataract, anterior cortex	3	1.2%	2	0.6%	2	0.9%
100.302	punctate cataract, posterior cortex	0		4	1.1%	1	0.4%
100.303	punctate cataract, equatorial cortex	0		0		1	0.4%
100.304	punctate cataract, anterior sutures	1	0.4%	0		0	
100.305	punctate cataract, posterior sutures	2	0.8%	1	0.3%	0	
100.307	punctate cataract, capsular	0		1	0.3%	1	0.4%
100.311	incipient cataract, anterior cortex	5	2.0%	4	1.1%	8	3.5%
100.312	incipient cataract, posterior cortex	3	1.2%	4	1.1%	3	1.3%
100.313	incipient cataract, equatorial cortex	3	1.2%	0		0	
100.315	incipient cataract, posterior sutures	1	0.4%	0		0	
100.317	incipient cataract, capsular	0		1	0.3%	0	
100.321	incomplete cataract, anterior cortex	0		0		1	0.4%
100.322	incomplete cataract, posterior cortex	0		0		1	0.4%
100.330	generalized/complete cataract	6	2.4%	1	0.3%	0	
100.375	subluxation/luxation, unspecified	2	0.8%	0		1	0.4%
100.999	*significant cataracts (summary)*	*24*	*9.5%*	*18*	*5.1%*	*18*	*7.9%*

OCULAR DISORDERS REPORT
MINIATURE PINSCHER

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	2	0.8%	2	0.6%	1	0.4%
110.135	PHPV/PTVL	2	0.8%	0		0	
110.320	vitreal degeneration	8	3.2%	28	8.0%	9	3.9%
FUNDUS							
97.120	coloboma	1	0.4%	0		0	
RETINA							
120.170	retinal dysplasia, folds	2	0.8%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	8	3.2%	4	1.1%	0	
120.910	retinal detachment without dialysis	0		3	0.9%	0	
OPTIC NERVE							
130.110	micropapilla	0		0		2	0.9%
130.120	optic nerve hypoplasia	5	2.0%	4	1.1%	0	
OTHER							
900.000	other, unspecified	0		4	1.1%	8	3.5%
900.100	other, not inherited	1	0.4%	25	7.1%	11	4.8%
900.110	other, suspected as inherited	5	2.0%	2	0.6%	0	
NORMAL							
0.000	normal globe	183	72.3%	269	76.4%	171	75.0%

OCULAR DISORDERS REPORT

MINIATURE SCHNAUZER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with congenital cataract	Autosomal recessive	1-4	NO
B.	Distichiasis	Not defined	1, 18	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	17	Breeder option
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	6	Breeder option
	- lens pigment foci/no strands	Not defined	7	Passes with no notation
E.	Cataract	Autosomal recessive	1, 8-11	NO
F.	Vitreous degeneration	Not defined	17	Breeder option
G.	Retinal atrophy-generalized	Not defined	1, 12, 13	NO
H.	Retinal dysplasia			
	- folds	Not defined	14	Breeder option
	- geographic/detached	Not defined	14	NO
I.	Ceroid lipofuscinosis	Presumed autosomal recessive	15, 16	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Microphthalmia with congenital cataract

Congenital nuclear and posterior cortical lens opacities that progress slowly. In some cases, these cataracts appear similar to the congenital cataracts described in “E” below. An associated abnormality in this defect is microphthalmia that is often mild and is accompanied by a 1-3 mm reduction in the axial length of the globe as determined by ultrasonography. The cataracts often do not become mature and cause blindness until the dogs reach 3-5 years of age. Congenital cataracts and microphthalmia are inherited as an autosomal recessive disorder.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Congenital cataracts in the Miniature Schnauzer are bilateral and appear prior to 6 weeks of age. At this time they may already involve the entire lens. Others will first appear as posterior subcapsular opacities and usually progress to complete cataracts. These congenital

cataracts are inherited as an autosomal recessive trait. Later-onset cataracts may represent a genetically distinct entity. There are other types of cataract in the breed which are also likely hereditary.

Note: It is not certain whether A and F are genetically distinct, or different manifestations of the same entity, as eyes affected with cataracts are often smaller than normal.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most forms of PRA are inherited as recessive traits.

A form of PRA in the Miniature Schnauzer was previously characterized and called photoreceptor dysplasia (now called Type A PRA). The dysplasia results from the abnormal development of visual cells followed by their degeneration. The disorder appears to affect the generation of an electrical signal within the retinal photoreceptor cells. Although fundus abnormalities usually are not present until 2-3 years of age, abnormalities of the electroretinogram can be demonstrated by 8-10 weeks of age. Clinical signs include mildly impaired night vision and variable rate of progression.

Initial studies suggested a mutation in phosducin was responsible, but this was disproven. This disease is extremely rare. The causative gene for Type A PRA has not been published although a DNA test is available. Another more common autosomal recessive form of PRA appears to be present in the Miniature Schnauzer, but the causative gene has not yet been determined; it also affects dogs ~2-4 years of age. Lastly, cases of late-onset PRA in the breed are recognized clinically but the inheritance pattern is unknown. (G. Aguirre personal communication 2016).

H. Retinal dysplasia – folds, geographic, detached

Abnormal development of the retina present at birth usually recognized to have three forms: folds, geographic and retinal detachment. However, in the Miniature Schnauzer retinal dysplasia is also associated with persistent hyperplastic primary vitreous. These are described below:

Retinal dysplasia - folds: Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other form of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These last two forms are associated with vision impairment or blindness. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

Retinal dysplasia with persistent hyperplastic primary vitreous: In the Miniature Schnauzer persistent hyperplastic primary vitreous is associated with retinal dysplasia in some dogs. In this association it may be unilateral or bilateral and most often manifests as small white posterior lens capsule plaques accompanied by white primary vitreous mass extending to the optic disc. Patent hyaloid arteries and posterior lens capsule vessels may also be present.

I. Ceroid lipofuscinosis

An inherited disease of man and animals characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease). This disease is very rare.

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17. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 2000-2009.

18. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
MINIATURE SCHNAUZER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 8082 #	%	2000-2009 14122 #	%	2010-2016 7663 #	%
GLOBE							
0.110	microphthalmia	9	0.1%	9	0.1%	5	0.1%
EYELIDS							
21.000	entropion, unspecified	3	0.0%	0		2	0.0%
25.110	distichiasis	154	1.9%	310	2.2%	155	2.0%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.0%
40.910	keratoconjunctivitis sicca	0		2	0.0%	4	0.1%
NICTITANS							
51.100	third eyelid cartilage anomaly	1	0.0%	0		0	
52.110	prolapsed gland of the third eyelid	1	0.0%	0		3	0.0%
CORNEA							
70.210	corneal pannus	2	0.0%	0		0	
70.220	pigmentary keratitis	2	0.0%	5	0.0%	0	
70.700	corneal dystrophy	47	0.6%	66	0.5%	40	0.5%
70.730	corneal endothelial degeneration	4	0.0%	10	0.1%	3	0.0%
UVEA							
90.250	pigmentary uveitis	0		1	0.0%	1	0.0%
93.140	corneal endothelial pigment without PPM	0		6	0.0%	4	0.1%
93.150	iris coloboma	0		0		1	0.0%
93.710	persistent pupillary membranes, iris to iris	55	0.7%	306	2.2%	125	1.6%
93.720	persistent pupillary membranes, iris to lens	11	0.1%	32	0.2%	7	0.1%
93.730	persistent pupillary membranes, iris to cornea	19	0.2%	44	0.3%	17	0.2%
93.740	persistent pupillary membranes, iris sheets	2	0.0%	10	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		7	0.0%	84	1.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		2	0.0%	11	0.1%
93.999	uveal cysts	0		1	0.0%	0	
LENS							
100.200	cataract, unspecified	61	0.8%	0		0	
100.210	cataract, suspect not inherited	129	1.6%	298	2.1%	185	2.4%
100.301	punctate cataract, anterior cortex	39	0.5%	36	0.3%	21	0.3%
100.302	punctate cataract, posterior cortex	16	0.2%	19	0.1%	12	0.2%
100.303	punctate cataract, equatorial cortex	11	0.1%	10	0.1%	15	0.2%
100.304	punctate cataract, anterior sutures	6	0.1%	8	0.1%	1	0.0%
100.305	punctate cataract, posterior sutures	11	0.1%	25	0.2%	23	0.3%
100.306	punctate cataract, nucleus	5	0.1%	4	0.0%	6	0.1%
100.307	punctate cataract, capsular	0		12	0.1%	20	0.3%
100.311	incipient cataract, anterior cortex	35	0.4%	38	0.3%	32	0.4%
100.312	incipient cataract, posterior cortex	36	0.4%	70	0.5%	36	0.5%
100.313	incipient cataract, equatorial cortex	16	0.2%	30	0.2%	16	0.2%
100.314	incipient cataract, anterior sutures	2	0.0%	5	0.0%	1	0.0%
100.315	incipient cataract, posterior sutures	10	0.1%	12	0.1%	15	0.2%
100.316	incipient cataract, nucleus	8	0.1%	8	0.1%	10	0.1%
100.317	incipient cataract, capsular	0		13	0.1%	13	0.2%

OCULAR DISORDERS REPORT
MINIATURE SCHNAUZER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.321	incomplete cataract, anterior cortex	0		0		10	0.1%
100.322	incomplete cataract, posterior cortex	0		0		15	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.0%
100.325	incomplete cataract, posterior sutures	0		0		1	0.0%
100.326	incomplete cataract, nucleus	0		0		15	0.2%
100.327	incomplete cataract, capsular	0		0		2	0.0%
100.330	generalized/complete cataract	52	0.6%	71	0.5%	29	0.4%
100.340	resorbing/hypermature cataract	0		0		1	0.0%
100.375	subluxation/luxation, unspecified	3	0.0%	4	0.0%	0	
100.999	*significant cataracts (summary)*	*308*	*3.8%*	*361*	*2.6%*	*295*	*3.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	9	0.1%	21	0.1%	7	0.1%
110.135	PHPV/PTVL	2	0.0%	16	0.1%	6	0.1%
110.320	vitreal degeneration	35	0.4%	101	0.7%	45	0.6%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.0%	3	0.0%
97.120	coloboma	0		1	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	10	0.1%	48	0.3%	9	0.1%
120.180	retinal dysplasia, geographic	3	0.0%	41	0.3%	5	0.1%
120.190	retinal dysplasia, detached	0		29	0.2%	3	0.0%
120.310	generalized progressive retinal atrophy (PRA)	89	1.1%	50	0.4%	11	0.1%
120.400	retinal hemorrhage	2	0.0%	3	0.0%	1	0.0%
120.910	retinal detachment without dialysis	6	0.1%	7	0.0%	1	0.0%
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		4	0.1%
OPTIC NERVE							
130.110	micropapilla	0		38	0.3%	6	0.1%
130.120	optic nerve hypoplasia	8	0.1%	5	0.0%	3	0.0%
130.150	optic disc coloboma	0		1	0.0%	1	0.0%
OTHER							
900.000	other, unspecified	0		38	0.3%	120	1.6%
900.100	other, not inherited	14	0.2%	326	2.3%	117	1.5%
900.110	other, suspected as inherited	31	0.4%	31	0.2%	0	
NORMAL							
0.000	normal globe	7333	90.7%	13014	92.2%	6846	89.3%

MUDI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Mudi breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
MUDI

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 15 #	%	2010-2016 59 #	%
EYELIDS							
25.110	distichiasis	0		0		2	3.4%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		1	6.7%	7	11.9%
LENS							
100.210	cataract, suspect not inherited	0		0		2	3.4%
100.316	incipient cataract, nucleus	0		1	6.7%	0	
100.999	*significant cataracts (summary)*	*0*		*1*	*6.7%*	*0*	
OTHER							
900.000	other, unspecified	0		1	6.7%	0	
900.100	other, not inherited	0		0		3	5.1%
NORMAL							
0.000	normal globe	0		13	86.7%	48	81.4%

NEAPOLITAN MASTIFF

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	3	Breeder option
B.	Ectropion	Not defined	3	Breeder option
C.	Macroblepharon/ macropalpebral fissure	Not defined	3	Breeder option
D.	Distichiasis	Not defined	3	Breeder option
E.	Prolapsed gland of the third eyelid	Not defined	2	Breeder option
F.	Cataract	Not defined	1	NO

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Macroblepharon/macropalpebral fissure

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Prolapsed gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated and cause tear film anomalies. Commonly referred to as "cherry eye."

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Neapolitan Mastiff breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, consensus agreed/supportive vote.

3. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
NEAPOLITAN MASTIFF

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 13 #	 %	2000-2009 9 #	 %	2010-2016 55 #	 %
EYELIDS								
20.160	macropalpebral fissure		4	30.8%	1	11.1%	9	16.4%
21.000	entropion, unspecified		4	30.8%	0		15	27.3%
22.000	ectropion, unspecified		4	30.8%	4	44.4%	19	34.5%
25.110	distichiasis		0		1	11.1%	7	12.7%
NASOLACRIMAL								
40.910	keratoconjunctivitis sicca		0		0		1	1.8%
NICTITANS								
51.100	third eyelid cartilage anomaly		0		1	11.1%	0	
52.110	prolapsed gland of the third eyelid		1	7.7%	0		4	7.3%
CORNEA								
70.220	pigmentary keratitis		0		0		3	5.5%
70.700	corneal dystrophy		0		0		1	1.8%
UVEA								
93.730	persistent pupillary membranes, iris to cornea		1	7.7%	0		0	
LENS								
100.210	cataract, suspect not inherited		0		0		1	1.8%
100.306	punctate cataract, nucleus		0		0		1	1.8%
100.313	incipient cataract, equatorial cortex		1	7.7%	0		0	
100.316	incipient cataract, nucleus		1	7.7%	0		0	
100.330	generalized/complete cataract		3	23.1%	0		0	
100.999	*significant cataracts (summary)*		*5*	*38.5%*	*0*		*1*	*1.8%*
RETINA								
120.170	retinal dysplasia, folds		0		1	11.1%	1	1.8%
120.960	retinopathy		0		0		1	1.8%
OTHER								
900.000	other, unspecified		0		0		1	1.8%
900.100	other, not inherited		0		0		5	9.1%
900.110	other, suspected as inherited		1	7.7%	0		1	1.8%
NORMAL								
0.000	normal globe		4	30.8%	4	44.4%	17	30.9%

OCULAR DISORDERS REPORT

NEDERLANDSE KOOIKERHONDJE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Nederlandse Kooikerhondje breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
NEDERLANDSE KOOIKERHONDJE

Diagnostic Name		1991-1999 0 #	%	2000-2009 0 #	%	2010-2016 102 #	%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		1	1.0%
93.730	persistent pupillary membranes, iris to cornea	0		0		1	1.0%
LENS							
100.210	cataract, suspect not inherited	0		0		7	6.9%
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		0		1	1.0%
110.320	vitreal degeneration	0		0		2	2.0%
RETINA							
120.960	retinopathy	0		0		1	1.0%
OTHER							
900.000	other, unspecified	0		0		2	2.0%
900.100	other, not inherited	0		0		6	5.9%
NORMAL							
0.000	normal globe	0		0		87	85.3%

NEWFOUNDLAND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	2	NO
B.	Entropion	Not defined	3	Breeder option
C.	Ectropion	Not defined	3	Breeder option
D.	Macroblepharon/ macropalpebral fissure	Not defined	3	Breeder option
E.	Distichiasis	Not defined	4	Breeder option
F.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
G.	Uveal cysts	Not defined	3	Breeder option
H.	Cataract	Not defined	3	NO
I.	Retinal dysplasia - folds	Not defined	2, 3, 5	Breeder option
J.	Retinal atrophy - generalized	Not defined	6	NO

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure which, when sustained even for a brief period of time, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening examination.

Some Newfoundlands have an abnormality of the iridocorneal angle termed goniodysgenesis. This abnormality is not visible during routine ophthalmic examination using a slitlamp biomicroscope and an indirect ophthalmoscope. There appears to be an association between goniodysgenesis and glaucoma, but the mechanism by which the angle

defect results in glaucoma has not been determined. The inheritance of goniodysgenesis in the Newfoundland is not known. Until the inheritance is determined, control should be directed towards removing dogs from breeding that have glaucoma and have goniodysgenesis, as well as those dogs that produce progeny afflicted with glaucoma.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Ectropion

A conformational defect resulting in eversion of the eyelids, which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Macroblepharon/macropalpebral fissure

Abnormally large eyelid opening; may lead to secondary conditions associated with corneal exposure. In the Newfoundland, ectropion is associated with an exceptionally large palpebral fissure and laxity of the canthal structures. Central lower lid ectropion is often associated with entropion of the adjacent lid. This causes severe ocular irritation.

E. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Uveal cysts

A pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are

commonly benign, although they may be associated with other pathologic conditions is various breeds.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

J. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

References

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

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3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Report, 2013-2014.

5. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

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OCULAR DISORDERS REPORT
NEWFOUNDLAND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 867 #	%	2000-2009 1448 #	%	2010-2016 874 #	%
GLOBE								
0.110	microphthalmia		4	0.5%	1	0.1%	1	0.1%
10.000	glaucoma		0		0		1	0.1%
EYELIDS								
20.160	macropalpebral fissure		17	2.0%	90	6.2%	21	2.4%
21.000	entropion, unspecified		59	6.8%	106	7.3%	47	5.4%
22.000	ectropion, unspecified		44	5.1%	132	9.1%	50	5.7%
25.110	distichiasis		7	0.8%	5	0.3%	9	1.0%
NASOLACRIMAL								
40.910	keratoconjunctivitis sicca		0		1	0.1%	0	
NICTITANS								
51.100	third eyelid cartilage anomaly		0		11	0.8%	3	0.3%
52.110	prolapsed gland of the third eyelid		5	0.6%	3	0.2%	1	0.1%
CORNEA								
70.210	corneal pannus		1	0.1%	0		0	
70.220	pigmentary keratitis		0		2	0.1%	0	
70.700	corneal dystrophy		0		1	0.1%	0	
UVEA								
93.140	corneal endothelial pigment without PPM		0		0		1	0.1%
93.710	persistent pupillary membranes, iris to iris		3	0.3%	10	0.7%	9	1.0%
93.720	persistent pupillary membranes, iris to lens		2	0.2%	3	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea		2	0.2%	3	0.2%	0	
93.740	persistent pupillary membranes, iris sheets		0		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		2	0.2%
93.810	uveal melanoma		0		0		1	0.1%
93.999	uveal cysts		14	1.6%	19	1.3%	21	2.4%
LENS								
100.200	cataract, unspecified		11	1.3%	0		0	
100.210	cataract, suspect not inherited		19	2.2%	63	4.4%	24	2.7%
100.301	punctate cataract, anterior cortex		1	0.1%	4	0.3%	2	0.2%
100.302	punctate cataract, posterior cortex		6	0.7%	4	0.3%	3	0.3%
100.303	punctate cataract, equatorial cortex		0		3	0.2%	3	0.3%
100.305	punctate cataract, posterior sutures		1	0.1%	2	0.1%	4	0.5%
100.306	punctate cataract, nucleus		2	0.2%	1	0.1%	0	
100.307	punctate cataract, capsular		0		2	0.1%	2	0.2%
100.311	incipient cataract, anterior cortex		6	0.7%	7	0.5%	5	0.6%
100.312	incipient cataract, posterior cortex		40	4.6%	33	2.3%	15	1.7%
100.313	incipient cataract, equatorial cortex		5	0.6%	9	0.6%	5	0.6%
100.314	incipient cataract, anterior sutures		2	0.2%	1	0.1%	0	
100.315	incipient cataract, posterior sutures		6	0.7%	5	0.3%	2	0.2%
100.316	incipient cataract, nucleus		4	0.5%	4	0.3%	5	0.6%
100.317	incipient cataract, capsular		0		6	0.4%	2	0.2%
100.322	incomplete cataract, posterior cortex		0		0		5	0.6%
100.323	incomplete cataract, equatorial cortex		0		0		1	0.1%
100.330	generalized/complete cataract		19	2.2%	18	1.2%	1	0.1%

OCULAR DISORDERS REPORT
NEWFOUNDLAND

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.375	subluxation/luxation, unspecified	1	0.1%	0		0	
100.999	*significant cataracts (summary)*	*103*	*11.9%*	*99*	*6.8%*	*55*	*6.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.1%	4	0.5%
110.135	PHPV/PTVL	0		3	0.2%	1	0.1%
110.320	vitreal degeneration	2	0.2%	1	0.1%	2	0.2%
RETINA							
120.170	retinal dysplasia, folds	10	1.2%	15	1.0%	2	0.2%
120.180	retinal dysplasia, geographic	0		2	0.1%	0	
120.190	retinal dysplasia, detached	0		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.1%	0		0	
120.910	retinal detachment without dialysis	0		1	0.1%	0	
120.960	retinopathy	0		0		1	0.1%
OPTIC NERVE							
130.120	optic nerve hypoplasia	7	0.8%	0		0	
130.150	optic disc coloboma	0		1	0.1%	0	
OTHER							
900.000	other, unspecified	0		7	0.5%	22	2.5%
900.100	other, not inherited	8	0.9%	61	4.2%	22	2.5%
900.110	other, suspected as inherited	14	1.6%	12	0.8%	3	0.3%
NORMAL							
0.000	normal globe	639	73.7%	1096	75.7%	676	77.3%

NORFOLK TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	4-6	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation
B.	Cataract	Not defined	6	NO
C.	Lens luxation * a DNA test is available	Not defined	2, 3	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

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5. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 2000-2009.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
NORFOLK TERRIER

	TOTAL DOGS EXAMINED	1991-1999 124		2000-2009 773		2010-2016 480	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
EYELIDS							
20.160	macropalpebral fissure	0		1	0.1%	0	
25.110	distichiasis	0		4	0.5%	2	0.4%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		2	0.4%
CORNEA							
70.700	corneal dystrophy	1	0.8%	7	0.9%	4	0.8%
70.730	corneal endothelial degeneration	0		0		1	0.2%
UVEA							
93.140	corneal endothelial pigment without PPM	0		0		1	0.2%
93.710	persistent pupillary membranes, iris to iris	9	7.3%	163	21.1%	114	23.8%
93.720	persistent pupillary membranes, iris to lens	0		1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	3	2.4%	0		1	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.3%	6	1.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		2	0.4%
LENS							
100.200	cataract, unspecified	1	0.8%	0		0	
100.210	cataract, suspect not inherited	4	3.2%	34	4.4%	6	1.2%
100.301	punctate cataract, anterior cortex	0		3	0.4%	2	0.4%
100.302	punctate cataract, posterior cortex	0		3	0.4%	2	0.4%
100.305	punctate cataract, posterior sutures	0		8	1.0%	1	0.2%
100.306	punctate cataract, nucleus	0		1	0.1%	0	
100.307	punctate cataract, capsular	0		2	0.3%	0	
100.311	incipient cataract, anterior cortex	1	0.8%	5	0.6%	1	0.2%
100.312	incipient cataract, posterior cortex	1	0.8%	13	1.7%	2	0.4%
100.313	incipient cataract, equatorial cortex	1	0.8%	2	0.3%	2	0.4%
100.315	incipient cataract, posterior sutures	0		2	0.3%	0	
100.317	incipient cataract, capsular	0		4	0.5%	0	
100.322	incomplete cataract, posterior cortex	0		0		2	0.4%
100.330	generalized/complete cataract	1	0.8%	3	0.4%	0	
100.999	*significant cataracts (summary)*	*5*	*4.0%*	*46*	*6.0%*	*12*	*2.5%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.8%	3	0.4%	3	0.6%
110.135	PHPV/PTVL	0		0		1	0.2%
110.320	vitreal degeneration	2	1.6%	4	0.5%	2	0.4%
FUNDUS							
97.120	coloboma	0		1	0.1%	0	
RETINA							
120.170	retinal dysplasia, folds	0		5	0.6%	2	0.4%
120.180	retinal dysplasia, geographic	0		1	0.1%	1	0.2%
120.310	generalized progressive retinal atrophy (PRA)	3	2.4%	7	0.9%	0	
120.910	retinal detachment without dialysis	0		1	0.1%	0	

OCULAR DISORDERS REPORT
NORFOLK TERRIER

	1991-1999		2000-2009		2010-2016	
OPTIC NERVE						
130.110 micropapilla	0		8	1.0%	3	0.6%
130.120 optic nerve hypoplasia	1	0.8%	14	1.8%	3	0.6%
130.150 optic disc coloboma	1	0.8%	14	1.8%	4	0.8%
OTHER						
900.000 other, unspecified	0		2	0.3%	12	2.5%
900.100 other, not inherited	0		38	4.9%	20	4.2%
900.110 other, suspected as inherited	1	0.8%	5	0.6%	0	
NORMAL						
0.000 normal globe	101	81.5%	569	73.6%	318	66.2%

OCULAR DISORDERS REPORT

NORBOTTENSPETS

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Norbottenspets. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
NORRBOTTENSPETS

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 42 #	 %	2000-2009 43 #	 %	2010-2016 22 #	 %
EYELIDS								
25.110	distichiasis		0		1	2.3%	0	
CORNEA								
70.700	corneal dystrophy		1	2.4%	0		0	
UVEA								
93.710	persistent pupillary membranes, iris to iris		2	4.8%	3	7.0%	1	4.5%
93.720	persistent pupillary membranes, iris to lens		1	2.4%	0		0	
LENS								
100.210	cataract, suspect not inherited		2	4.8%	2	4.7%	1	4.5%
100.302	punctate cataract, posterior cortex		2	4.8%	0		0	
100.305	punctate cataract, posterior sutures		1	2.4%	0		0	
100.306	punctate cataract, nucleus		1	2.4%	0		0	
100.311	incipient cataract, anterior cortex		7	16.7%	0		0	
100.312	incipient cataract, posterior cortex		9	21.4%	0		0	
100.315	incipient cataract, posterior sutures		1	2.4%	0		0	
100.316	incipient cataract, nucleus		2	4.8%	1	2.3%	0	
100.330	generalized/complete cataract		1	2.4%	0		0	
100.999	*significant cataracts (summary)*		*24*	*57.1%*	*1*	*2.3%*	*0*	
RETINA								
120.170	retinal dysplasia, folds		1	2.4%	0		0	
120.310	generalized progressive retinal atrophy (PRA)		2	4.8%	0		0	
OTHER								
900.100	other, not inherited		0		3	7.0%	0	
NORMAL								
0.000	normal globe		26	61.9%	36	83.7%	21	95.5%

OCULAR DISORDERS REPORT

NORWEGIAN BUHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1, 4	NO
B.	Cataract - pulverulent	Presumed autosomal dominant	2, 4	Breeder option
C.	Retinal dysplasia - folds	Not defined	3	Breeder option

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Cataract - pulverulent

With the pulverulent cataract in the Norwegian Buhund, initial lens changes may be visible as early as 6.5 weeks of age as small dots parallel to the suture lines behind the nucleus. By the age of 4 to 5.5 years, the opacities progress to involve the fetal nucleus which then resembles a ball of candy floss. The adult nucleus and the cortex remain clear. An autosomal dominant mode of inheritance with a high degree of penetrance has been suggested.

Rates of progression of these cataracts can vary, and have been noted to develop in older animals (over the age of 7) that were previously documented to be free from this condition.

C. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

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3. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Report, 2013-2014.

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OCULAR DISORDERS REPORT
NORWEGIAN BUHUND

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 139 #	 %	2000-2009 277 #	 %	2010-2016 270 #	 %
GLOBE							
10.000	glaucoma	0		0		1	0.4%
EYELIDS							
25.110	distichiasis	0		1	0.4%	1	0.4%
CORNEA							
70.700	corneal dystrophy	0		3	1.1%	4	1.5%
UVEA							
93.110	iris hypoplasia	0		0		1	0.4%
93.710	persistent pupillary membranes, iris to iris	0		1	0.4%	1	0.4%
93.740	persistent pupillary membranes, iris sheets	0		1	0.4%	0	
LENS							
100.210	cataract, suspect not inherited	4	2.9%	45	16.2%	31	11.5%
100.301	punctate cataract, anterior cortex	2	1.4%	2	0.7%	2	0.7%
100.302	punctate cataract, posterior cortex	3	2.2%	2	0.7%	4	1.5%
100.303	punctate cataract, equatorial cortex	0		0		1	0.4%
100.305	punctate cataract, posterior sutures	2	1.4%	2	0.7%	2	0.7%
100.306	punctate cataract, nucleus	2	1.4%	5	1.8%	3	1.1%
100.307	punctate cataract, capsular	0		1	0.4%	0	
100.311	incipient cataract, anterior cortex	0		3	1.1%	1	0.4%
100.312	incipient cataract, posterior cortex	4	2.9%	9	3.2%	7	2.6%
100.313	incipient cataract, equatorial cortex	0		0		2	0.7%
100.315	incipient cataract, posterior sutures	2	1.4%	6	2.2%	2	0.7%
100.316	incipient cataract, nucleus	0		8	2.9%	7	2.6%
100.321	incomplete cataract, anterior cortex	0		0		1	0.4%
100.322	incomplete cataract, posterior cortex	0		0		1	0.4%
100.325	incomplete cataract, posterior sutures	0		0		1	0.4%
100.330	generalized/complete cataract	3	2.2%	2	0.7%	1	0.4%
100.999	*significant cataracts (summary)*	*18*	*12.9%*	*40*	*14.4%*	*35*	*13.0%*
RETINA							
120.170	retinal dysplasia, folds	2	1.4%	1	0.4%	5	1.9%
120.310	generalized progressive retinal atrophy (PRA)	1	0.7%	0		2	0.7%
120.960	retinopathy	0		0		3	1.1%
OTHER							
900.000	other, unspecified	0		3	1.1%	11	4.1%
900.100	other, not inherited	3	2.2%	14	5.1%	11	4.1%
900.110	other, suspected as inherited	1	0.7%	6	2.2%	1	0.4%
NORMAL							
0.000	normal globe	116	83.5%	203	73.3%	193	71.5%

OCULAR DISORDERS REPORT

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NORWEGIAN ELKHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-6	NO
B.	Ectropion	Not defined	7	Breeder option
C.	Macroblepharon	Not defined	7	Breeder option
D.	Distichiasis	Not defined	4	Breeder option
E.	Corneal dystrophy - epithelial/stromal	Not defined	19	Breeder option
F.	Uveal cysts	Not defined	8	Breeder option
G.	Persistent pupillary membranes - iris to iris	Not defined	4	Breeder option
H.	Cataract	Not defined	4	NO
I.	Retinal atrophy - generalized (*prcd)* * a DNA test is available	Autosomal recessive	9	NO
J.	Retinal atrophy - generalized			
	1. Rod dysplasia (*rd*)	Presumed autosomal recessive	10-13	NO
	2. Early retinal degeneration (*erd*) * a DNA test is available	Autosomal recessive	14-18	NO
K.	Retinal dysplasia - folds	Not defined	4	Breeder option

OCULAR DISORDERS REPORT

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated intraocular pressure occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine screening exam for certification.

In the Norwegian Elkhound, glaucoma appears to be familial. In most cases the drainage angle is reported to be open. A mutation has been found in *ADAMTS10* in some Norwegian Elkhounds with glaucoma, but a genetic test is not yet available.

B. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

E. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

F. Uveal cysts

A pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions is various breeds.

G. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

H. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

I. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that PRA in the Norwegian Elkhound is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

J. Retinal atrophy - generalized

1. **Rod dysplasia (*rd*)**: Inappropriate development of the visual cells resulting in vision impairment in dim light by 6 months and total blindness at 3-5 years. Ophthalmoscopic signs may be evident after 5 months of age, with signs of retinal vascular thinning after 2 years. An ERG can provide a diagnosis as early as 6 weeks of age. In the Norwegian Elkhound, this is an autosomal recessive trait.

2. **Early retinal degeneration (*erd*)**: Another form of PRA reported in the Norwegian Elkhound. Animals are night blind at 6 weeks and blind by 1 year of age. Clinical signs are evident by 6 months. On histopathologic examination there is an abnormal structural development of the photoreceptors followed by rapid rod/cone degeneration. The mutation is found in the *STK38L* gene and is inherited as an autosomal recessive trait. While a DNA test is available, no Norwegian Elkhounds are thought to exist with this mutation anymore.

K. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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19. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
NORWEGIAN ELKHOUND

	TOTAL DOGS EXAMINED	1991-1999 1192		2000-2009 1007		2010-2016 388	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	2	0.2%	2	0.2%	0	
10.000	glaucoma	2	0.2%	0		0	
EYELIDS							
20.160	macropalpebral fissure	1	0.1%	13	1.3%	2	0.5%
21.000	entropion, unspecified	0		2	0.2%	3	0.8%
22.000	ectropion, unspecified	0		9	0.9%	5	1.3%
25.110	distichiasis	29	2.4%	11	1.1%	5	1.3%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.3%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		1	0.3%
52.110	prolapsed gland of the third eyelid	0		0		1	0.3%
CORNEA							
70.210	corneal pannus	2	0.2%	0		0	
70.700	corneal dystrophy	1	0.1%	3	0.3%	5	1.3%
UVEA							
93.710	persistent pupillary membranes, iris to iris	21	1.8%	6	0.6%	8	2.1%
93.720	persistent pupillary membranes, iris to lens	3	0.3%	6	0.6%	2	0.5%
93.730	persistent pupillary membranes, iris to cornea	3	0.3%	2	0.2%	1	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		3	0.8%
93.999	uveal cysts	0		2	0.2%	5	1.3%
LENS							
100.200	cataract, unspecified	23	1.9%	0		0	
100.210	cataract, suspect not inherited	37	3.1%	50	5.0%	20	5.2%
100.301	punctate cataract, anterior cortex	6	0.5%	2	0.2%	0	
100.302	punctate cataract, posterior cortex	4	0.3%	2	0.2%	3	0.8%
100.303	punctate cataract, equatorial cortex	3	0.3%	1	0.1%	0	
100.304	punctate cataract, anterior sutures	0		1	0.1%	0	
100.305	punctate cataract, posterior sutures	6	0.5%	2	0.2%	3	0.8%
100.306	punctate cataract, nucleus	1	0.1%	2	0.2%	0	
100.307	punctate cataract, capsular	0		2	0.2%	1	0.3%
100.311	incipient cataract, anterior cortex	4	0.3%	7	0.7%	0	
100.312	incipient cataract, posterior cortex	25	2.1%	9	0.9%	3	0.8%
100.313	incipient cataract, equatorial cortex	12	1.0%	6	0.6%	3	0.8%
100.314	incipient cataract, anterior sutures	1	0.1%	2	0.2%	0	
100.315	incipient cataract, posterior sutures	6	0.5%	1	0.1%	1	0.3%
100.316	incipient cataract, nucleus	6	0.5%	2	0.2%	1	0.3%
100.317	incipient cataract, capsular	0		9	0.9%	0	
100.321	incomplete cataract, anterior cortex	0		0		1	0.3%
100.326	incomplete cataract, nucleus	0		0		1	0.3%
100.327	incomplete cataract, capsular	0		0		1	0.3%
100.330	generalized/complete cataract	4	0.3%	3	0.3%	0	
100.375	subluxation/luxation, unspecified	3	0.3%	1	0.1%	0	
100.999	*significant cataracts (summary)*	*101*	*8.5%*	*51*	*5.1%*	*18*	*4.6%*

OCULAR DISORDERS REPORT
NORWEGIAN ELKHOUND

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	0.3%	3	0.3%	1	0.3%
110.135	PHPV/PTVL	0		2	0.2%	0	
110.320	vitreal degeneration	3	0.3%	3	0.3%	1	0.3%
RETINA							
120.170	retinal dysplasia, folds	28	2.3%	7	0.7%	10	2.6%
120.180	retinal dysplasia, geographic	2	0.2%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	8	0.7%	0		2	0.5%
120.400	retinal hemorrhage	2	0.2%	1	0.1%	0	
120.910	retinal detachment without dialysis	1	0.1%	0		0	
OPTIC NERVE							
130.120	optic nerve hypoplasia	2	0.2%	0		1	0.3%
OTHER							
900.000	other, unspecified	0		10	1.0%	12	3.1%
900.100	other, not inherited	2	0.2%	30	3.0%	8	2.1%
900.110	other, suspected as inherited	9	0.8%	1	0.1%	0	
NORMAL							
0.000	normal globe	985	82.6%	904	89.8%	333	85.8%

OCULAR DISORDERS REPORT

NORWEGIAN LUNDEHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	2	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary conditions of the Norwegian Lundehund breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

2. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
NORWEGIAN LUNDEHUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 14 #	%	2000-2009 17 #	%	2010-2016 19 #	%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		9	52.9%	4	21.1%
93.720	persistent pupillary membranes, iris to lens		0		1	5.9%	0	
LENS								
100.210	cataract, suspect not inherited		1	7.1%	1	5.9%	6	31.6%
100.301	punctate cataract, anterior cortex		0		0		1	5.3%
100.302	punctate cataract, posterior cortex		0		0		2	10.5%
100.311	incipient cataract, anterior cortex		0		1	5.9%	1	5.3%
100.313	incipient cataract, equatorial cortex		1	7.1%	0		0	
100.315	incipient cataract, posterior sutures		0		1	5.9%	1	5.3%
100.330	generalized/complete cataract		3	21.4%	0		0	
100.999	*significant cataracts (summary)*		*4*	*28.6%*	*2*	*11.8%*	*5*	*26.3%*
VITREOUS								
110.320	vitreal degeneration		0		0		2	10.5%
OTHER								
900.000	other, unspecified		0		1	5.9%	0	
NORMAL								
0.000	normal globe		9	64.3%	11	64.7%	11	57.9%

OCULAR DISORDERS REPORT

NORWICH TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	4	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	1	NO
D.	Lens luxation * a DNA is available	Not defined	2, 3	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

3. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

4. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
NORWICH TERRIER

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 335 #	 %	2000-2009 1615 #	 %	2010-2016 1256 #	 %
EYELIDS							
20.160	macropalpebral fissure	0		1	0.1%	0	
22.000	ectropion, unspecified	0		1	0.1%	0	
25.110	distichiasis	1	0.3%	7	0.4%	12	1.0%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		2	0.2%
NICTITANS							
52.110	prolapsed gland of the third eyelid	1	0.3%	3	0.2%	0	
CORNEA							
70.700	corneal dystrophy	4	1.2%	8	0.5%	6	0.5%
70.730	corneal endothelial degeneration	1	0.3%	2	0.1%	1	0.1%
UVEA							
93.150	iris coloboma	0		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	5	1.5%	107	6.6%	71	5.7%
93.720	persistent pupillary membranes, iris to lens	0		4	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.3%	4	0.2%	3	0.2%
93.740	persistent pupillary membranes, iris sheets	0		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.1%	5	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		2	0.1%	3	0.2%
93.999	uveal cysts	0		1	0.1%	0	
LENS							
100.200	cataract, unspecified	5	1.5%	0		0	
100.210	cataract, suspect not inherited	10	3.0%	38	2.4%	27	2.1%
100.301	punctate cataract, anterior cortex	0		5	0.3%	5	0.4%
100.302	punctate cataract, posterior cortex	0		7	0.4%	1	0.1%
100.303	punctate cataract, equatorial cortex	0		2	0.1%	0	
100.305	punctate cataract, posterior sutures	0		5	0.3%	0	
100.306	punctate cataract, nucleus	0		3	0.2%	0	
100.307	punctate cataract, capsular	0		1	0.1%	0	
100.311	incipient cataract, anterior cortex	1	0.3%	8	0.5%	6	0.5%
100.312	incipient cataract, posterior cortex	2	0.6%	9	0.6%	6	0.5%
100.313	incipient cataract, equatorial cortex	0		8	0.5%	5	0.4%
100.314	incipient cataract, anterior sutures	0		1	0.1%	0	
100.315	incipient cataract, posterior sutures	1	0.3%	5	0.3%	0	
100.316	incipient cataract, nucleus	3	0.9%	6	0.4%	2	0.2%
100.317	incipient cataract, capsular	0		1	0.1%	0	
100.321	incomplete cataract, anterior cortex	0		0		1	0.1%
100.322	incomplete cataract, posterior cortex	0		0		1	0.1%
100.330	generalized/complete cataract	3	0.9%	5	0.3%	4	0.3%
100.375	subluxation/luxation, unspecified	0		1	0.1%	0	
100.999	*significant cataracts (summary)*	*15*	*4.5%*	*66*	*4.1%*	*31*	*2.5%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.3%	2	0.1%	0	
110.135	PHPV/PTVL	0		1	0.1%	0	

OCULAR DISORDERS REPORT
NORWICH TERRIER

VITREOUS CONTINUED	1991-1999	2000-2009	2010-2016
110.320 vitreal degeneration	0	7 0.4%	4 0.3%
FUNDUS			
97.120 coloboma	1 0.3%	1 0.1%	0
RETINA			
120.170 retinal dysplasia, folds	1 0.3%	3 0.2%	2 0.2%
120.180 retinal dysplasia, geographic	0	4 0.2%	0
120.310 generalized progressive retinal atrophy (PRA)	5 1.5%	5 0.3%	4 0.3%
120.960 retinopathy	0	0	5 0.4%
OPTIC NERVE			
130.110 micropapilla	0	1 0.1%	0
130.120 optic nerve hypoplasia	0	6 0.4%	2 0.2%
130.150 optic disc coloboma	1 0.3%	2 0.1%	0
OTHER			
900.000 other, unspecified	0	9 0.6%	19 1.5%
900.100 other, not inherited	0	48 3.0%	20 1.6%
900.110 other, suspected as inherited	3 0.9%	3 0.2%	3 0.2%
NORMAL			
0.000 normal globe	298 89.0%	1442 89.3%	1118 89.0%

NOVA SCOTIA DUCK TOLLING RETRIEVER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 3	Breeder option
	- iris to lens	Not defined	1, 3	NO
	- lens pigment foci/no strands	Not defined	11	Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Retinal atrophy - generalized (*prcd)* *a DNA test is available	Autosomal recessive	1, 4	NO
F.	Retinal dysplasia - folds	Not defined	2	Breeder option
G.	Choroidal hypoplasia (Collie eye anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma * a DNA test is available	Autosomal recessive	5-7	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

In the Nova Scotia Duck Tolling Retriever, many of the PPMs identified on routine screening examinations bridge from the iris to the lens where they are associated with focal cataract. This may result in vision impairment.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Nova Scotia Duck Tolling Retriever is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

F. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

G. Choroidal hypoplasia (Collie eye anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie eye anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics.* 2006 Nov;88:551-563.

5. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

6. Parker HG, Kukekova AV, Akey DT, et al. Breed relationships facilitate fine-mapping studies: a 7.8-kb deletion cosegregates with Collie eye anomaly across multiple dog breeds. *Genome Res*. 2007 Nov;17:1562-1571.

7. Lowe JK, Kukekova AV, Kirkness EF, et al. Linkage mapping of the primary disease locus for Collie eye anomaly. *Genomics*. 2003;82:86-95.

8. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

9. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 2000-2009.

10. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
NOVA SCOTIA DUCK TOLLING RETRIEVER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1279 #	 %	2000-2009 2424 #	 %	2010-2016 2035 #	 %
GLOBE							
0.110	microphthalmia	0		0		1	0.0%
10.000	glaucoma	1	0.1%	0		0	
EYELIDS							
20.140	ectopic cilia	0		0		1	0.0%
25.110	distichiasis	134	10.5%	335	13.8%	230	11.3%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	2	0.2%	0		5	0.2%
40.910	keratoconjunctivitis sicca	0		0		1	0.0%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		5	0.2%
52.110	prolapsed gland of the third eyelid	0		0		5	0.2%
CORNEA							
70.700	corneal dystrophy	36	2.8%	71	2.9%	44	2.2%
70.730	corneal endothelial degeneration	2	0.2%	0		2	0.1%
UVEA							
93.140	corneal endothelial pigment without PPM	0		0		1	0.0%
93.710	persistent pupillary membranes, iris to iris	19	1.5%	60	2.5%	41	2.0%
93.720	persistent pupillary membranes, iris to lens	19	1.5%	33	1.4%	1	0.0%
93.730	persistent pupillary membranes, iris to cornea	0		2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.2%	6	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		9	0.4%	127	6.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		2	0.1%
93.999	uveal cysts	0		14	0.6%	8	0.4%
LENS							
100.200	cataract, unspecified	18	1.4%	0		0	
100.210	cataract, suspect not inherited	62	4.8%	143	5.9%	126	6.2%
100.301	punctate cataract, anterior cortex	9	0.7%	6	0.2%	5	0.2%
100.302	punctate cataract, posterior cortex	10	0.8%	12	0.5%	3	0.1%
100.303	punctate cataract, equatorial cortex	6	0.5%	2	0.1%	2	0.1%
100.305	punctate cataract, posterior sutures	3	0.2%	1	0.0%	1	0.0%
100.306	punctate cataract, nucleus	2	0.2%	3	0.1%	4	0.2%
100.307	punctate cataract, capsular	2	0.2%	4	0.2%	3	0.1%
100.311	incipient cataract, anterior cortex	3	0.2%	10	0.4%	5	0.2%
100.312	incipient cataract, posterior cortex	10	0.8%	14	0.6%	10	0.5%
100.313	incipient cataract, equatorial cortex	3	0.2%	11	0.5%	3	0.1%
100.314	incipient cataract, anterior sutures	0		0		1	0.0%
100.315	incipient cataract, posterior sutures	3	0.2%	0		0	
100.316	incipient cataract, nucleus	2	0.2%	3	0.1%	4	0.2%
100.317	incipient cataract, capsular	0		6	0.2%	1	0.0%
100.321	incomplete cataract, anterior cortex	0		0		3	0.1%
100.322	incomplete cataract, posterior cortex	0		0		2	0.1%
100.330	generalized/complete cataract	1	0.1%	5	0.2%	1	0.0%
100.999	*significant cataracts (summary)*	*72*	*5.6%*	*77*	*3.2%*	*48*	*2.4%*

OCULAR DISORDERS REPORT
NOVA SCOTIA DUCK TOLLING RETRIEVER

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	2	0.2%	6	0.2%	7	0.3%
110.135	PHPV/PTVL	3	0.2%	4	0.2%	0	
110.320	vitreal degeneration	1	0.1%	7	0.3%	5	0.2%
FUNDUS							
97.110	choroidal hypoplasia	0		2	0.1%	0	
RETINA							
120.170	retinal dysplasia, folds	10	0.8%	25	1.0%	14	0.7%
120.180	retinal dysplasia, geographic	7	0.5%	2	0.1%	4	0.2%
120.310	generalized progressive retinal atrophy (PRA)	68	5.3%	25	1.0%	4	0.2%
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		1	0.0%
OPTIC NERVE							
130.110	micropapilla	2	0.2%	2	0.1%	9	0.4%
130.120	optic nerve hypoplasia	4	0.3%	6	0.2%	3	0.1%
130.150	optic disc coloboma	0		2	0.1%	1	0.0%
OTHER							
900.000	other, unspecified	0		35	1.4%	63	3.1%
900.100	other, not inherited	16	1.3%	262	10.8%	89	4.4%
900.110	other, suspected as inherited	5	0.4%	11	0.5%	1	0.0%
NORMAL							
0.000	normal globe	917	71.7%	1905	78.6%	1484	72.9%

OLD ENGLISH SHEEPDOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular anomalies	Not defined		NO
B.	Distichiasis	Not defined	1, 3, 9	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	1, 4	Breeder option
D.	Cataract	Not defined	1, 2, 5, 6, 7	NO
E.	Retinal dysplasia - folds	Not defined	1, 6, 7	Breeder option

Description and Comments

A. Microphthalmia with multiple congenital ocular defects

Microphthalmia is a developmental anomaly in which the eyeball is abnormally small. This is often associated with other ocular malformations, including defects of the cornea, anterior chamber, lens and/or retina.

Microphthalmia with cataract and retinal abnormalities including retinal detachment, has been reported in litters of Old English Sheepdogs. Lesions were non-progressive. However, blindness did result in some dogs. The mode of inheritance is unknown, but affected dogs should not be bred.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region. In one study of 66 interrelated Old English Sheepdogs, an autosomal recessive mode of inheritance was suggested. Retinal detachment was an associated finding in 5/43 affected dogs in this study. The location of the opacity within the lens and the age of onset was highly variable.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

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7. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2010.

OCULAR DISORDERS REPORT
OLD ENGLISH SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1825 #	%	2000-2009 1997 #	%	2010-2016 1341 #	%
GLOBE							
0.110	microphthalmia	8	0.4%	1	0.1%	1	0.1%
10.000	glaucoma	4	0.2%	0		0	
EYELIDS							
20.140	ectopic cilia	0		0		1	0.1%
20.160	macropalpebral fissure	0		1	0.1%	0	
21.000	entropion, unspecified	7	0.4%	4	0.2%	1	0.1%
22.000	ectropion, unspecified	1	0.1%	1	0.1%	0	
25.110	distichiasis	27	1.5%	26	1.3%	34	2.5%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.1%	0		1	0.1%
NICTITANS							
51.100	third eyelid cartilage anomaly	1	0.1%	0		0	
52.110	prolapsed gland of the third eyelid	0		0		1	0.1%
CORNEA							
70.700	corneal dystrophy	2	0.1%	6	0.3%	12	0.9%
UVEA							
93.140	corneal endothelial pigment without PPM	0		1	0.1%	0	
93.150	iris coloboma	0		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	110	6.0%	182	9.1%	151	11.3%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	5	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea	3	0.2%	6	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	2	0.1%	8	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		3	0.2%
93.810	uveal melanoma	0		0		1	0.1%
93.999	uveal cysts	0		0		1	0.1%
LENS							
100.200	cataract, unspecified	35	1.9%	0		0	
100.210	cataract, suspect not inherited	77	4.2%	116	5.8%	81	6.0%
100.301	punctate cataract, anterior cortex	9	0.5%	17	0.9%	9	0.7%
100.302	punctate cataract, posterior cortex	2	0.1%	5	0.3%	2	0.1%
100.303	punctate cataract, equatorial cortex	1	0.1%	3	0.2%	3	0.2%
100.304	punctate cataract, anterior sutures	4	0.2%	0		2	0.1%
100.305	punctate cataract, posterior sutures	3	0.2%	1	0.1%	2	0.1%
100.306	punctate cataract, nucleus	9	0.5%	2	0.1%	3	0.2%
100.307	punctate cataract, capsular	2	0.1%	3	0.2%	2	0.1%
100.311	incipient cataract, anterior cortex	21	1.2%	20	1.0%	3	0.2%
100.312	incipient cataract, posterior cortex	21	1.2%	19	1.0%	5	0.4%
100.313	incipient cataract, equatorial cortex	6	0.3%	6	0.3%	5	0.4%
100.314	incipient cataract, anterior sutures	2	0.1%	9	0.5%	0	
100.315	incipient cataract, posterior sutures	4	0.2%	8	0.4%	1	0.1%
100.316	incipient cataract, nucleus	16	0.9%	12	0.6%	3	0.2%
100.317	incipient cataract, capsular	1	0.1%	4	0.2%	0	

OCULAR DISORDERS REPORT
OLD ENGLISH SHEEPDOG

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.321	incomplete cataract, anterior cortex	0		0		2	0.1%
100.322	incomplete cataract, posterior cortex	0		0		2	0.1%
100.326	incomplete cataract, nucleus	0		0		2	0.1%
100.330	generalized/complete cataract	43	2.4%	10	0.5%	8	0.6%
100.340	resorbing/hypermature cataract	0		0		2	0.1%
100.375	subluxation/luxation, unspecified	4	0.2%	2	0.1%	0	
100.999	*significant cataracts (summary)*	*179*	*9.8%*	*119*	*6.0%*	*56*	*4.2%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	10	0.5%	6	0.3%	1	0.1%
110.135	PHPV/PTVL	0		3	0.2%	0	
110.320	vitreal degeneration	6	0.3%	13	0.7%	10	0.7%
FUNDUS							
97.110	choroidal hypoplasia	1	0.1%	0		2	0.1%
97.120	coloboma	0		1	0.1%	0	
RETINA							
120.170	retinal dysplasia, folds	32	1.8%	40	2.0%	18	1.3%
120.180	retinal dysplasia, geographic	5	0.3%	1	0.1%	2	0.1%
120.190	retinal dysplasia, detached	0		0		2	0.1%
120.310	generalized progressive retinal atrophy (PRA)	7	0.4%	2	0.1%	4	0.3%
120.400	retinal hemorrhage	1	0.1%	0		0	
120.910	retinal detachment without dialysis	4	0.2%	5	0.3%	0	
OPTIC NERVE							
130.110	micropapilla	1	0.1%	8	0.4%	6	0.4%
130.120	optic nerve hypoplasia	7	0.4%	8	0.4%	0	
130.150	optic disc coloboma	2	0.1%	1	0.1%	1	0.1%
OTHER							
900.000	other, unspecified	0		13	0.7%	22	1.6%
900.100	other, not inherited	3	0.2%	73	3.7%	36	2.7%
900.110	other, suspected as inherited	8	0.4%	11	0.6%	1	0.1%
NORMAL							
0.000	normal globe	1448	79.3%	1637	82.0%	1038	77.4%

OCULAR DISORDERS REPORT

OLDE ENGLISH BULLDOGGE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Olde English Bulldogge breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
OLDE ENGLISH BULLDOGGE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	 %	2000-2009 0 #	 %	2010-2016 19 #	 %
EYELIDS							
21.000	entropion, unspecified	0		0		2	10.5%
25.110	distichiasis	0		0		6	31.6%
UVEA							
93.110	iris hypoplasia	0		0		1	5.3%
93.710	persistent pupillary membranes, iris to iris	0		0		1	5.3%
93.720	persistent pupillary membranes, iris to lens	0		0		1	5.3%
LENS							
100.210	cataract, suspect not inherited	0		0		1	5.3%
OTHER							
900.100	other, not inherited	0		0		2	10.5%
NORMAL							
0.000	normal globe	0		0		8	42.1%

OCULAR DISORDERS REPORT

PAPILLON

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1, 2, 4, 11	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	3, 11	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	2, 4, 11	Breeder option
D.	Cataract	Not defined	4, 11, 12	NO
E.	Vitreous degeneration	Not defined	4, 11, 12	Breeder option
F.	Retinal atrophy - generalized * a DNA test is available	Autosomal recessive	4-8, 12	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

Nuclear and posterior cortical cataracts have been reported in the Papillon.

E. Vitreous degeneration

A liquefaction of the vitreous gel, which may predispose to retinal detachment resulting in blindness.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. In one study of 707 dogs in Sweden, an autosomal recessive mode of inheritance was suggested. Clinical onset is reported at 5-6 years of age. In approximately 70% of cases of PRA in the Papillon, a CNGB1 mutation is present, leading to an abnormal CNGA1 protein in the rod outer segments. The mode of transmission is autosomal recessive. A genetic test is available.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

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10. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

11. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

12. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 2000-2009.

OCULAR DISORDERS REPORT
PAPILLON

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 3446 #	%	2000-2009 4886 #	%	2010-2016 2548 #	%
GLOBE							
0.110	microphthalmia	3	0.1%	5	0.1%	1	0.0%
10.000	glaucoma	1	0.0%	0		0	
EYELIDS							
21.000	entropion, unspecified	5	0.1%	6	0.1%	5	0.2%
25.110	distichiasis	39	1.1%	74	1.5%	34	1.3%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0		4	0.2%
40.910	keratoconjunctivitis sicca	0		0		1	0.0%
NICTITANS							
52.110	prolapsed gland of the third eyelid	3	0.1%	0		0	
CORNEA							
70.210	corneal pannus	3	0.1%	2	0.0%	0	
70.220	pigmentary keratitis	0		1	0.0%	1	0.0%
70.700	corneal dystrophy	28	0.8%	48	1.0%	30	1.2%
70.730	corneal endothelial degeneration	1	0.0%	2	0.0%	1	0.0%
UVEA							
93.110	iris hypoplasia	0		0		2	0.1%
93.140	corneal endothelial pigment without PPM	0		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	51	1.5%	160	3.3%	123	4.8%
93.720	persistent pupillary membranes, iris to lens	4	0.1%	3	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	4	0.1%	3	0.1%	2	0.1%
93.740	persistent pupillary membranes, iris sheets	4	0.1%	2	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.0%	13	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		5	0.2%
93.999	uveal cysts	1	0.0%	3	0.1%	0	
LENS							
100.200	cataract, unspecified	19	0.6%	0		0	
100.210	cataract, suspect not inherited	98	2.8%	159	3.3%	99	3.9%
100.301	punctate cataract, anterior cortex	24	0.7%	20	0.4%	11	0.4%
100.302	punctate cataract, posterior cortex	8	0.2%	8	0.2%	1	0.0%
100.303	punctate cataract, equatorial cortex	4	0.1%	5	0.1%	2	0.1%
100.304	punctate cataract, anterior sutures	3	0.1%	1	0.0%	0	
100.305	punctate cataract, posterior sutures	4	0.1%	3	0.1%	3	0.1%
100.306	punctate cataract, nucleus	6	0.2%	5	0.1%	5	0.2%
100.307	punctate cataract, capsular	1	0.0%	6	0.1%	1	0.0%
100.311	incipient cataract, anterior cortex	32	0.9%	40	0.8%	9	0.4%
100.312	incipient cataract, posterior cortex	22	0.6%	26	0.5%	4	0.2%
100.313	incipient cataract, equatorial cortex	11	0.3%	14	0.3%	6	0.2%
100.314	incipient cataract, anterior sutures	2	0.1%	4	0.1%	0	
100.315	incipient cataract, posterior sutures	4	0.1%	6	0.1%	0	
100.316	incipient cataract, nucleus	7	0.2%	8	0.2%	6	0.2%
100.317	incipient cataract, capsular	0		5	0.1%	6	0.2%
100.321	incomplete cataract, anterior cortex	0		0		3	0.1%

OCULAR DISORDERS REPORT
PAPILLON

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.322	incomplete cataract, posterior cortex	0		0		3	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.0%
100.326	incomplete cataract, nucleus	0		0		3	0.1%
100.330	generalized/complete cataract	22	0.6%	21	0.4%	2	0.1%
100.375	subluxation/luxation, unspecified	1	0.0%	3	0.1%	1	0.0%
100.999	*significant cataracts (summary)*	*169*	*4.9%*	*172*	*3.5%*	*66*	*2.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	13	0.4%	16	0.3%	9	0.4%
110.135	PHPV/PTVL	5	0.1%	7	0.1%	2	0.1%
110.320	vitreal degeneration	78	2.3%	155	3.2%	87	3.4%
FUNDUS							
97.120	coloboma	2	0.1%	0		0	
RETINA							
120.170	retinal dysplasia, folds	24	0.7%	24	0.5%	18	0.7%
120.180	retinal dysplasia, geographic	0		8	0.2%	4	0.2%
120.190	retinal dysplasia, detached	1	0.0%	1	0.0%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	49	1.4%	49	1.0%	13	0.5%
120.400	retinal hemorrhage	1	0.0%	0		0	
120.910	retinal detachment without dialysis	3	0.1%	4	0.1%	1	0.0%
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		2	0.1%
OPTIC NERVE							
130.110	micropapilla	0		7	0.1%	1	0.0%
130.120	optic nerve hypoplasia	6	0.2%	4	0.1%	1	0.0%
130.150	optic disc coloboma	3	0.1%	0		0	
OTHER							
900.000	other, unspecified	0		25	0.5%	52	2.0%
900.100	other, not inherited	16	0.5%	185	3.8%	61	2.4%
900.110	other, suspected as inherited	11	0.3%	12	0.2%	1	0.0%
NORMAL							
0.000	normal globe	2985	86.6%	4280	87.6%	2121	83.2%

OCULAR DISORDERS REPORT

PARSON RUSSELL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1, 8	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not define	1, 8	Breeder options
C.	Cataract	Not defined	1,3, 8	NO
D.	Lens luxation * a DNA test is available	Not defined	4, 5	NO
E.	Vitreous degeneration	Not defined	6	Breeder option
F.	Retinal atrophy - generalized	Not defined	7	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes

of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation may result in blinding retinal detachment and/or elevated intraocular pressure (glaucoma) causing vision impairment, pain, and blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment resulting in blindness.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as Progressive Retinal Atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

References

1. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

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6. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

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OCULAR DISORDERS REPORT
PARSON RUSSELL TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 2 #	%	2000-2009 1931 #	%	2010-2016 763 #	%
EYELIDS								
25.110	distichiasis		0		44	2.3%	21	2.8%
NICTITANS								
52.110	prolapsed gland of the third eyelid		0		0		1	0.1%
CORNEA								
70.700	corneal dystrophy		0		11	0.6%	3	0.4%
70.730	corneal endothelial degeneration		0		2	0.1%	0	
UVEA								
93.710	persistent pupillary membranes, iris to iris		1	50.0%	93	4.8%	74	9.7%
93.720	persistent pupillary membranes, iris to lens		0		1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea		0		1	0.1%	2	0.3%
93.740	persistent pupillary membranes, iris sheets		0		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		5	0.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		3	0.4%
93.999	uveal cysts		0		2	0.1%	0	
LENS								
100.210	cataract, suspect not inherited		0		45	2.3%	38	5.0%
100.301	punctate cataract, anterior cortex		0		7	0.4%	0	
100.302	punctate cataract, posterior cortex		0		6	0.3%	2	0.3%
100.303	punctate cataract, equatorial cortex		0		1	0.1%	3	0.4%
100.305	punctate cataract, posterior sutures		0		3	0.2%	1	0.1%
100.306	punctate cataract, nucleus		0		1	0.1%	1	0.1%
100.307	punctate cataract, capsular		0		1	0.1%	1	0.1%
100.311	incipient cataract, anterior cortex		0		12	0.6%	4	0.5%
100.312	incipient cataract, posterior cortex		0		36	1.9%	3	0.4%
100.313	incipient cataract, equatorial cortex		0		5	0.3%	2	0.3%
100.314	incipient cataract, anterior sutures		0		0		1	0.1%
100.315	incipient cataract, posterior sutures		0		12	0.6%	1	0.1%
100.316	incipient cataract, nucleus		0		1	0.1%	0	
100.317	incipient cataract, capsular		0		8	0.4%	1	0.1%
100.322	incomplete cataract, posterior cortex		0		0		2	0.3%
100.330	generalized/complete cataract		0		6	0.3%	5	0.7%
100.375	subluxation/luxation, unspecified		0		1	0.1%	0	
100.999	*significant cataracts (summary)*		*0*		*99*	*5.1%*	*27*	*3.5%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		0		4	0.2%	1	0.1%
110.135	PHPV/PTVL		0		1	0.1%	0	
110.320	vitreal degeneration		0		27	1.4%	18	2.4%
FUNDUS								
97.120	coloboma		0		1	0.1%	0	
RETINA								
120.170	retinal dysplasia, folds		0		3	0.2%	6	0.8%
120.180	retinal dysplasia, geographic		0		0		2	0.3%

OCULAR DISORDERS REPORT
PARSON RUSSELL TERRIER

RETINA CONTINUED	1991-1999	2000-2009	2010-2016
120.310 generalized progressive retinal atrophy (PRA)	0	19 1.0%	6 0.8%
120.910 retinal detachment without dialysis	0	1 0.1%	0
120.960 retinopathy	0	0	1 0.1%
OPTIC NERVE			
130.110 micropapilla	0	2 0.1%	0
130.120 optic nerve hypoplasia	0	2 0.1%	0
OTHER			
900.000 other, unspecified	0	18 0.9%	21 2.8%
900.100 other, not inherited	0	97 5.0%	29 3.8%
900.110 other, suspected as inherited	0	2 0.1%	0
NORMAL			
0.000 normal globe	1 50.0%	1733 89.7%	597 78.2%

OCULAR DISORDERS REPORT

PATTERDALE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Lens luxation *a DNA is available	Not defined	1	NO

Description and Comments

A. Lens Luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
PATTERDALE TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	 %	2000-2009 0 #	 %	2010-2016 15 #	 %
EYELIDS							
25.110	distichiasis	0		0		1	6.7%
RETINA							
120.170	retinal dysplasia, folds	0		0		1	6.7%
120.180	retinal dysplasia, geographic	0		0		1	6.7%
NORMAL							
0.000	normal globe	0		0		13	86.7%

OCULAR DISORDERS REPORT

PEKINGESE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1-3, 5, 6	Breeder option
B.	Entropion	Not defined	1, 6	Breeder option
C.	Exposure keratopathy syndrome/ macroblepharon	Not defined	1, 5, 6	Breeder option
D.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Exposure keratopathy syndrome/macroblepharon

A corneal disease involving all or part of the cornea, resulting from inadequate blinking. This results from a combination of anatomic features including shallow orbits, exophthalmos, macroblepharon and lagophthalmos. Macroblepharon is defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

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4. Priester W. Canine progressive retinal atrophy: Occurrence by age, breed, and sex. *American Journal of Veterinary Research.* 1974;35:571-574.

5. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 2000-2009.

6. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
PEKINGESE

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 99 #	 %	2000-2009 65 #	 %	2010-2016 57 #	 %
GLOBE							
0.110	microphthalmia	0		0		1	1.8%
EYELIDS							
20.140	ectopic cilia	2	2.0%	0		0	
20.160	macropalpebral fissure	11	11.1%	1	1.5%	0	
21.000	entropion, unspecified	7	7.1%	3	4.6%	11	19.3%
22.000	ectropion, unspecified	0		1	1.5%	1	1.8%
25.110	distichiasis	10	10.1%	6	9.2%	7	12.3%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		1	1.8%
CORNEA							
70.210	corneal pannus	5	5.1%	2	3.1%	0	
70.220	pigmentary keratitis	15	15.2%	8	12.3%	10	17.5%
UVEA							
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	1.8%
LENS							
100.200	cataract, unspecified	3	3.0%	0		0	
100.210	cataract, suspect not inherited	1	1.0%	0		2	3.5%
100.301	punctate cataract, anterior cortex	1	1.0%	2	3.1%	0	
100.302	punctate cataract, posterior cortex	0		2	3.1%	0	
100.305	punctate cataract, posterior sutures	0		1	1.5%	0	
100.311	incipient cataract, anterior cortex	3	3.0%	2	3.1%	0	
100.312	incipient cataract, posterior cortex	2	2.0%	0		1	1.8%
100.313	incipient cataract, equatorial cortex	2	2.0%	1	1.5%	1	1.8%
100.315	incipient cataract, posterior sutures	0		3	4.6%	0	
100.316	incipient cataract, nucleus	1	1.0%	0		0	
100.330	generalized/complete cataract	1	1.0%	1	1.5%	0	
100.375	subluxation/luxation, unspecified	2	2.0%	0		0	
100.999	*significant cataracts (summary)*	*13*	*13.1%*	*12*	*18.5%*	*2*	*3.5%*
RETINA							
120.170	retinal dysplasia, folds	0		0		1	1.8%
120.190	retinal dysplasia, detached	0		1	1.5%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	1.0%	2	3.1%	0	
OPTIC NERVE							
130.120	optic nerve hypoplasia	0		1	1.5%	0	
OTHER							
900.000	other, unspecified	0		3	4.6%	3	5.3%
900.100	other, not inherited	2	2.0%	8	12.3%	3	5.3%
900.110	other, suspected as inherited	4	4.0%	0		1	1.8%
NORMAL							
0.000	normal globe	53	53.5%	38	58.5%	30	52.6%

OCULAR DISORDERS REPORT

PEMBROKE WELSH CORGI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1, 5,6	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2, 6	Breeder option
	- iris to cornea	Not defined	1, 3, 6	NO
	- endothelial pigment/no strands	Not defined	4	NO
C.	Cataract	Not defined	1, 5, 6	NO
D.	Retinal dysplasia - folds	Not defined	1, 5, 6	Breeder option
E.	Retinal dysplasia - geographic - detached	Not defined	1, 5	NO

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of persistent pupillary membranes.

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.
Persistent pupillary membranes are a significant problem in this breed with frequent documentation of strands bridging from the iris to the cornea noted on routine screening eye examinations. These may be associated with corneal opacity which may result in vision impairment, thus the recommendation against breeding Pembroke Welsh Corgis with PPM.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

E. Retinal dysplasia - geographic, detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

References

There are no specific references providing detailed descriptions of hereditary ocular conditions of the Pembroke Welsh Corgi. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

4. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

5. ACVO Genetics Committee, 2017, and/or Data from CERF All-Breeds Report, 2000-2009.

6. ACVO Genetics Committee 2017, and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
PEMBROKE WELSH CORGI

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 6851 #	%	2000-2009 8447 #	%	2010-2016 4589 #	%
GLOBE							
0.110	microphthalmia	9	0.1%	7	0.1%	3	0.1%
10.000	glaucoma	1	0.0%	0		0	
EYELIDS							
20.140	ectopic cilia	2	0.0%	1	0.0%	0	
22.000	ectropion, unspecified	1	0.0%	0		0	
25.110	distichiasis	144	2.1%	129	1.5%	71	1.5%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		6	0.1%
40.910	keratoconjunctivitis sicca	1	0.0%	0		5	0.1%
NICTITANS							
51.100	third eyelid cartilage anomaly	1	0.0%	0		0	
52.110	prolapsed gland of the third eyelid	2	0.0%	0		0	
CORNEA							
70.210	corneal pannus	0		3	0.0%	0	
70.220	pigmentary keratitis	1	0.0%	0		1	0.0%
70.700	corneal dystrophy	21	0.3%	29	0.3%	15	0.3%
70.730	corneal endothelial degeneration	38	0.6%	17	0.2%	12	0.3%
UVEA							
93.110	iris hypoplasia	0		1	0.0%	2	0.0%
93.140	corneal endothelial pigment without PPM	0		5	0.1%	3	0.1%
93.150	iris coloboma	4	0.1%	1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	1037	15.1%	1559	18.5%	1021	22.2%
93.720	persistent pupillary membranes, iris to lens	31	0.5%	25	0.3%	10	0.2%
93.730	persistent pupillary membranes, iris to cornea	202	2.9%	147	1.7%	52	1.1%
93.740	persistent pupillary membranes, iris sheets	5	0.1%	10	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	0.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		9	0.1%	45	1.0%
93.999	uveal cysts	2	0.0%	6	0.1%	3	0.1%
LENS							
100.200	cataract, unspecified	79	1.2%	0		0	
100.210	cataract, suspect not inherited	144	2.1%	175	2.1%	133	2.9%
100.301	punctate cataract, anterior cortex	28	0.4%	16	0.2%	22	0.5%
100.302	punctate cataract, posterior cortex	25	0.4%	20	0.2%	12	0.3%
100.303	punctate cataract, equatorial cortex	10	0.1%	12	0.1%	4	0.1%
100.304	punctate cataract, anterior sutures	0		2	0.0%	1	0.0%
100.305	punctate cataract, posterior sutures	5	0.1%	7	0.1%	10	0.2%
100.306	punctate cataract, nucleus	24	0.4%	19	0.2%	12	0.3%
100.307	punctate cataract, capsular	0		16	0.2%	8	0.2%
100.311	incipient cataract, anterior cortex	40	0.6%	38	0.4%	26	0.6%
100.312	incipient cataract, posterior cortex	71	1.0%	77	0.9%	35	0.8%
100.313	incipient cataract, equatorial cortex	28	0.4%	25	0.3%	12	0.3%
100.314	incipient cataract, anterior sutures	2	0.0%	2	0.0%	3	0.1%
100.315	incipient cataract, posterior sutures	5	0.1%	11	0.1%	3	0.1%

OCULAR DISORDERS REPORT
PEMBROKE WELSH CORGI

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.316	incipient cataract, nucleus	75	1.1%	79	0.9%	40	0.9%
100.317	incipient cataract, capsular	0		12	0.1%	12	0.3%
100.321	incomplete cataract, anterior cortex	0		0		7	0.2%
100.322	incomplete cataract, posterior cortex	0		0		7	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		3	0.1%
100.325	incomplete cataract, posterior sutures	0		0		1	0.0%
100.326	incomplete cataract, nucleus	0		0		14	0.3%
100.327	incomplete cataract, capsular	0		0		2	0.0%
100.330	generalized/complete cataract	28	0.4%	39	0.5%	9	0.2%
100.340	resorbing/hypermature cataract	0		0		1	0.0%
100.375	subluxation/luxation, unspecified	3	0.0%	2	0.0%	1	0.0%
100.999	*significant cataracts (summary)*	*420*	*6.1%*	*375*	*4.4%*	*244*	*5.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	22	0.3%	32	0.4%	16	0.3%
110.135	PHPV/PTVL	4	0.1%	9	0.1%	8	0.2%
110.320	vitreal degeneration	14	0.2%	44	0.5%	41	0.9%
FUNDUS							
97.110	choroidal hypoplasia	0		2	0.0%	3	0.1%
RETINA							
120.170	retinal dysplasia, folds	516	7.5%	449	5.3%	226	4.9%
120.180	retinal dysplasia, geographic	88	1.3%	70	0.8%	13	0.3%
120.190	retinal dysplasia, detached	2	0.0%	1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	13	0.2%	19	0.2%	3	0.1%
120.400	retinal hemorrhage	4	0.1%	3	0.0%	0	
120.910	retinal detachment without dialysis	2	0.0%	1	0.0%	0	
120.920	retinal detachment with dialysis	0		0		5	0.1%
120.960	retinopathy	0		0		6	0.1%
OPTIC NERVE							
130.110	micropapilla	0		4	0.0%	2	0.0%
130.120	optic nerve hypoplasia	5	0.1%	3	0.0%	1	0.0%
130.150	optic disc coloboma	1	0.0%	1	0.0%	0	
OTHER							
900.000	other, unspecified	0		37	0.4%	88	1.9%
900.100	other, not inherited	28	0.4%	279	3.3%	120	2.6%
900.110	other, suspected as inherited	69	1.0%	31	0.4%	6	0.1%
NORMAL							
0.000	normal globe	4682	68.3%	6427	76.1%	3086	67.2%

OCULAR DISORDERS REPORT

PERRO DE PRESA CANARIO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Multifocal retinopathy - *cmr1* * a DNA test is available.	Autosomal recessive	1	Breeder option

Description and Comments

A. Multifocal retinopathy

Canine Multi-focal Retinopathy type 1 (*cmr1*) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (BEST1) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff. A DNA test is available.

References

1. Zangerl B, Wickstrom K, Slavik J, et al. Assessment of canine BEST1 variations identifies new mutations and establishes an independent bestrophinopathy model (cmr3). *Mol Vis*. 2010;16:2791-2804.

OCULAR DISORDERS REPORT
PERRO DE PRESA CANARIO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 0 #	%	2010-2016 9 #	%
GLOBE							
10.000	glaucoma	0		0		1	11.1%
LENS							
100.210	cataract, suspect not inherited	0		0		2	22.2%
100.302	punctate cataract, posterior cortex	0		0		1	11.1%
100.999	*significant cataracts (summary)*	*0*		*0*		*1*	*11.1%*
OTHER							
900.110	other, suspected as inherited	0		0		1	11.1%
NORMAL							
0.000	normal globe	0		0		6	66.7%

PETIT BASSET GRIFFON VENDEEN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma * a DNA test is available	Autosomal recessive	1, 10, 11	NO
B.	Corneal dystrophy - endothelial	Not defined	4	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	3-5, 9	Breeder option
	- iris sheets	Not defined	4	NO
	- lens pigment foci/ no strands	Not defined	9	Passes with no notation
	- endothelial opacity / no strands	Not defined	7, 9, 10	NO
D.	Cataract	Not defined	4, 5, 9	NO
E.	Persistent hyaloid artery	Not defined	8	Breeder option
F.	Vitreous degeneration	Not defined	4	Breeder option
G.	Retinal dysplasia - folds	Not defined	4, 9, 10	Breeder option

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

Primary Open Angle Glaucoma (POAG) in the Petit Basset Griffon Vendeen is caused by a missense mutation in exon 11 causing a glycine to serine substitution (G519S) in ADAMTS17. This mutation is predicted to alter protein function. The trait shows an

autosomal recessive mode of inheritance. Primary open angle glaucoma is reported in the PBGV as an autosomal recessively inherited condition associated with mutations of the ADAMTS17 gene. Pectinate ligament abnormalities are not present on gonioscopy and the iridocorneal angle remains open. The initial clinical features are noted around 3-4 years and include a small rise in intraocular pressure accompanied by lens subluxation. Retinal degeneration and optic nerve cupping noted in late stages when globe enlargement and vision disruption has occurred. A DNA test is available.

B. Corneal dystrophy - endothelial

Corneal endothelial dystrophy is an abnormal loss of the inner lining of the cornea that causes progressive fluid retention (edema). With time the edema results in keratitis and decreased vision. This usually does not occur until the animal is older.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment resulting in blindness.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. Oliver JA, Forman OP, Pettitt L, et al. Two Independent Mutations in ADAMTS17 Are Associated with Primary Open Angle Glaucoma in the Basset Hound and Basset Fauve de Bretagne Breeds of Dog. *PloS one*. 2015;10:e0140436.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

5. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

6. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

7. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2010.

8. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

9. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

10. ACVO Genetics Committee, 2017 and/or Data from CERF All-Breeds Report, 2000-2009.

11. Bedford, PGC (2017), Open-angle glaucoma in the Petit Basset Griffon Vendeen. Vet Ophthalmol, 20: 98-102. doi.10.1111/vop.12369.

OCULAR DISORDERS REPORT
PETIT BASSET GRIFFON VENDEEN

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 602 #	 %	2000-2009 1215 #	 %	2010-2016 649 #	 %
GLOBE							
10.000	glaucoma	0		2	0.2%	1	0.2%
EYELIDS							
21.000	entropion, unspecified	3	0.5%	0		0	
25.110	distichiasis	3	0.5%	5	0.4%	3	0.5%
NICTITANS							
52.110	prolapsed gland of the third eyelid	1	0.2%	0		0	
CORNEA							
70.220	pigmentary keratitis	0		1	0.1%	0	
70.700	corneal dystrophy	5	0.8%	10	0.8%	2	0.3%
70.730	corneal endothelial degeneration	12	2.0%	8	0.7%	6	0.9%
UVEA							
93.140	corneal endothelial pigment without PPM	0		2	0.2%	0	
93.150	iris coloboma	1	0.2%	0		0	
93.710	persistent pupillary membranes, iris to iris	108	17.9%	259	21.3%	101	15.6%
93.720	persistent pupillary membranes, iris to lens	3	0.5%	24	2.0%	8	1.2%
93.730	persistent pupillary membranes, iris to cornea	58	9.6%	133	10.9%	22	3.4%
93.740	persistent pupillary membranes, iris sheets	14	2.3%	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		14	2.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		14	1.2%	46	7.1%
93.999	uveal cysts	0		2	0.2%	2	0.3%
LENS							
100.200	cataract, unspecified	2	0.3%	0		0	
100.210	cataract, suspect not inherited	17	2.8%	53	4.4%	40	6.2%
100.301	punctate cataract, anterior cortex	6	1.0%	11	0.9%	8	1.2%
100.302	punctate cataract, posterior cortex	2	0.3%	2	0.2%	1	0.2%
100.303	punctate cataract, equatorial cortex	1	0.2%	0		2	0.3%
100.304	punctate cataract, anterior sutures	0		3	0.2%	1	0.2%
100.305	punctate cataract, posterior sutures	0		3	0.2%	2	0.3%
100.306	punctate cataract, nucleus	1	0.2%	1	0.1%	0	
100.307	punctate cataract, capsular	3	0.5%	9	0.7%	3	0.5%
100.311	incipient cataract, anterior cortex	6	1.0%	11	0.9%	7	1.1%
100.312	incipient cataract, posterior cortex	1	0.2%	6	0.5%	0	
100.313	incipient cataract, equatorial cortex	2	0.3%	3	0.2%	0	
100.315	incipient cataract, posterior sutures	0		5	0.4%	1	0.2%
100.316	incipient cataract, nucleus	0		3	0.2%	0	
100.317	incipient cataract, capsular	0		10	0.8%	2	0.3%
100.326	incomplete cataract, nucleus	0		0		1	0.2%
100.330	generalized/complete cataract	1	0.2%	11	0.9%	0	
100.375	subluxation/luxation, unspecified	3	0.5%	5	0.4%	0	
100.999	*significant cataracts (summary)*	*25*	*4.2%*	*78*	*6.4%*	*28*	*4.3%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	0.5%	1	0.1%	8	1.2%
110.320	vitreal degeneration	6	1.0%	5	0.4%	2	0.3%

OCULAR DISORDERS REPORT
PETIT BASSET GRIFFON VENDEEN

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	51	8.5%	42	3.5%	17	2.6%
120.180	retinal dysplasia, geographic	5	0.8%	2	0.2%	4	0.6%
120.310	generalized progressive retinal atrophy (PRA)	0		1	0.1%	2	0.3%
120.400	retinal hemorrhage	2	0.3%	0		0	
OPTIC NERVE							
130.110	micropapilla	2	0.3%	1	0.1%	0	
130.150	optic disc coloboma	1	0.2%	0		0	
OTHER							
900.000	other, unspecified	0		20	1.6%	18	2.8%
900.100	other, not inherited	2	0.3%	72	5.9%	11	1.7%
900.110	other, suspected as inherited	8	1.3%	28	2.3%	2	0.3%
NORMAL							
0.000	normal globe	355	59.0%	802	66.0%	431	66.4%

OCULAR DISORDERS REPORT

PHARAOH HOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2, 4	Breeder option
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
B.	Cataract	Not defined	3	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pharaoh Hound breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

2. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
PHARAOH HOUND

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**86**		**161**		**152**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
EYELIDS							
25.110	distichiasis	2	2.3%	4	2.5%	1	0.7%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		1	0.7%
CORNEA							
70.700	corneal dystrophy	0		0		3	2.0%
UVEA							
93.140	corneal endothelial pigment without PPM	0		0		1	0.7%
93.710	persistent pupillary membranes, iris to iris	3	3.5%	9	5.6%	17	11.2%
93.720	persistent pupillary membranes, iris to lens	1	1.2%	0		0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		12	7.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.7%
93.999	uveal cysts	0		1	0.6%	0	
LENS							
100.200	cataract, unspecified	1	1.2%	0		0	
100.210	cataract, suspect not inherited	2	2.3%	9	5.6%	14	9.2%
100.301	punctate cataract, anterior cortex	0		0		3	2.0%
100.302	punctate cataract, posterior cortex	0		0		1	0.7%
100.305	punctate cataract, posterior sutures	0		0		2	1.3%
100.306	punctate cataract, nucleus	0		0		1	0.7%
100.307	punctate cataract, capsular	0		0		1	0.7%
100.311	incipient cataract, anterior cortex	0		1	0.6%	0	
100.312	incipient cataract, posterior cortex	0		2	1.2%	0	
100.313	incipient cataract, equatorial cortex	0		2	1.2%	0	
100.315	incipient cataract, posterior sutures	0		3	1.9%	1	0.7%
100.316	incipient cataract, nucleus	0		0		1	0.7%
100.330	generalized/complete cataract	0		1	0.6%	0	
100.999	*significant cataracts (summary)*	*1*	*1.2%*	*9*	*5.6%*	*10*	*6.6%*
RETINA							
120.170	retinal dysplasia, folds	0		3	1.9%	0	
120.180	retinal dysplasia, geographic	0		2	1.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		3	1.9%	0	
OTHER							
900.000	other, unspecified	0		1	0.6%	3	2.0%
900.100	other, not inherited	1	1.2%	6	3.7%	4	2.6%
NORMAL							
0.000	normal globe	77	89.5%	134	83.2%	111	73.0%

POINTER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder options
B.	Cataract	Not defined	2	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pointer breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
POINTER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 231 #	1991-1999 231 %	2000-2009 235 #	2000-2009 235 %	2010-2016 248 #	2010-2016 248 %
EYELIDS							
21.000	entropion, unspecified	1	0.4%	2	0.9%	2	0.8%
22.000	ectropion, unspecified	1	0.4%	0		0	
25.110	distichiasis	2	0.9%	1	0.4%	1	0.4%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		1	0.4%
CORNEA							
70.700	corneal dystrophy	2	0.9%	2	0.9%	5	2.0%
UVEA							
93.710	persistent pupillary membranes, iris to iris	1	0.4%	3	1.3%	7	2.8%
93.720	persistent pupillary membranes, iris to lens	1	0.4%	0		0	
93.730	persistent pupillary membranes, iris to cornea	0		1	0.4%	0	
LENS							
100.210	cataract, suspect not inherited	3	1.3%	8	3.4%	8	3.2%
100.302	punctate cataract, posterior cortex	0		0		1	0.4%
100.303	punctate cataract, equatorial cortex	1	0.4%	0		0	
100.306	punctate cataract, nucleus	1	0.4%	0		0	
100.312	incipient cataract, posterior cortex	2	0.9%	0		1	0.4%
100.313	incipient cataract, equatorial cortex	0		1	0.4%	0	
100.315	incipient cataract, posterior sutures	1	0.4%	0		0	
100.999	*significant cataracts (summary)*	*5*	*2.2%*	*1*	*0.4%*	*2*	*0.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.4%	0	
RETINA							
120.170	retinal dysplasia, folds	2	0.9%	3	1.3%	2	0.8%
120.180	retinal dysplasia, geographic	0		3	1.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		2	0.9%	0	
OPTIC NERVE							
130.110	micropapilla	0		1	0.4%	3	1.2%
130.120	optic nerve hypoplasia	0		0		1	0.4%
OTHER							
900.000	other, unspecified	0		2	0.9%	5	2.0%
900.100	other, not inherited	0		6	2.6%	8	3.2%
900.110	other, suspected as inherited	1	0.4%	0		0	
NORMAL							
0.000	normal globe	214	92.6%	217	92.3%	213	85.9%

OCULAR DISORDERS REPORT

POLISH LOWLAND SHEEPDOG
(Polski Owczarek Nizinny)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1, 2, 4, 7	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1, 2, 4, 7	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	2, 4, 7	Breeder option
D.	Cataract	Not defined	3, 4, 7	NO
E.	Retinal atrophy - rod-cone dysplasia type 1 (*rcd4*) * a DNA test is available	Autosomal recessive	5	NO
F.	Ceroid lipofuscinosis	Not defined	6	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the C2orf71 gene. A DNA test is available.

A form of PRA, similar to that found in Gordon and Irish setters, has also been found in the the Polish lowland sheepdog. This form of PRA has been referred to as late-onset, slowly progressive PRA (LOPRA). Slight vascular attenuation, first seen between 4.5 -6 years of age precedes tapetal hyperreflectivity. All fundic changes were bilaterally symmetric and progressed slowly eventually causing clinical blindness, bilateral complete vascular attenuation, and tapetal hyperreflectivity by 12 years of age, on average. Almost all affected dogs were homozygous for the rcd4 mutation in C17H2orf71 gene. A DNA test is available.

F. Ceroid lipofuscinosis

A systemic metabolic disorder that affects the retina and retinal pigment epithelium with accumulation of lipopigments resulting in retinal degeneration.

Historical Note:

Central progressive retinal atrophy was previously a condition listed for this breed. However as the condition is no longer identified in the breed, the condition has been removed. Central progressive retinal atrophy was a progressive retinal degeneration in which photoreceptor death occurred secondary to disease of the underlying pigment epithelium. Progression was slow and some animals never lost vision. CPRA occurred in England, but was uncommon elsewhere.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

5. Downs LM, Bell JS, Freeman J, et al. Late-onset progressive retinal atrophy in the Gordon and Irish Setter breeds is associated with a frameshift mutation in C2orf71. *Anim Genet*. 2012;44:169-177.

6. Narfstrom K, Wrigstad A, Ekesten B, et al. Neuronal ceroid lipofuscinosis: clinical and morphologic findings in nine affected Polish Owczarek Nizinny (PON) dogs. *Vet Ophthalmol*. 2007;10:111-120.

7. ACVO Genetics Committee, 2017 and/or DATA from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
POLISH LOWLAND SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 243 #	1991-1999 243 %	2000-2009 563 #	2000-2009 563 %	2010-2016 310 #	2010-2016 310 %
EYELIDS							
25.110	distichiasis	5	2.1%	7	1.2%	5	1.6%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.3%
CORNEA							
70.700	corneal dystrophy	5	2.1%	17	3.0%	10	3.2%
70.730	corneal endothelial degeneration	0		1	0.2%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	12	4.9%	42	7.5%	22	7.1%
93.999	uveal cysts	0		2	0.4%	0	
LENS							
100.210	cataract, suspect not inherited	9	3.7%	22	3.9%	18	5.8%
100.301	punctate cataract, anterior cortex	0		2	0.4%	5	1.6%
100.302	punctate cataract, posterior cortex	4	1.6%	2	0.4%	2	0.6%
100.303	punctate cataract, equatorial cortex	0		1	0.2%	0	
100.305	punctate cataract, posterior sutures	1	0.4%	0		0	
100.307	punctate cataract, capsular	0		1	0.2%	0	
100.311	incipient cataract, anterior cortex	1	0.4%	2	0.4%	1	0.3%
100.312	incipient cataract, posterior cortex	1	0.4%	1	0.2%	1	0.3%
100.313	incipient cataract, equatorial cortex	0		1	0.2%	1	0.3%
100.315	incipient cataract, posterior sutures	0		1	0.2%	2	0.6%
100.316	incipient cataract, nucleus	0		0		1	0.3%
100.317	incipient cataract, capsular	0		1	0.2%	1	0.3%
100.321	incomplete cataract, anterior cortex	0		0		1	0.3%
100.330	generalized/complete cataract	0		1	0.2%	0	
100.999	*significant cataracts (summary)*	*7*	*2.9%*	*13*	*2.3%*	*15*	*4.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		0		1	0.3%
110.320	vitreal degeneration	0		2	0.4%	0	
RETINA							
120.170	retinal dysplasia, folds	4	1.6%	6	1.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.4%	13	2.3%	3	1.0%
120.960	retinopathy	0		0		1	0.3%
OTHER							
900.000	other, unspecified	0		2	0.4%	3	1.0%
900.100	other, not inherited	1	0.4%	23	4.1%	1	0.3%
NORMAL							
0.000	normal globe	203	83.5%	488	86.7%	248	80.0%

OCULAR DISORDERS REPORT

POMERANIAN

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1, 2	Breeder option
B.	Entropion	Not defined	1	Breeder option
C.	Persistent pupillary membranes - iris to iris	Not defined	3	Breeder option
D.	Cataract	Not defined	4	NO
E.	Retinal atrophy - rod-cone dysplasia type 3 (rcd3) * a DNA test is available	Autosomal recessive	5	NO
F.	Vitreous degeneration	Not defined	6	Breeder option
G.	Retinal atrophy - generalized	Not defined	7	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. Selection should be directed against entropion and toward head conformation that minimizes or eliminates the likelihood of the defect.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA in the Cardigan Welsh Corgi is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the PDE6A gene. A DNA test is available.

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment resulting in blindness.

G. Retinal atrophy, generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality is also known as progressive retinal atrophy or PRA, and may be detected by electroretinogram (not part of a routine eye screening examination) before there are detectable funduscopic changes seen by ophthalmoscopy. There are multiple genetic types of PRA including the rod cone dysplasias described elsewhere. Tests are available to identify the genetic mutation in some breeds.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pomeranian breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

4. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

5. ACVO Genetics Committee, 2016 and/or Data from OFA All-Breeds Report, 2016.

6. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

7. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

OCULAR DISORDERS REPORT
POMERANIAN

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 155 #	%	2000-2009 433 #	%	2010-2016 628 #	%
GLOBE							
0.110	microphthalmia	2	1.3%	0		1	0.2%
EYELIDS							
20.140	ectopic cilia	0		1	0.2%	0	
21.000	entropion, unspecified	0		0		7	1.1%
22.000	ectropion, unspecified	0		1	0.2%	0	
25.110	distichiasis	8	5.2%	26	6.0%	20	3.2%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.6%	0		0	
40.910	keratoconjunctivitis sicca	1	0.6%	0		0	
CORNEA							
70.210	corneal pannus	1	0.6%	0		0	
70.220	pigmentary keratitis	0		1	0.2%	1	0.2%
70.700	corneal dystrophy	3	1.9%	0		0	
70.730	corneal endothelial degeneration	0		2	0.5%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	6	3.9%	25	5.8%	41	6.5%
93.720	persistent pupillary membranes, iris to lens	2	1.3%	1	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.6%	2	0.5%	1	0.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		6	1.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.2%	0	
93.810	uveal melanoma	0		1	0.2%	0	
LENS							
100.200	cataract, unspecified	1	0.6%	0		0	
100.210	cataract, suspect not inherited	2	1.3%	11	2.5%	15	2.4%
100.301	punctate cataract, anterior cortex	0		2	0.5%	0	
100.302	punctate cataract, posterior cortex	1	0.6%	1	0.2%	0	
100.303	punctate cataract, equatorial cortex	0		1	0.2%	0	
100.304	punctate cataract, anterior sutures	0		1	0.2%	0	
100.305	punctate cataract, posterior sutures	2	1.3%	1	0.2%	0	
100.306	punctate cataract, nucleus	0		1	0.2%	0	
100.307	punctate cataract, capsular	0		1	0.2%	1	0.2%
100.311	incipient cataract, anterior cortex	2	1.3%	4	0.9%	3	0.5%
100.312	incipient cataract, posterior cortex	1	0.6%	3	0.7%	4	0.6%
100.313	incipient cataract, equatorial cortex	1	0.6%	2	0.5%	0	
100.316	incipient cataract, nucleus	2	1.3%	0		0	
100.322	incomplete cataract, posterior cortex	0		0		1	0.2%
100.330	generalized/complete cataract	5	3.2%	5	1.2%	1	0.2%
100.340	resorbing/hypermature cataract	0		0		1	0.2%
100.999	*significant cataracts (summary)*	*15*	*9.7%*	*22*	*5.1%*	*11*	*1.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	2	1.3%	1	0.2%	0	
110.135	PHPV/PTVL	0		1	0.2%	0	
110.320	vitreal degeneration	0		7	1.6%	12	1.9%

OCULAR DISORDERS REPORT
POMERANIAN

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	2	1.3%	0		2	0.3%
120.180	retinal dysplasia, geographic	1	0.6%	1	0.2%	1	0.2%
120.310	generalized progressive retinal atrophy (PRA)	6	3.9%	10	2.3%	1	0.2%
120.400	retinal hemorrhage	0		1	0.2%	0	
120.910	retinal detachment without dialysis	1	0.6%	1	0.2%	0	
OPTIC NERVE							
130.120	optic nerve hypoplasia	0		2	0.5%	0	
130.150	optic disc coloboma	2	1.3%	0		0	
OTHER							
900.000	other, unspecified	0		4	0.9%	6	1.0%
900.100	other, not inherited	0		26	6.0%	7	1.1%
900.110	other, suspected as inherited	2	1.3%	3	0.7%	1	0.2%
NORMAL							
0.000	normal globe	115	74.2%	359	82.9%	527	83.9%

POODLE

(Toy, Miniature, and Standard varieties)

* All varieties of the Poodle are basically the same genetic makeup, having their size governed by differences in an "insulin-like growth factor." (See Reference 2.)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-4	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	5	Breeder option
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1, 6 29	 Breeder option Passes with no notation
E.	Cataract	Not defined	1, 7-9	NO
F.	Vitreous degeneration	Not defined	1, 10	Breeder option
G.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1, 10-26	NO
H.	Cone degeneration (achromotopsia) * a DNA test is available	Autosomal recessive	29	NO
I.	Optic nerve hypoplasia	Not defined	1, 27, 28	NO
J.	Micropapilla	Not defined	1	Breeder option

OCULAR DISORDERS REPORT

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

The Poodle form is usually a narrow angle variety and often associated with a condition of goniodysgenesis (a condition of incomplete formation and development of the iridocorneal angle).

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The Poodle cataract can involve the lens cortex and lens nucleus. The rate and degree of

progression are variable. A familial form of cataract has been described in the Standard Poodle, beginning with an equatorial opacity initially observed in dogs prior to 2 years of age.

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment and/or glaucoma. Either condition may cause blindness.

G. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that PRA in the Poodle is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available. It is important to note that in all breeds in which a molecular diagnostic test for the disease is available, it is possible to have dogs diagnosed clinically as affected, yet the DNA test results are normal. This suggests that other genetic causes of PRA exist or that the diagnosed affected dog has an acquired disease that mimics the inherited disorder.

H. Cone degeneration: Day Blindness/Retinal degeneration:

An autosomal recessive disorder of standard poodles and ‘Doodles’ (where the mix-bred dogs are backcrossed to standard poodles that carry the genetic defect); the disease also has been referred to as achromatopsia. The salient clinical findings is profound visual difficulty in bright light, day blindness, with subjective normal night vision. In the early stages of the disease, fundus examination is normal with some dogs showing focal hyperreflectivity of the cone-rich fovea like region of the retina; the photopic ERG is not recordable. In some older dogs, there is progression resulting in poor/absent vision under both dim and bright light conditions, markedly abnormal or non-recordable ERG, and a fundus appearance indicative of late stage retinal degeneration and indistinguishable from progressive retinal atrophy.

I. Optic nerve hypoplasia

Hypoplasia of the optic nerve is seen in the Poodle. In this condition, the optic nerve fails to develop completely. The signs have a variety of expression and degrees of hypoplasia can be found. One or both eyes may be affected. Affected eyes may retain some function or be blind. The mode of inheritance is not clear.

J. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

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OCULAR DISORDERS REPORT
POODLE

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	18466		19429		12166	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	7	0.0%	10	0.1%	4	0.0%
10.000	glaucoma	4	0.0%	1	0.0%	1	0.0%
EYELIDS							
20.110	eyelid dermoid	1	0.0%	0		0	
20.140	ectopic cilia	14	0.1%	13	0.1%	11	0.1%
20.160	macropalpebral fissure	0		0		1	0.0%
21.000	entropion, unspecified	41	0.2%	56	0.3%	31	0.3%
22.000	ectropion, unspecified	1	0.0%	4	0.0%	0	
25.110	distichiasis	1467	7.9%	1002	5.2%	607	5.0%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	2	0.0%	0		8	0.1%
40.910	keratoconjunctivitis sicca	0		5	0.0%	6	0.0%
NICTITANS							
50.210	pannus of third eyelid	0		0		1	0.0%
51.100	third eyelid cartilage anomaly	12	0.1%	14	0.1%	17	0.1%
52.110	prolapsed gland of the third eyelid	0		6	0.0%	12	0.1%
CORNEA							
70.210	corneal pannus	24	0.1%	15	0.1%	0	
70.220	pigmentary keratitis	6	0.0%	15	0.1%	9	0.1%
70.700	corneal dystrophy	113	0.6%	96	0.5%	65	0.5%
70.730	corneal endothelial degeneration	4	0.0%	4	0.0%	4	0.0%
UVEA							
90.250	pigmentary uveitis	0		0		2	0.0%
93.110	iris hypoplasia	0		1	0.0%	1	0.0%
93.140	corneal endothelial pigment without PPM	0		5	0.0%	0	
93.150	iris coloboma	2	0.0%	3	0.0%	1	0.0%
93.710	persistent pupillary membranes, iris to iris	363	2.0%	660	3.4%	582	4.8%
93.720	persistent pupillary membranes, iris to lens	30	0.2%	33	0.2%	25	0.2%
93.730	persistent pupillary membranes, iris to cornea	9	0.0%	18	0.1%	9	0.1%
93.740	persistent pupillary membranes, iris sheets	19	0.1%	19	0.1%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		11	0.1%	206	1.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		6	0.0%
93.810	uveal melanoma	0		0		4	0.0%
93.999	uveal cysts	1	0.0%	3	0.0%	5	0.0%
97.150	chorioretinal coloboma, congenital	0		0		1	0.0%
LENS							
100.200	cataract, unspecified	384	2.1%	0		0	
100.210	cataract, suspect not inherited	721	3.9%	1193	6.1%	780	6.4%
100.301	punctate cataract, anterior cortex	196	1.1%	161	0.8%	109	0.9%
100.302	punctate cataract, posterior cortex	85	0.5%	71	0.4%	45	0.4%
100.303	punctate cataract, equatorial cortex	47	0.3%	51	0.3%	26	0.2%
100.304	punctate cataract, anterior sutures	25	0.1%	19	0.1%	11	0.1%
100.305	punctate cataract, posterior sutures	41	0.2%	47	0.2%	35	0.3%

OCULAR DISORDERS REPORT
POODLE

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.306	punctate cataract, nucleus	15	0.1%	16	0.1%	10	0.1%
100.307	punctate cataract, capsular	2	0.0%	26	0.1%	24	0.2%
100.311	incipient cataract, anterior cortex	223	1.2%	185	1.0%	87	0.7%
100.312	incipient cataract, posterior cortex	179	1.0%	154	0.8%	82	0.7%
100.313	incipient cataract, equatorial cortex	100	0.5%	115	0.6%	51	0.4%
100.314	incipient cataract, anterior sutures	19	0.1%	15	0.1%	3	0.0%
100.315	incipient cataract, posterior sutures	29	0.2%	46	0.2%	18	0.1%
100.316	incipient cataract, nucleus	28	0.2%	24	0.1%	19	0.2%
100.317	incipient cataract, capsular	2	0.0%	19	0.1%	23	0.2%
100.321	incomplete cataract, anterior cortex	0		0		17	0.1%
100.322	incomplete cataract, posterior cortex	0		0		20	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		9	0.1%
100.324	incomplete cataract, anterior sutures	0		0		1	0.0%
100.325	incomplete cataract, posterior sutures	0		0		1	0.0%
100.326	incomplete cataract, nucleus	0		0		3	0.0%
100.330	generalized/complete cataract	267	1.4%	140	0.7%	23	0.2%
100.340	resorbing/hypermature cataract	0		0		4	0.0%
100.375	subluxation/luxation, unspecified	13	0.1%	10	0.1%	6	0.0%
100.999	*significant cataracts (summary)*	*1642*	*8.9%*	*1089*	*5.6%*	*621*	*5.1%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	33	0.2%	24	0.1%	30	0.2%
110.135	PHPV/PTVL	9	0.0%	8	0.0%	8	0.1%
110.320	vitreal degeneration	93	0.5%	139	0.7%	107	0.9%
FUNDUS							
97.110	choroidal hypoplasia	1	0.0%	1	0.0%	1	0.0%
97.120	coloboma	8	0.0%	3	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	41	0.2%	59	0.3%	34	0.3%
120.180	retinal dysplasia, geographic	2	0.0%	14	0.1%	5	0.0%
120.190	retinal dysplasia, detached	3	0.0%	6	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	336	1.8%	214	1.1%	36	0.3%
120.400	retinal hemorrhage	3	0.0%	0		0	
120.910	retinal detachment without dialysis	13	0.1%	13	0.1%	1	0.0%
120.920	retinal detachment with dialysis	0		0		3	0.0%
120.960	retinopathy	0		0		14	0.1%
OPTIC NERVE							
130.110	micropapilla	10	0.1%	81	0.4%	84	0.7%
130.120	optic nerve hypoplasia	133	0.7%	46	0.2%	40	0.3%
130.150	optic disc coloboma	28	0.2%	18	0.1%	4	0.0%
OTHER							
900.000	other, unspecified	0		118	0.6%	315	2.6%
900.100	other, not inherited	73	0.4%	801	4.1%	335	2.8%
900.110	other, suspected as inherited	127	0.7%	68	0.3%	26	0.2%
NORMAL							
0.000	normal globe	14496	78.5%	16227	83.5%	9608	79.0%

OCULAR DISORDERS REPORT

PORTUGUESE PODENGO PEQUENO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	2	Breeder option
C.	Cataract	Not defined	3	NO
D.	Vitreous degeneration	Not defined	1	Breeder option
E.	Retinal atrophy - rod-cone dysplasia type 3 (rcd3) * a DNA test is available	Autosomal recessive	4	NO
F.	Retinal atrophy - generalized (prcd) * a DNA test is available	Autosomal recessive	5	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataracts

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - rod-cone dysplasia type 3 (*rcd3*)

PRA in the Cardigan Welsh Corgi is an autosomal recessive trait caused by a one base pair deletion in the gene encoding the alpha subunit of cyclic GMP phosphodiesterase (rcd3). PRA begins early in life with clinical signs of night blindness and a lack of rod ERG responses is seen at 6-8 weeks of age. Dogs are completely blind by 2-3 years of age when ophthalmoscopic signs are first visible. The mutation is found in the PDE6A gene. A DNA test is available.

F. Retinal atrophy - generalized (*prcd)*

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Other forms of retinal degeneration that are not PRCD are recognized in the breed. The currently available genetic test will not detect these other forms of PRA.

References

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3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

4. ACVO Genetics Committee, 2016 and/or Data from OFA All-Breeds Report, 2016.

5. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

OCULAR DISORDERS REPORT
PORTUGUESE PODENGO PEQUENO

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 0 #	%	2010-2016 202 #	%
EYELIDS								
25.110	distichiasis		0		0		8	4.0%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		0		11	5.4%
93.730	persistent pupillary membranes, iris to cornea		0		0		1	0.5%
LENS								
100.210	cataract, suspect not inherited		0		0		6	3.0%
100.301	punctate cataract, anterior cortex		0		0		1	0.5%
100.311	incipient cataract, anterior cortex		0		0		4	2.0%
100.312	incipient cataract, posterior cortex		0		0		2	1.0%
100.313	incipient cataract, equatorial cortex		0		0		1	0.5%
100.315	incipient cataract, posterior sutures		0		0		1	0.5%
100.317	incipient cataract, capsular		0		0		1	0.5%
100.330	generalized/complete cataract		0		0		1	0.5%
100.340	resorbing/hypermature cataract		0		0		1	0.5%
100.375	subluxation/luxation, unspecified		0		0		3	1.5%
100.999	*significant cataracts (summary)*		*0*		*0*		*12*	*5.9%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		0		0		1	0.5%
110.320	vitreal degeneration		0		0		12	5.9%
RETINA								
120.310	generalized progressive retinal atrophy (PRA)		0		0		4	2.0%
120.960	retinopathy		0		0		2	1.0%
OTHER								
900.100	other, not inherited		0		0		6	3.0%
NORMAL								
0.000	normal globe		0		0		155	76.7%

OCULAR DISORDERS REPORT

PORTUGUESE WATER DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1, 2	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	3	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
E.	Cataract	Not defined	1	NO
F.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1, 4, 5	NO
G.	Retinal dysplasia - folds	Not defined	6, 7	Breeder option

Description and Comments

A. Microphthalmia with multiple congenital ocular defects

This is a congenital abnormality present bilaterally and characterized by a small globe and associated ocular defects which can affect the cornea, anterior chamber, lens and/or retina. These associated defects may be variable in severity. Several cases have been identified, all of which appeared to have a common ancestry. All affected animals so far identified have been the progeny of dogs that were phenotypically normal, suggesting that the defect is not dominantly inherited.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Portuguese Water Dog is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

A second, earlier onset form of PRA has also been identified recently in the Portuguese

Water Dog. The onset of visual deficits occurs at 2-3 years of age, and, dogs show advanced retinal degeneration at the time visual deficits are recognized. The condition appears inherited as autosomal recessive. The gene/mutation that causes this form of PRA has not yet been identified. The currently available genetic test will not detect this form of PRA.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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7. ACVO Genetics Committee 2017, and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
PORTUGUESE WATER DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 8302 #	%	2000-2009 11876 #	%	2010-2016 10634 #	%
GLOBE							
0.110	microphthalmia	9	0.1%	4	0.0%	5	0.0%
10.000	glaucoma	5	0.1%	0		1	0.0%
EYELIDS							
20.140	ectopic cilia	0		2	0.0%	1	0.0%
20.160	macropalpebral fissure	0		0		1	0.0%
21.000	entropion, unspecified	14	0.2%	16	0.1%	25	0.2%
22.000	ectropion, unspecified	0		3	0.0%	0	
25.110	distichiasis	228	2.7%	455	3.8%	444	4.2%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	2	0.0%	2	0.0%	2	0.0%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		1	0.0%
CORNEA							
70.210	corneal pannus	3	0.0%	1	0.0%	0	
70.220	pigmentary keratitis	0		3	0.0%	1	0.0%
70.700	corneal dystrophy	54	0.7%	64	0.5%	101	0.9%
70.730	corneal endothelial degeneration	1	0.0%	1	0.0%	4	0.0%
UVEA							
93.110	iris hypoplasia	0		1	0.0%	1	0.0%
93.140	corneal endothelial pigment without PPM	0		1	0.0%	1	0.0%
93.150	iris coloboma	1	0.0%	0		0	
93.710	persistent pupillary membranes, iris to iris	282	3.4%	747	6.3%	876	8.2%
93.720	persistent pupillary membranes, iris to lens	13	0.2%	15	0.1%	15	0.1%
93.730	persistent pupillary membranes, iris to cornea	12	0.1%	14	0.1%	8	0.1%
93.740	persistent pupillary membranes, iris sheets	8	0.1%	34	0.3%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		47	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		8	0.1%
93.810	uveal melanoma	0		1	0.0%	5	0.0%
93.999	uveal cysts	1	0.0%	6	0.1%	6	0.1%
LENS							
100.200	cataract, unspecified	69	0.8%	0		0	
100.210	cataract, suspect not inherited	383	4.6%	804	6.8%	838	7.9%
100.301	punctate cataract, anterior cortex	31	0.4%	59	0.5%	68	0.6%
100.302	punctate cataract, posterior cortex	17	0.2%	25	0.2%	22	0.2%
100.303	punctate cataract, equatorial cortex	20	0.2%	24	0.2%	13	0.1%
100.304	punctate cataract, anterior sutures	0		11	0.1%	12	0.1%
100.305	punctate cataract, posterior sutures	5	0.1%	9	0.1%	18	0.2%
100.306	punctate cataract, nucleus	4	0.0%	4	0.0%	9	0.1%
100.307	punctate cataract, capsular	2	0.0%	14	0.1%	9	0.1%
100.311	incipient cataract, anterior cortex	29	0.3%	44	0.4%	28	0.3%
100.312	incipient cataract, posterior cortex	14	0.2%	54	0.5%	20	0.2%
100.313	incipient cataract, equatorial cortex	19	0.2%	43	0.4%	27	0.3%
100.314	incipient cataract, anterior sutures	2	0.0%	5	0.0%	6	0.1%

OCULAR DISORDERS REPORT
PORTUGUESE WATER DOG

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.315	incipient cataract, posterior sutures	3	0.0%	7	0.1%	6	0.1%
100.316	incipient cataract, nucleus	3	0.0%	10	0.1%	8	0.1%
100.317	incipient cataract, capsular	1	0.0%	12	0.1%	9	0.1%
100.321	incomplete cataract, anterior cortex	0		0		9	0.1%
100.322	incomplete cataract, posterior cortex	0		0		11	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		3	0.0%
100.324	incomplete cataract, anterior sutures	0		0		1	0.0%
100.326	incomplete cataract, nucleus	0		0		1	0.0%
100.330	generalized/complete cataract	27	0.3%	31	0.3%	12	0.1%
100.340	resorbing/hypermature cataract	0		0		2	0.0%
100.375	subluxation/luxation, unspecified	4	0.0%	3	0.0%	4	0.0%
100.999	*significant cataracts (summary)*	*246*	*3.0%*	*352*	*3.0%*	*294*	*2.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	9	0.1%	22	0.2%	16	0.2%
110.135	PHPV/PTVL	0		11	0.1%	7	0.1%
110.320	vitreal degeneration	5	0.1%	19	0.2%	22	0.2%
FUNDUS							
97.110	choroidal hypoplasia	2	0.0%	0		0	
RETINA							
120.170	retinal dysplasia, folds	47	0.6%	102	0.9%	103	1.0%
120.180	retinal dysplasia, geographic	5	0.1%	9	0.1%	5	0.0%
120.190	retinal dysplasia, detached	2	0.0%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	118	1.4%	45	0.4%	11	0.1%
120.400	retinal hemorrhage	2	0.0%	6	0.1%	0	
120.910	retinal detachment without dialysis	2	0.0%	1	0.0%	0	
120.920	retinal detachment with dialysis	0		0		3	0.0%
120.960	retinopathy	0		0		1	0.0%
OPTIC NERVE							
130.110	micropapilla	0		6	0.1%	8	0.1%
130.120	optic nerve hypoplasia	4	0.0%	6	0.1%	1	0.0%
130.150	optic disc coloboma	4	0.0%	2	0.0%	0	
OTHER							
900.000	other, unspecified	0		75	0.6%	238	2.2%
900.100	other, not inherited	29	0.3%	501	4.2%	293	2.8%
900.110	other, suspected as inherited	57	0.7%	10	0.1%	5	0.0%
NORMAL							
0.000	normal globe	7108	85.6%	10245	86.3%	8404	79.0%

OCULAR DISORDERS REPORT

PUG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Exposure/Pigmentary Keratitis/Pigmentary Keratopathy	Not defined	1, 2	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	3	Breeder option
E.	Cataract	Not defined	3, 4	NO
F.	Vitreous degeneration	Not defined	3	Breeder option
G.	Retinal dysplasia – folds	Presumed autosomal recessive	5	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In the Pug, entropion usually involves the medial canthal margin of the lower eyelid(s).

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Exposure/Pigmentary keratitis/Pigmentary keratopathy

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

The breed standard indicates the Pug should have a "large massive round head with very large, bold and prominent eyes." These characteristics give rise to the ocular exposure and irritative problems common in the breed.

Pigmentary keratopathy is a condition reported in Pugs in which the cornea becomes pigmented, often resulting in vision impairment. Development of pigmentary keratopathy is associated with congenital uveal pathology – iris hypoplasia and the presence of persistent pupillary membranes – but not with other factors such as Schirmer tear test values or medial canthal entropion.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally in the neonatal period. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

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7. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

OCULAR DISORDERS REPORT
PUG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 633 #	%	2000-2009 1264 #	%	2010-2016 806 #	%
GLOBE							
0.110	microphthalmia	0		3	0.2%	0	
EYELIDS							
20.110	eyelid dermoid	1	0.2%	0		0	
20.140	ectopic cilia	3	0.5%	10	0.8%	1	0.1%
20.160	macropalpebral fissure	17	2.7%	45	3.6%	5	0.6%
21.000	entropion, unspecified	138	21.8%	251	19.9%	99	12.3%
22.000	ectropion, unspecified	3	0.5%	6	0.5%	2	0.2%
25.110	distichiasis	74	11.7%	105	8.3%	61	7.6%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		2	0.2%	6	0.7%
NICTITANS							
50.210	pannus of third eyelid	0		0		1	0.1%
CORNEA							
70.210	corneal pannus	53	8.4%	27	2.1%	0	
70.220	pigmentary keratitis	118	18.6%	290	22.9%	444	55.1%
70.700	corneal dystrophy	6	0.9%	6	0.5%	2	0.2%
70.730	corneal endothelial degeneration	0		3	0.2%	1	0.1%
UVEA							
93.150	iris coloboma	0		2	0.2%	0	
93.710	persistent pupillary membranes, iris to iris	35	5.5%	128	10.1%	112	13.9%
93.720	persistent pupillary membranes, iris to lens	2	0.3%	4	0.3%	2	0.2%
93.730	persistent pupillary membranes, iris to cornea	5	0.8%	9	0.7%	2	0.2%
93.740	persistent pupillary membranes, iris sheets	0		1	0.1%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.1%	6	0.7%
93.999	uveal cysts	1	0.2%	0		1	0.1%
LENS							
100.200	cataract, unspecified	4	0.6%	0		0	
100.210	cataract, suspect not inherited	2	0.3%	28	2.2%	26	3.2%
100.301	punctate cataract, anterior cortex	1	0.2%	1	0.1%	2	0.2%
100.302	punctate cataract, posterior cortex	2	0.3%	0		2	0.2%
100.303	punctate cataract, equatorial cortex	0		5	0.4%	0	
100.304	punctate cataract, anterior sutures	0		1	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures	0		5	0.4%	1	0.1%
100.306	punctate cataract, nucleus	1	0.2%	1	0.1%	2	0.2%
100.307	punctate cataract, capsular	0		1	0.1%	2	0.2%
100.311	incipient cataract, anterior cortex	7	1.1%	6	0.5%	5	0.6%
100.312	incipient cataract, posterior cortex	5	0.8%	5	0.4%	8	1.0%
100.313	incipient cataract, equatorial cortex	1	0.2%	4	0.3%	3	0.4%
100.315	incipient cataract, posterior sutures	5	0.8%	0		3	0.4%
100.316	incipient cataract, nucleus	1	0.2%	1	0.1%	2	0.2%
100.317	incipient cataract, capsular	0		3	0.2%	2	0.2%
100.321	incomplete cataract, anterior cortex	0		0		3	0.4%
100.322	incomplete cataract, posterior cortex	0		0		3	0.4%

OCULAR DISORDERS REPORT
PUG

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.325	incomplete cataract, posterior sutures	0		0		1	0.1%
100.326	incomplete cataract, nucleus	0		0		1	0.1%
100.330	generalized/complete cataract	5	0.8%	3	0.2%	5	0.6%
100.999	*significant cataracts (summary)*	*32*	*5.1%*	*36*	*2.8%*	*46*	*5.7%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	6	0.9%	3	0.2%	4	0.5%
110.135	PHPV/PTVL	0		1	0.1%	2	0.2%
110.320	vitreal degeneration	5	0.8%	14	1.1%	11	1.4%
FUNDUS							
97.120	coloboma	0		1	0.1%	0	
RETINA							
120.170	retinal dysplasia, folds	2	0.3%	13	1.0%	5	0.6%
120.180	retinal dysplasia, geographic	0		9	0.7%	3	0.4%
120.310	generalized progressive retinal atrophy (PRA)	1	0.2%	2	0.2%	0	
120.400	retinal hemorrhage	1	0.2%	0		0	
120.910	retinal detachment without dialysis	0		1	0.1%	0	
OPTIC NERVE							
130.120	optic nerve hypoplasia	1	0.2%	0		0	
130.150	optic disc coloboma	0		1	0.1%	0	
OTHER							
900.000	other, unspecified	0		15	1.2%	21	2.6%
900.100	other, not inherited	11	1.7%	146	11.6%	35	4.3%
900.110	other, suspected as inherited	38	6.0%	28	2.2%	7	0.9%
NORMAL							
0.000	normal globe	270	42.7%	592	46.8%	240	29.8%

OCULAR DISORDERS REPORT

PULI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy-epithelial/stromal	Not defined	1, 2	Breeder option
B.	Persistent pupillary membranes			
	-iris to iris	Not defined	2	Breeder option
	-iris to lens	Not defined	2	NO
C.	Cataract	Not defined	3	NO
D.	Lens luxation * a DNA test is available	Not defined	5	NO
E.	Retinal dysplasia -folds	Not defined	4	Breeder option

Description and Comments

A. Corneal Dystrophy- epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation may result in blinding retinal detachment and/or elevated intraocular pressure (glaucoma) causing vision impairment, pain, and blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

5. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
PULI

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**367**		**478**		**271**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
EYELIDS							
20.110	eyelid dermoid	1	0.3%	0		0	
20.140	ectopic cilia	0		1	0.2%	0	
20.160	macropalpebral fissure	0		1	0.2%	0	
21.000	entropion, unspecified	4	1.1%	2	0.4%	2	0.7%
25.110	distichiasis	3	0.8%	2	0.4%	2	0.7%
CORNEA							
70.220	pigmentary keratitis	2	0.5%	3	0.6%	0	
70.700	corneal dystrophy	13	3.5%	5	1.0%	0	
70.730	corneal endothelial degeneration	1	0.3%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	68	18.5%	138	28.9%	46	17.0%
93.720	persistent pupillary membranes, iris to lens	3	0.8%	9	1.9%	2	0.7%
93.730	persistent pupillary membranes, iris to cornea	3	0.8%	3	0.6%	2	0.7%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		6	2.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.2%	0	
93.999	uveal cysts	0		1	0.2%	0	
LENS							
100.200	cataract, unspecified	3	0.8%	0		0	
100.210	cataract, suspect not inherited	22	6.0%	30	6.3%	14	5.2%
100.301	punctate cataract, anterior cortex	2	0.5%	2	0.4%	1	0.4%
100.302	punctate cataract, posterior cortex	0		2	0.4%	0	
100.305	punctate cataract, posterior sutures	5	1.4%	0		3	1.1%
100.306	punctate cataract, nucleus	2	0.5%	0		1	0.4%
100.307	punctate cataract, capsular	0		1	0.2%	1	0.4%
100.311	incipient cataract, anterior cortex	4	1.1%	2	0.4%	3	1.1%
100.312	incipient cataract, posterior cortex	2	0.5%	1	0.2%	1	0.4%
100.313	incipient cataract, equatorial cortex	4	1.1%	2	0.4%	1	0.4%
100.315	incipient cataract, posterior sutures	0		1	0.2%	0	
100.316	incipient cataract, nucleus	2	0.5%	1	0.2%	0	
100.317	incipient cataract, capsular	0		1	0.2%	0	
100.330	generalized/complete cataract	6	1.6%	1	0.2%	0	
100.375	subluxation/luxation, unspecified	1	0.3%	0		0	
100.999	*significant cataracts (summary)*	*30*	*8.2%*	*14*	*2.9%*	*11*	*4.1%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.2%	1	0.4%
110.135	PHPV/PTVL	0		0		1	0.4%
110.320	vitreal degeneration	0		1	0.2%	0	
RETINA							
120.170	retinal dysplasia, folds	10	2.7%	30	6.3%	6	2.2%
120.180	retinal dysplasia, geographic	0		3	0.6%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	0.5%	2	0.4%	0	
120.400	retinal hemorrhage	1	0.3%	0		0	
120.910	retinal detachment without dialysis	1	0.3%	1	0.2%	0	

OCULAR DISORDERS REPORT
PULI

	1991-1999	2000-2009	2010-2016
OPTIC NERVE			
130.110 micropapilla	2 0.5%	0	0
130.120 optic nerve hypoplasia	3 0.8%	0	0
OTHER			
900.000 other, unspecified	0	1 0.2%	12 4.4%
900.100 other, not inherited	13 3.5%	33 6.9%	3 1.1%
900.110 other, suspected as inherited	0	4 0.8%	0
NORMAL			
0.000 normal globe	250 68.1%	299 62.6%	203 74.9%

PYRENEAN SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Retinal dysplasia - folds	Not defined	2	Breeder option
D.	Choroidal hypoplasia	Not defined	1, 2	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

D. Choroidal hypoplasia

Inadequate development of the choroid present at birth and non-progressive. This condition is more commonly identified in the Collie breed where it is a manifestation of "Collie Eye Anomaly."

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Pyrenean Shepherd. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Report, 2013-2014.

OCULAR DISORDERS REPORT
PYRENEAN SHEPHERD

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 9 #	 %	2000-2009 156 #	 %	2010-2016 332 #	 %
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.3%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		1	0.6%	0	
CORNEA							
70.700	corneal dystrophy	0		1	0.6%	1	0.3%
UVEA							
93.110	iris hypoplasia	0		0		1	0.3%
93.150	iris coloboma	0		0		1	0.3%
93.710	persistent pupillary membranes, iris to iris	2	22.2%	10	6.4%	14	4.2%
93.740	persistent pupillary membranes, iris sheets	0		1	0.6%	0	
LENS							
100.210	cataract, suspect not inherited	0		6	3.8%	7	2.1%
100.301	punctate cataract, anterior cortex	0		2	1.3%	1	0.3%
100.302	punctate cataract, posterior cortex	0		1	0.6%	1	0.3%
100.303	punctate cataract, equatorial cortex	1	11.1%	0		0	
100.305	punctate cataract, posterior sutures	0		1	0.6%	0	
100.311	incipient cataract, anterior cortex	0		2	1.3%	3	0.9%
100.312	incipient cataract, posterior cortex	0		1	0.6%	0	
100.313	incipient cataract, equatorial cortex	1	11.1%	1	0.6%	0	
100.315	incipient cataract, posterior sutures	0		0		1	0.3%
100.316	incipient cataract, nucleus	0		0		6	1.8%
100.322	incomplete cataract, posterior cortex	0		0		4	1.2%
100.326	incomplete cataract, nucleus	0		0		2	0.6%
100.375	subluxation/luxation, unspecified	0		1	0.6%	0	
100.999	*significant cataracts (summary)*	*2*	*22.2%*	*8*	*5.1%*	*18*	*5.4%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.6%	4	1.2%
110.320	vitreal degeneration	0		0		1	0.3%
FUNDUS							
97.110	choroidal hypoplasia	0		6	3.8%	12	3.6%
RETINA							
120.170	retinal dysplasia, folds	0		3	1.9%	6	1.8%
120.180	retinal dysplasia, geographic	0		0		1	0.3%
120.310	generalized progressive retinal atrophy (PRA)	0		0		1	0.3%
OTHER							
900.000	other, unspecified	0		1	0.6%	8	2.4%
900.100	other, not inherited	0		11	7.1%	9	2.7%
NORMAL							
0.000	normal globe	6	66.7%	129	82.7%	280	84.3%

OCULAR DISORDERS REPORT

RAT TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Cataract	Not defined	1	NO
C.	Retinal atrophy - generalized (prcd) * a DNA test is available	Autosomal recessive	2	NO
D.	Lens luxation * a DNA test is available	Not defined	3, 4	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

3. Farias FH, Johnson GS, Taylor JF, et al. An ADAMTS17 splice donor site mutation in dogs with primary lens luxation. *Invest Ophthalmol Vis Sci*. 2010;51:4716-4721.

4. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011;14:378-384.

OCULAR DISORDERS REPORT
RAT TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 8 #	%	2000-2009 179 #	%	2010-2016 94 #	%
EYELIDS								
25.110	distichiasis		1	12.5%	1	0.6%	3	3.2%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		5	2.8%	3	3.2%
93.730	persistent pupillary membranes, iris to cornea		0		1	0.6%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		2	2.1%
LENS								
100.210	cataract, suspect not inherited		0		2	1.1%	3	3.2%
100.303	punctate cataract, equatorial cortex		0		0		1	1.1%
100.311	incipient cataract, anterior cortex		0		2	1.1%	1	1.1%
100.312	incipient cataract, posterior cortex		0		2	1.1%	1	1.1%
100.313	incipient cataract, equatorial cortex		0		1	0.6%	1	1.1%
100.315	incipient cataract, posterior sutures		0		1	0.6%	0	
100.316	incipient cataract, nucleus		0		1	0.6%	0	
100.330	generalized/complete cataract		0		4	2.2%	0	
100.375	subluxation/luxation, unspecified		0		1	0.6%	2	2.1%
100.999	*significant cataracts (summary)*		*0*		*11*	*6.1%*	*4*	*4.3%*
VITREOUS								
110.320	vitreal degeneration		0		3	1.7%	1	1.1%
RETINA								
120.190	retinal dysplasia, detached		0		0		1	1.1%
120.310	generalized progressive retinal atrophy (PRA)		0		1	0.6%	0	
OTHER								
900.000	other, unspecified		0		1	0.6%	2	2.1%
900.100	other, not inherited		0		0		2	2.1%
900.110	other, suspected as inherited		0		1	0.6%	0	
NORMAL								
0.000	normal globe		7	87.5%	164	91.6%	81	86.2%

RHODESIAN RIDGEBACK

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Entropion	Not defined	2	NO
C.	Persistent pupillary membranes - iris to iris	Not defined	3	Breeder option
D.	Cataract	Not defined	1	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Rhodesian Ridgeback breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Breed club request to ACVO Genetics Committee, 2008.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

OCULAR DISORDERS REPORT
RHODESIAN RIDGEBACK

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 544 #	 %	2000-2009 2308 #	 %	2010-2016 1942 #	 %
GLOBE							
0.110	microphthalmia	0		2	0.1%	0	
EYELIDS							
21.000	entropion, unspecified	4	0.7%	8	0.3%	3	0.2%
22.000	ectropion, unspecified	0		1	0.0%	0	
25.110	distichiasis	14	2.6%	63	2.7%	62	3.2%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		5	0.3%
52.110	prolapsed gland of the third eyelid	0		0		3	0.2%
CORNEA							
70.210	corneal pannus	0		3	0.1%	3	0.2%
70.700	corneal dystrophy	4	0.7%	15	0.6%	8	0.4%
UVEA							
93.110	iris hypoplasia	0		1	0.0%	0	
93.140	corneal endothelial pigment without PPM	0		0		4	0.2%
93.710	persistent pupillary membranes, iris to iris	20	3.7%	126	5.5%	133	6.8%
93.720	persistent pupillary membranes, iris to lens	4	0.7%	2	0.1%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	0		2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	0		1	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.0%	70	3.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		5	0.3%
93.810	uveal melanoma	0		0		3	0.2%
93.999	uveal cysts	0		2	0.1%	3	0.2%
97.150	chorioretinal coloboma, congenital	0		0		1	0.1%
LENS							
100.200	cataract, unspecified	4	0.7%	0		0	
100.210	cataract, suspect not inherited	32	5.9%	108	4.7%	83	4.3%
100.301	punctate cataract, anterior cortex	1	0.2%	3	0.1%	9	0.5%
100.302	punctate cataract, posterior cortex	8	1.5%	22	1.0%	16	0.8%
100.303	punctate cataract, equatorial cortex	1	0.2%	1	0.0%	0	
100.304	punctate cataract, anterior sutures	0		0		1	0.1%
100.305	punctate cataract, posterior sutures	4	0.7%	9	0.4%	9	0.5%
100.307	punctate cataract, capsular	0		8	0.3%	2	0.1%
100.311	incipient cataract, anterior cortex	0		0		7	0.4%
100.312	incipient cataract, posterior cortex	22	4.0%	44	1.9%	20	1.0%
100.313	incipient cataract, equatorial cortex	2	0.4%	4	0.2%	4	0.2%
100.315	incipient cataract, posterior sutures	3	0.6%	7	0.3%	5	0.3%
100.316	incipient cataract, nucleus	0		4	0.2%	1	0.1%
100.317	incipient cataract, capsular	1	0.2%	13	0.6%	3	0.2%
100.322	incomplete cataract, posterior cortex	0		0		1	0.1%
100.324	incomplete cataract, anterior sutures	0		0		1	0.1%
100.325	incomplete cataract, posterior sutures	0		0		1	0.1%
100.330	generalized/complete cataract	2	0.4%	1	0.0%	0	
100.375	subluxation/luxation, unspecified	0		3	0.1%	0	
100.999	*significant cataracts (summary)*	*48*	*8.8%*	*116*	*5.0%*	*80*	*4.1%*

OCULAR DISORDERS REPORT
RHODESIAN RIDGEBACK

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.0%	2	0.1%
110.135	PHPV/PTVL	0		1	0.0%	0	
110.320	vitreal degeneration	3	0.6%	6	0.3%	5	0.3%
RETINA							
120.170	retinal dysplasia, folds	1	0.2%	3	0.1%	2	0.1%
120.180	retinal dysplasia, geographic	0		1	0.0%	0	
120.190	retinal dysplasia, detached	0		1	0.0%	0	
120.310	generalized progressive retinal atrophy (PRA)	1	0.2%	2	0.1%	2	0.1%
120.910	retinal detachment without dialysis	0		2	0.1%	0	
OPTIC NERVE							
130.110	micropapilla	0		1	0.0%	0	
130.120	optic nerve hypoplasia	1	0.2%	0		0	
130.150	optic disc coloboma	0		5	0.2%	0	
OTHER							
900.000	other, unspecified	0		21	0.9%	30	1.5%
900.100	other, not inherited	4	0.7%	84	3.6%	50	2.6%
900.110	other, suspected as inherited	2	0.4%	6	0.3%	4	0.2%
NORMAL							
0.000	normal globe	433	79.6%	2019	87.5%	1548	79.7%

OCULAR DISORDERS REPORT

ROTTWEILER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1, 2	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Uveal cysts	Not defined	1, 3, 4	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	5	Breeder option
E.	Cataract	Not defined	1, 3	NO
F.	Retinal atrophy - generalized	Not defined	1	NO
G.	Retinal dysplasia - folds	Not defined	1, 4	Breeder option

Description and Comments

A. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

Entropion in the Rottweiler has been observed with increasing frequency in the past few years. Selection should be directed against entropion and toward a head conformation that minimizes or eliminates the likelihood of the defect. The entropion usually involves the lower eyelids in this breed and requires surgical correction.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

OCULAR DISORDERS REPORT

C. Uveal cysts

A pigmented, fluid-filled epithelial-lined structure arising from the posterior iris or ciliary body epithelium. Cysts may remain attached to the pupil margin, iris, or ciliary body, or may detach and be free-floating within the anterior chamber. They may rupture and adhere to the cornea or anterior lens capsule. Uveal cysts may occur in any breed. Uveal cysts are commonly benign, although they may be associated with other pathologic conditions is various breeds.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

A variety of cataracts have been observed in this breed ranging from the posterior polar cataract similar to that in the Golden Retriever and cataracts involving multiple areas of the nucleus and cortex. Further studies need to be performed as to the exact mode of inheritance, but it is our recommendation that the individually afflicted dog should not be bred.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2001 and/or Data from CERF All-Breeds Report, 2001.

3. Bjerkas E. Progressive retinal atrophy in dogs in Norway. *Norsk Veterinaertidsskrift.* 1991;103:601-610.

4. Bedford PG. Multifocal retinal dysplasia in the Rottweiler. *Vet Rec.* 1982 Sep 25;111:304-305.

5. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

OCULAR DISORDERS REPORT
ROTTWEILER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 5756 #	%	2000-2009 5416 #	%	2010-2016 4198 #	%
GLOBE							
0.110	microphthalmia	1	0.0%	1	0.0%	1	0.0%
EYELIDS							
20.140	ectopic cilia	0		1	0.0%	0	
20.160	macropalpebral fissure	1	0.0%	9	0.2%	0	
21.000	entropion, unspecified	63	1.1%	34	0.6%	26	0.6%
22.000	ectropion, unspecified	13	0.2%	15	0.3%	1	0.0%
25.110	distichiasis	29	0.5%	33	0.6%	28	0.7%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		3	0.1%
NICTITANS							
51.100	third eyelid cartilage anomaly	3	0.1%	0		1	0.0%
52.110	prolapsed gland of the third eyelid	5	0.1%	2	0.0%	8	0.2%
CORNEA							
70.210	corneal pannus	3	0.1%	0		0	
70.220	pigmentary keratitis	0		1	0.0%	1	0.0%
70.700	corneal dystrophy	60	1.0%	46	0.8%	37	0.9%
70.730	corneal endothelial degeneration	3	0.1%	3	0.1%	1	0.0%
UVEA							
93.110	iris hypoplasia	0		3	0.1%	8	0.2%
93.140	corneal endothelial pigment without PPM	0		1	0.0%	0	
93.150	iris coloboma	21	0.4%	19	0.4%	10	0.2%
93.710	persistent pupillary membranes, iris to iris	26	0.5%	42	0.8%	53	1.3%
93.720	persistent pupillary membranes, iris to lens	17	0.3%	18	0.3%	3	0.1%
93.730	persistent pupillary membranes, iris to cornea	22	0.4%	16	0.3%	14	0.3%
93.740	persistent pupillary membranes, iris sheets	6	0.1%	2	0.0%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		6	0.1%	138	3.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		2	0.0%	10	0.2%
93.810	uveal melanoma	0		1	0.0%	2	0.0%
93.999	uveal cysts	45	0.8%	88	1.6%	158	3.8%
LENS							
100.200	cataract, unspecified	229	4.0%	0		0	
100.210	cataract, suspect not inherited	225	3.9%	416	7.7%	278	6.6%
100.301	punctate cataract, anterior cortex	32	0.6%	34	0.6%	43	1.0%
100.302	punctate cataract, posterior cortex	126	2.2%	78	1.4%	64	1.5%
100.303	punctate cataract, equatorial cortex	4	0.1%	4	0.1%	1	0.0%
100.304	punctate cataract, anterior sutures	4	0.1%	9	0.2%	0	
100.305	punctate cataract, posterior sutures	38	0.7%	31	0.6%	16	0.4%
100.306	punctate cataract, nucleus	10	0.2%	8	0.1%	12	0.3%
100.307	punctate cataract, capsular	3	0.1%	19	0.4%	26	0.6%
100.311	incipient cataract, anterior cortex	39	0.7%	46	0.8%	28	0.7%
100.312	incipient cataract, posterior cortex	178	3.1%	236	4.4%	118	2.8%
100.313	incipient cataract, equatorial cortex	9	0.2%	23	0.4%	6	0.1%
100.314	incipient cataract, anterior sutures	4	0.1%	5	0.1%	3	0.1%

OCULAR DISORDERS REPORT
ROTTWEILER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.315	incipient cataract, posterior sutures	40	0.7%	28	0.5%	9	0.2%
100.316	incipient cataract, nucleus	25	0.4%	18	0.3%	12	0.3%
100.317	incipient cataract, capsular	0		18	0.3%	26	0.6%
100.321	incomplete cataract, anterior cortex	0		0		5	0.1%
100.322	incomplete cataract, posterior cortex	0		0		9	0.2%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.0%
100.327	incomplete cataract, capsular	0		0		4	0.1%
100.330	generalized/complete cataract	30	0.5%	17	0.3%	1	0.0%
100.375	subluxation/luxation, unspecified	1	0.0%	1	0.0%	1	0.0%
100.999	*significant cataracts (summary)*	*771*	*13.4%*	*574*	*10.6%*	*384*	*9.1%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	12	0.2%	6	0.1%	3	0.1%
110.135	PHPV/PTVL	3	0.1%	3	0.1%	2	0.0%
110.320	vitreal degeneration	23	0.4%	29	0.5%	18	0.4%
RETINA							
120.170	retinal dysplasia, folds	53	0.9%	47	0.9%	30	0.7%
120.180	retinal dysplasia, geographic	23	0.4%	12	0.2%	11	0.3%
120.190	retinal dysplasia, detached	0		0		1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	118	2.1%	47	0.9%	13	0.3%
120.910	retinal detachment without dialysis	1	0.0%	0		0	
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		20	0.5%
OPTIC NERVE							
130.110	micropapilla	0		6	0.1%	9	0.2%
130.120	optic nerve hypoplasia	10	0.2%	6	0.1%	1	0.0%
130.150	optic disc coloboma	0		2	0.0%	0	
OTHER							
900.000	other, unspecified	0		49	0.9%	88	2.1%
900.100	other, not inherited	22	0.4%	297	5.5%	125	3.0%
900.110	other, suspected as inherited	106	1.8%	33	0.6%	14	0.3%
NORMAL							
0.000	normal globe	4483	77.9%	4431	81.8%	3257	77.6%

OCULAR DISORDERS REPORT

RUSSELL TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
C.	Cataract	Not defined	1	NO
D.	Lens luxation * a DNA test is available	Not defined	2	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

2. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
RUSSELL TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 9 #	%	2010-2016 359 #	%
EYELIDS							
25.110	distichiasis	0		0		12	3.3%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		1	0.3%
CORNEA							
70.700	corneal dystrophy	0		0		1	0.3%
UVEA							
93.110	iris hypoplasia	0		0		1	0.3%
93.150	iris coloboma	0		0		1	0.3%
93.710	persistent pupillary membranes, iris to iris	0		0		13	3.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.3%
93.999	uveal cysts	0		0		1	0.3%
LENS							
100.210	cataract, suspect not inherited	0		0		16	4.5%
100.321	incomplete cataract, anterior cortex	0		0		1	0.3%
100.322	incomplete cataract, posterior cortex	0		0		3	0.8%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.3%
100.999	*significant cataracts (summary)*	*0*		*0*		*5*	*1.4%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		0		1	0.3%
RETINA							
120.170	retinal dysplasia, folds	0		0		2	0.6%
120.180	retinal dysplasia, geographic	0		0		1	0.3%
120.310	generalized progressive retinal atrophy (PRA)	0		1	11.1%	0	
OPTIC NERVE							
130.110	micropapilla	0		0		1	0.3%
OTHER							
900.000	other, unspecified	0		0		2	0.6%
900.100	other, not inherited	0		0		11	3.1%
NORMAL							
0.000	normal globe	0		9	100.0%	304	84.7%

OCULAR DISORDERS REPORT

SAINT BERNARD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1, 2	NO
B.	Eury/macroblepharon	Not defined	3	Breeder option
C.	Ectropion	Not defined	1	Breeder option
D.	Entropion	Not defined	1, 4, 5	Breeder option
E.	Dermoid	Not defined	1, 4, 6-8	Breeder option
F.	Persistent pupillary membrane - iris to iris	Not defined	9	Breeder option
G.	Cataract	Not defined	1	NO

Description and Comments

A. Microphthalmia with multiple ocular defects

Multiple ocular defects have been described in Saint Bernard puppies. The syndrome was composed of microphthalmia, microphakia, aphakia, acoria, peripheral anterior synechia, and retinal dysplasia. Glaucoma was also reported. Although the cause was not proven to be hereditary, the fact that several of these dogs were related suggests a hereditary basis. Affected dogs should not be bred.

B. Eury/Macroblepharon

Defined as an exceptionally large palpebral fissure, macroblepharon in conjunction with laxity of the lateral canthal structures may lead to lower lid ectropion and upper lid entropion. Either of these conditions may lead to severe ocular irritation.

C. Ectropion

A conformational defect resulting in eversion of the eyelids which may cause ocular irritation. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. In this breed, entropion is associated with an exceptionally large palpebral fissure.

E. Dermoid

A patch of skin, usually located on the cornea; its presence usually causes ocular irritation.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Martin CL and Leipold HW. Aphakia and multiple ocular defects in Saint Bernard puppies. *Vet Med Small Anim Clin*. 1974 Apr;69:448-453.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. Priester WA. Congenital ocular defects in cattle, horses, cats, and dogs. *J Am Vet Med Assoc*. 1972 Jun 1;160:1504-1511.

5. ACVO Genetics Committee, 2001 and/or Data from CERF All-Breeds Report, 2001.

6. Gelatt KN. Bilateral corneal dermoids and distichiasis in a dog. *Vet Med Small Anim Clin.* 1971 Jul;66:658-659.

7. Kittel H. *Deut Tieraerztl Wochenschr*. 1931;52:793.

8. Szczudlowska M. Dermoid cyst of the eye in relation to heredity and overfeeding. *Med Vet.* 1967;23:567.

9. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

OCULAR DISORDERS REPORT
SAINT BERNARD

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 58 #	1991-1999 58 %	2000-2009 88 #	2000-2009 88 %	2010-2016 105 #	2010-2016 105 %
EYELIDS							
20.160	macropalpebral fissure	2	3.4%	16	18.2%	3	2.9%
21.000	entropion, unspecified	19	32.8%	12	13.6%	38	36.2%
22.000	ectropion, unspecified	24	41.4%	32	36.4%	36	34.3%
25.110	distichiasis	4	6.9%	3	3.4%	10	9.5%
NICTITANS							
51.100	third eyelid cartilage anomaly	1	1.7%	0		0	
52.110	prolapsed gland of the third eyelid	1	1.7%	0		0	
CORNEA							
70.700	corneal dystrophy	0		1	1.1%	1	1.0%
UVEA							
93.710	persistent pupillary membranes, iris to iris	2	3.4%	6	6.8%	14	13.3%
93.720	persistent pupillary membranes, iris to lens	0		0		1	1.0%
93.730	persistent pupillary membranes, iris to cornea	0		0		1	1.0%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	1.0%
93.999	uveal cysts	0		0		1	1.0%
LENS							
100.210	cataract, suspect not inherited	5	8.6%	4	4.5%	5	4.8%
100.302	punctate cataract, posterior cortex	0		1	1.1%	2	1.9%
100.303	punctate cataract, equatorial cortex	0		1	1.1%	0	
100.305	punctate cataract, posterior sutures	0		0		1	1.0%
100.306	punctate cataract, nucleus	0		0		1	1.0%
100.307	punctate cataract, capsular	0		1	1.1%	0	
100.311	incipient cataract, anterior cortex	1	1.7%	0		1	1.0%
100.312	incipient cataract, posterior cortex	2	3.4%	1	1.1%	0	
100.313	incipient cataract, equatorial cortex	3	5.2%	2	2.3%	0	
100.316	incipient cataract, nucleus	0		3	3.4%	1	1.0%
100.317	incipient cataract, capsular	0		0		1	1.0%
100.321	incomplete cataract, anterior cortex	0		0		1	1.0%
100.326	incomplete cataract, nucleus	0		0		1	1.0%
100.330	generalized/complete cataract	1	1.7%	6	6.8%	1	1.0%
100.999	*significant cataracts (summary)*	*7*	*12.1%*	*15*	*17.0%*	*10*	*9.5%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	2	3.4%	0		1	1.0%
110.135	PHPV/PTVL	0		1	1.1%	0	
RETINA							
120.170	retinal dysplasia, folds	2	3.4%	0		3	2.9%
OPTIC NERVE							
130.110	micropapilla	0		0		1	1.0%
130.120	optic nerve hypoplasia	1	1.7%	0		0	

OCULAR DISORDERS REPORT
SAINT BERNARD

	1991-1999	2000-2009	2010-2016
OTHER			
900.000 other, unspecified	0	1 1.1%	2 1.9%
900.100 other, not inherited	0	5 5.7%	4 3.8%
900.110 other, suspected as inherited	4 6.9%	4 4.5%	4 3.8%
NORMAL			
0.000 normal globe	19 32.8%	40 45.5%	32 30.5%

SALUKI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Saluki breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report 2003-2004.

OCULAR DISORDERS REPORT
SALUKI

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 102 #	 %	2000-2009 110 #	 %	2010-2016 72 #	 %
EYELIDS							
25.110	distichiasis	0		0		1	1.4%
CORNEA							
70.700	corneal dystrophy	1	1.0%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	2	2.0%	3	2.7%	2	2.8%
93.730	persistent pupillary membranes, iris to cornea	0		2	1.8%	1	1.4%
93.740	persistent pupillary membranes, iris sheets	0		2	1.8%	0	
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	1.4%
LENS							
100.210	cataract, suspect not inherited	9	8.8%	4	3.6%	4	5.6%
100.301	punctate cataract, anterior cortex	1	1.0%	0		0	
100.302	punctate cataract, posterior cortex	1	1.0%	1	0.9%	1	1.4%
100.305	punctate cataract, posterior sutures	1	1.0%	0		0	
100.307	punctate cataract, capsular	0		0		2	2.8%
100.312	incipient cataract, posterior cortex	0		1	0.9%	0	
100.313	incipient cataract, equatorial cortex	0		2	1.8%	0	
100.316	incipient cataract, nucleus	0		0		1	1.4%
100.330	generalized/complete cataract	0		2	1.8%	0	
100.999	*significant cataracts (summary)*	*3*	*2.9%*	*6*	*5.5%*	*4*	*5.6%*
VITREOUS							
110.320	vitreal degeneration	0		4	3.6%	4	5.6%
RETINA							
120.310	generalized progressive retinal atrophy (PRA)	2	2.0%	0		0	
OPTIC NERVE							
130.150	optic disc coloboma	1	1.0%	0		0	
OTHER							
900.000	other, unspecified	0		1	0.9%	0	
900.100	other, not inherited	2	2.0%	3	2.7%	0	
NORMAL							
0.000	normal globe	86	84.3%	94	85.5%	62	86.1%

OCULAR DISORDERS REPORT

SAMOYED

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-7	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	1, 8	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
E.	Cataract	Not defined	1	NO
F.	Retinal atrophy - generalized * a DNA test is available	X-linked recessive	1, 9, 10	NO
G.	Retinal dysplasia - folds	Presumed autosomal recessive	1, 11, 12	NO (Breeder option with “Normal” DNA test for folds)
H.	Retinal dysplasia - geographic/ detached	Presumed autosomal recessive	1, 11, 12	NO
I.	Retinal dysplasia - folds/geographic/ detached (with skeletal defects) * a DNA test is available	Autosomal recessive with incomplete dominance for the eyes	1, 11-13	NO
J.	Uveodermatologic syndrome	Not defined	1, 14, 15	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the Samoyed, many of the PPMs identified on routine screening examinations bridge from the iris to the cornea where they may be associated with corneal opacity and vision impairment.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. In the Samoyed, one form of PRA, known as XLPRA1, is due to a mutation in the *RPGR* gene and is inherited as a recessive, sex-linked trait. A DNA test is available.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness.

In the Samoyed, the presence of retinal folds may be seen in the heterozygous state described in “I” below. Thus the recommendation against breeding. The breeding advice for Labrador Retrievers and Samoyeds diagnosed with "retinal dysplasia - folds" will be changed from "No" to "Breeder option" if the owner of the dog provides the registering office with results of the DNA test for the affected dog showing that it is not a carrier of the *COL9A2* mutation.

H. Retinal dysplasia – geographic/detached without skeletal defects

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

I. Retinal dysplasia - folds or detachment with skeletal defects in homozygous affected dogs

This condition is also known as oculo-skeletal dysplasia (OSD) or dwarfism with retinal dysplasia type 2 (DRD2) in the Samoyed. A similar condition, DRD1, occurs in the Labrador Retriever. The condition is autosomal recessive and homozygous affected dogs have shortened forelimbs (“downhill” conformation) with valgus deformity. They have severe ocular defects including cataract, retinal folds/multifocal retinal dysplasia, vitreal degeneration and retinal detachment. The ocular abnormalities result in blindness in most dogs. Heterozygous dogs can have either a normal ocular exam or have multiple retinal folds, vitreal membranes, or vitreal degeneration suggesting a semi-dominant mechanism

with respect to the eyes. It is important to note that generally the retinal folds present in heterozygous dogs tend to cluster around the major superior blood vessels of the central tapetal region. The condition is caused by a 1,267 bp deletion of *COL9A2.* A DNA test is available.

J. Uveodermatologic syndrome

Uveodermatologic syndrome in the Samoyed bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. Adhesions between the iris and lens (posterior synechiae) and the peripheral iris and cornea (peripheral anterior synechiae) develop rapidly. Other complications include cataract development, retinal degeneration, retinal separation or detachment, optic disc atrophy and secondary glaucoma. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. Some veterinary ophthalmologists feel there is a prevalence of this entity in the Samoyed. Additional studies are needed to validate this experience and explore the possibility of a genetic basis.

References

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OCULAR DISORDERS REPORT
SAMOYED

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 7518 #	%	2000-2009 10138 #	%	2010-2016 6508 #	%
GLOBE							
0.110	microphthalmia	13	0.2%	7	0.1%	1	0.0%
10.000	glaucoma	8	0.1%	2	0.0%	0	
EYELIDS							
20.140	ectopic cilia	5	0.1%	1	0.0%	1	0.0%
20.160	macropalpebral fissure	1	0.0%	0		0	
21.000	entropion, unspecified	2	0.0%	3	0.0%	1	0.0%
22.000	ectropion, unspecified	0		3	0.0%	0	
25.110	distichiasis	464	6.2%	540	5.3%	384	5.9%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	3	0.0%	0		12	0.2%
40.910	keratoconjunctivitis sicca	2	0.0%	6	0.1%	6	0.1%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		4	0.1%
CORNEA							
70.210	corneal pannus	3	0.0%	1	0.0%	0	
70.220	pigmentary keratitis	1	0.0%	0		1	0.0%
70.700	corneal dystrophy	245	3.3%	332	3.3%	280	4.3%
70.730	corneal endothelial degeneration	7	0.1%	5	0.0%	3	0.0%
UVEA							
93.140	corneal endothelial pigment without PPM	0		1	0.0%	0	
93.150	iris coloboma	1	0.0%	0		0	
93.710	persistent pupillary membranes, iris to iris	79	1.1%	227	2.2%	171	2.6%
93.720	persistent pupillary membranes, iris to lens	6	0.1%	14	0.1%	4	0.1%
93.730	persistent pupillary membranes, iris to cornea	14	0.2%	17	0.2%	6	0.1%
93.740	persistent pupillary membranes, iris sheets	4	0.1%	11	0.1%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.0%	9	0.1%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.0%	13	0.2%
93.810	uveal melanoma	0		1	0.0%	0	
93.999	uveal cysts	0		7	0.1%	6	0.1%
LENS							
100.200	cataract, unspecified	100	1.3%	0		0	
100.210	cataract, suspect not inherited	190	2.5%	368	3.6%	242	3.7%
100.301	punctate cataract, anterior cortex	18	0.2%	28	0.3%	23	0.4%
100.302	punctate cataract, posterior cortex	62	0.8%	55	0.5%	39	0.6%
100.303	punctate cataract, equatorial cortex	4	0.1%	8	0.1%	2	0.0%
100.304	punctate cataract, anterior sutures	2	0.0%	4	0.0%	3	0.0%
100.305	punctate cataract, posterior sutures	24	0.3%	25	0.2%	12	0.2%
100.306	punctate cataract, nucleus	4	0.1%	12	0.1%	1	0.0%
100.307	punctate cataract, capsular	1	0.0%	12	0.1%	13	0.2%
100.311	incipient cataract, anterior cortex	29	0.4%	32	0.3%	24	0.4%
100.312	incipient cataract, posterior cortex	78	1.0%	116	1.1%	67	1.0%
100.313	incipient cataract, equatorial cortex	8	0.1%	11	0.1%	6	0.1%
100.314	incipient cataract, anterior sutures	1	0.0%	4	0.0%	2	0.0%

OCULAR DISORDERS REPORT
SAMOYED

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.315	incipient cataract, posterior sutures	14	0.2%	27	0.3%	13	0.2%
100.316	incipient cataract, nucleus	10	0.1%	15	0.1%	9	0.1%
100.317	incipient cataract, capsular	0		14	0.1%	15	0.2%
100.322	incomplete cataract, posterior cortex	0		0		12	0.2%
100.325	incomplete cataract, posterior sutures	0		0		3	0.0%
100.326	incomplete cataract, nucleus	0		0		1	0.0%
100.327	incomplete cataract, capsular	0		0		3	0.0%
100.330	generalized/complete cataract	39	0.5%	20	0.2%	7	0.1%
100.340	resorbing/hypermature cataract	0		0		1	0.0%
100.375	subluxation/luxation, unspecified	2	0.0%	1	0.0%	0	
100.999	*significant cataracts (summary)*	*394*	*5.2%*	*383*	*3.8%*	*256*	*3.9%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	10	0.1%	9	0.1%	4	0.1%
110.135	PHPV/PTVL	6	0.1%	4	0.0%	1	0.0%
110.320	vitreal degeneration	37	0.5%	40	0.4%	20	0.3%
FUNDUS							
97.110	choroidal hypoplasia	1	0.0%	3	0.0%	0	
97.120	coloboma	3	0.0%	3	0.0%	1	0.0%
RETINA							
120.170	retinal dysplasia, folds	168	2.2%	246	2.4%	77	1.2%
120.180	retinal dysplasia, geographic	50	0.7%	72	0.7%	64	1.0%
120.190	retinal dysplasia, detached	7	0.1%	12	0.1%	7	0.1%
120.310	generalized progressive retinal atrophy (PRA)	36	0.5%	14	0.1%	6	0.1%
120.400	retinal hemorrhage	2	0.0%	0		0	
120.910	retinal detachment without dialysis	8	0.1%	2	0.0%	0	
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		3	0.0%
OPTIC NERVE							
130.110	micropapilla	0		12	0.1%	7	0.1%
130.120	optic nerve hypoplasia	12	0.2%	1	0.0%	1	0.0%
130.150	optic disc coloboma	32	0.4%	33	0.3%	5	0.1%
OTHER							
900.000	other, unspecified	0		57	0.6%	119	1.8%
900.100	other, not inherited	61	0.8%	375	3.7%	131	2.0%
900.110	other, suspected as inherited	75	1.0%	51	0.5%	12	0.2%
NORMAL							
0.000	normal globe	5981	79.6%	8587	84.7%	5250	80.7%

SCHAPENDOES

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - generalized (*CCDC66*) * a DNA test is available	Autosomal recessive	1, 2	NO

Description and Comments

A. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

In the Schapendoes the age of onset is between 2-5 years of age. The causal mutation is a single base pair insertion in exon 6 of the gene coiled-coil domain containing 66 (*CCDC66)* that leads to a stop codon. The mutation is inherited as an autosomal recessive trait. A DNA test is available.

References

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OCULAR DISORDERS REPORT
SCHAPENDOES

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 39 #	%	2010-2016 44 #	%
EYELIDS								
25.110	distichiasis		0		0		2	4.5%
UVEA								
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		1	2.3%
LENS								
100.210	cataract, suspect not inherited		0		2	5.1%	1	2.3%
100.301	punctate cataract, anterior cortex		0		0		1	2.3%
100.315	incipient cataract, posterior sutures		0		1	2.6%	0	
100.999	*significant cataracts (summary)*		*0*		*1*	*2.6%*	*1*	*2.3%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		0		2	5.1%	0	
110.320	vitreal degeneration		0		1	2.6%	0	
RETINA								
120.180	retinal dysplasia, geographic		0		1	2.6%	0	
OTHER								
900.100	other, not inherited		0		5	12.8%	0	
900.110	other, suspected as inherited		0		0		1	2.3%
NORMAL								
0.000	normal globe		0		34	87.2%	37	84.1%

SCHIPPERKE

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1, 2	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	2, 3	Breeder option
	- iris sheets	Not defined	4	NO
C.	Cataract	Not defined	3	NO
D.	Vitreous degeneration	Not defined	4, 5	Breeder option
E.	Retinal atrophy - generalized (*prcdI*) * a DNA test is available	Presumed autosomal recessive	3	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Schipperke breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

4. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

5. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report 2002-2006.

OCULAR DISORDERS REPORT
SCHIPPERKE

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	**437**		**675**		**396**	
Diagnostic Name		**#**	**%**	**#**	**%**	**#**	**%**
GLOBE							
0.110	microphthalmia	0		1	0.1%	0	
EYELIDS							
25.110	distichiasis	7	1.6%	15	2.2%	24	6.1%
CORNEA							
70.210	corneal pannus	1	0.2%	0		0	
70.700	corneal dystrophy	0		1	0.1%	2	0.5%
70.730	corneal endothelial degeneration	1	0.2%	1	0.1%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	24	5.5%	43	6.4%	62	15.7%
93.720	persistent pupillary membranes, iris to lens	1	0.2%	5	0.7%	0	
93.730	persistent pupillary membranes, iris to cornea	0		2	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.2%	9	1.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.3%	5	1.3%
LENS							
100.200	cataract, unspecified	4	0.9%	0		0	
100.210	cataract, suspect not inherited	13	3.0%	33	4.9%	20	5.1%
100.301	punctate cataract, anterior cortex	2	0.5%	6	0.9%	5	1.3%
100.302	punctate cataract, posterior cortex	0		1	0.1%	0	
100.303	punctate cataract, equatorial cortex	1	0.2%	1	0.1%	3	0.8%
100.304	punctate cataract, anterior sutures	1	0.2%	0		0	
100.305	punctate cataract, posterior sutures	1	0.2%	0		0	
100.306	punctate cataract, nucleus	3	0.7%	1	0.1%	4	1.0%
100.311	incipient cataract, anterior cortex	3	0.7%	12	1.8%	5	1.3%
100.312	incipient cataract, posterior cortex	1	0.2%	8	1.2%	1	0.3%
100.313	incipient cataract, equatorial cortex	4	0.9%	3	0.4%	1	0.3%
100.315	incipient cataract, posterior sutures	0		1	0.1%	0	
100.316	incipient cataract, nucleus	0		2	0.3%	4	1.0%
100.317	incipient cataract, capsular	0		1	0.1%	1	0.3%
100.321	incomplete cataract, anterior cortex	0		0		1	0.3%
100.322	incomplete cataract, posterior cortex	0		0		1	0.3%
100.330	generalized/complete cataract	2	0.5%	6	0.9%	0	
100.999	*significant cataracts (summary)*	*22*	*5.0%*	*42*	*6.2%*	*26*	*6.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		0		1	0.3%
110.135	PHPV/PTVL	0		1	0.1%	0	
110.320	vitreal degeneration	3	0.7%	11	1.6%	7	1.8%
RETINA							
120.170	retinal dysplasia, folds	0		5	0.7%	5	1.3%
120.180	retinal dysplasia, geographic	0		3	0.4%	1	0.3%
120.310	generalized progressive retinal atrophy (PRA)	6	1.4%	8	1.2%	2	0.5%
120.960	retinopathy	0		0		2	0.5%

OCULAR DISORDERS REPORT
SCHIPPERKE

	1991-1999	2000-2009	2010-2016
OTHER			
900.000 other, unspecified	0	5 0.7%	11 2.8%
900.100 other, not inherited	6 1.4%	45 6.7%	16 4.0%
900.110 other, suspected as inherited	3 0.7%	1 0.1%	0
NORMAL			
0.000 normal globe	362 82.8%	571 84.6%	275 69.4%

OCULAR DISORDERS REPORT

SCOTTISH TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder option
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
B.	Cataract	Not defined	1	NO
C.	Vitreous degeneration	Not defined	5	Breeder option
D.	Ligneous conjunctivitis	Not defined	6, 7	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

D. Ligneous conjunctivitis

A rare type of conjunctivitis characterized by the formation of thick membranes covering conjunctiva of the nictitans and eyelids of affected dogs. This condition has been diagnosed in four unrelated Doberman Pinschers, three of which had life-threatening systemic disease. Ligneous conjunctivitis has also been reported in one Yorkshire Terrier.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

4. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

5. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

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7. Mason SL, McElroy P, Nuttall T. Ligneous membranitis in Scottish Terriers. *Vet Rec*. 2012; 171: 160.

OCULAR DISORDERS REPORT
SCOTTISH TERRIER

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 160 #	 %	2000-2009 428 #	 %	2010-2016 251 #	 %
EYELIDS							
25.110	distichiasis	1	0.6%	2	0.5%	0	
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		1	0.4%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		2	0.8%
CORNEA							
70.210	corneal pannus	1	0.6%	0		0	
70.220	pigmentary keratitis	0		1	0.2%	1	0.4%
70.700	corneal dystrophy	1	0.6%	4	0.9%	1	0.4%
70.730	corneal endothelial degeneration	1	0.6%	1	0.2%	0	
UVEA							
93.140	corneal endothelial pigment without PPM	0		0		3	1.2%
93.710	persistent pupillary membranes, iris to iris	43	26.9%	120	28.0%	84	33.5%
93.720	persistent pupillary membranes, iris to lens	16	10.0%	18	4.2%	8	3.2%
93.730	persistent pupillary membranes, iris to cornea	5	3.1%	4	0.9%	1	0.4%
93.740	persistent pupillary membranes, iris sheets	1	0.6%	2	0.5%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		8	1.9%	75	29.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		5	2.0%
LENS							
100.210	cataract, suspect not inherited	15	9.4%	56	13.1%	7	2.8%
100.301	punctate cataract, anterior cortex	3	1.9%	4	0.9%	0	
100.302	punctate cataract, posterior cortex	1	0.6%	1	0.2%	0	
100.303	punctate cataract, equatorial cortex	0		2	0.5%	0	
100.304	punctate cataract, anterior sutures	0		2	0.5%	0	
100.305	punctate cataract, posterior sutures	0		1	0.2%	0	
100.306	punctate cataract, nucleus	2	1.2%	1	0.2%	0	
100.307	punctate cataract, capsular	0		2	0.5%	0	
100.311	incipient cataract, anterior cortex	1	0.6%	4	0.9%	1	0.4%
100.312	incipient cataract, posterior cortex	1	0.6%	4	0.9%	1	0.4%
100.313	incipient cataract, equatorial cortex	0		3	0.7%	0	
100.314	incipient cataract, anterior sutures	1	0.6%	0		0	
100.315	incipient cataract, posterior sutures	1	0.6%	0		1	0.4%
100.316	incipient cataract, nucleus	4	2.5%	5	1.2%	0	
100.317	incipient cataract, capsular	0		2	0.5%	0	
100.321	incomplete cataract, anterior cortex	0		0		1	0.4%
100.322	incomplete cataract, posterior cortex	0		0		1	0.4%
100.326	incomplete cataract, nucleus	0		0		1	0.4%
100.330	generalized/complete cataract	1	0.6%	1	0.2%	3	1.2%
100.375	subluxation/luxation, unspecified	0		1	0.2%	0	
100.999	*significant cataracts (summary)*	*15*	*9.4%*	*32*	*7.5%*	*9*	*3.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.6%	0		0	
110.320	vitreal degeneration	0		5	1.2%	0	

OCULAR DISORDERS REPORT
SCOTTISH TERRIER

	1991-1999	2000-2009	2010-2016
RETINA			
120.170 retinal dysplasia, folds	0	4 0.9%	1 0.4%
120.310 generalized progressive retinal atrophy (PRA)	2 1.2%	6 1.4%	0
OPTIC NERVE			
130.150 optic disc coloboma	0	1 0.2%	1 0.4%
OTHER			
900.000 other, unspecified	0	8 1.9%	5 2.0%
900.100 other, not inherited	0	60 14.0%	4 1.6%
900.110 other, suspected as inherited	5 3.1%	11 2.6%	0
NORMAL			
0.000 normal globe	85 53.1%	240 56.1%	108 43.0%

SEALYHAM TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1-3	Breeder option
C.	Cataract	Not defined	3	NO
D.	Lens luxation * a DNA test is available	Not defined	4-8	NO
E.	Retinal dysplasia - folds	Presumed autosomal recessive	4, 9	Breeder option
F.	Retinal dysplasia - geographic/detached	Presumed autosomal recessive	4, 9	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

OCULAR DISORDERS REPORT

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

E. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

F. Retinal dysplasia - geographic/detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

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OCULAR DISORDERS REPORT
SEALYHAM TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 82 #	1991-1999 82 %	2000-2009 347 #	2000-2009 347 %	2010-2016 62 #	2010-2016 62 %
EYELIDS							
25.110	distichiasis	2	2.4%	17	4.9%	8	12.9%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		1	0.3%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	3	3.7%	26	7.5%	2	3.2%
93.720	persistent pupillary membranes, iris to lens	0		2	0.6%	0	
93.730	persistent pupillary membranes, iris to cornea	0		1	0.3%	0	
93.740	persistent pupillary membranes, iris sheets	0		2	0.6%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	1.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	1.6%
LENS							
100.200	cataract, unspecified	2	2.4%	0		0	
100.210	cataract, suspect not inherited	4	4.9%	15	4.3%	1	1.6%
100.301	punctate cataract, anterior cortex	2	2.4%	2	0.6%	0	
100.302	punctate cataract, posterior cortex	0		2	0.6%	1	1.6%
100.303	punctate cataract, equatorial cortex	0		1	0.3%	0	
100.305	punctate cataract, posterior sutures	0		2	0.6%	0	
100.307	punctate cataract, capsular	0		1	0.3%	2	3.2%
100.311	incipient cataract, anterior cortex	1	1.2%	2	0.6%	0	
100.312	incipient cataract, posterior cortex	4	4.9%	4	1.2%	0	
100.313	incipient cataract, equatorial cortex	0		1	0.3%	0	
100.315	incipient cataract, posterior sutures	1	1.2%	0		0	
100.316	incipient cataract, nucleus	0		1	0.3%	1	1.6%
100.317	incipient cataract, capsular	0		2	0.6%	0	
100.330	generalized/complete cataract	3	3.7%	3	0.9%	1	1.6%
100.375	subluxation/luxation, unspecified	0		5	1.4%	0	
100.999	*significant cataracts (summary)*	*13*	*15.9%*	*21*	*6.1%*	*5*	*8.1%*
VITREOUS							
110.135	PHPV/PTVL	0		2	0.6%	0	
110.320	vitreal degeneration	1	1.2%	5	1.4%	0	
FUNDUS							
97.120	coloboma	1	1.2%	0		0	
RETINA							
120.170	retinal dysplasia, folds	1	1.2%	7	2.0%	1	1.6%
120.180	retinal dysplasia, geographic	0		1	0.3%	0	
120.190	retinal dysplasia, detached	1	1.2%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	0		11	3.2%	0	
120.910	retinal detachment without dialysis	1	1.2%	0		0	
OPTIC NERVE							
130.120	optic nerve hypoplasia	0		1	0.3%	0	

OCULAR DISORDERS REPORT
SEALYHAM TERRIER

	1991-1999	2000-2009	2010-2016
OTHER			
900.000 other, unspecified	0	3 0.9%	1 1.6%
900.100 other, not inherited	0	10 2.9%	1 1.6%
900.110 other, suspected as inherited	0	1 0.3%	0
NORMAL			
0.000 normal globe	65 79.3%	297 85.6%	50 80.6%

OCULAR DISORDERS REPORT

SHETLAND SHEEPDOG
(Sheltie)

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	1. Corneal dystrophy	Not defined	1, 2	Breeder option
	2. Sheltie corneal dystrophy	Not defined	1, 2	NO
C.	Uveodermatologic syndrome	Not defined	1	NO
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 3	Breeder option
	- iris to lens	Not defined	4	NO
	- iris to cornea	Not defined	4	NO
E.	Cataract	Not defined	1	NO
F.	Retinal atrophy - generalized (CNGA1-PRA) * a DNA test is available	Autosomal recessive	1, 5	NO
G.	Slowly progressing retinopathy	Not defined	6	NO
H.	Choroidal hypoplasia (Collie eye anomaly) - optic nerve coloboma - retinal detachment - retinal hemorrhage - staphyloma/coloboma * a DNA test is available	Autosomal recessive	1, 7, 8	NO
I.	Optic nerve coloboma	Not defined	1	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

Distichiasis in the Shetland Sheepdog usually involves stiff lashes which require permanent epilation.

B. 1. Corneal dystrophy

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

2. Sheltie corneal dystrophy

The corneal changes in the Shetland Sheepdog are characterized grossly by multifocal, central, subepithelial and superficial stromal, grey-white, circular or irregular rings. Some affected animals develop corneal erosions. The preocular tear film in the majority of dogs is unstable and requires symptomatic therapy to keep the patients comfortable. Further studies are necessary to define this disorder.

C. Uveodermatologic syndrome

Uveodermatologic syndrome in the Shetland Sheepdog bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. Adhesions between the iris and lens (posterior synechia) and the peripheral iris and cornea (peripheral anterior synechia) develop rapidly. Other complications include cataract development, retinal degeneration, retinal separation or detachment, optic disc atrophy and secondary glaucoma. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. The genetics of this condition are unclear, but some genetic predisposition is indicated by the higher prevalence of this disorder in Shetland Sheepdogs compared with other dog breeds. Affected dogs are generally young, ranging in age between 1 ½ to 4 years.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms are seen in the Shetland sheepdog and pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

One form of PRA in the Shetland Sheepdog is caused by a 4bp exonic deletion in *CNGA1.* However multiple forms of PRA exist in the breed and slowly progressive retinopathy is also not genetically linked to this mutation. A DNA test is available; however it will only detect this mutation.

G. Slowly progressing retinopathy

A syndrome as yet not well defined. May be a variant of PRA.

H. Choroidal hypoplasia (Collie eye anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie eye anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has

to be present; that gene is still unknown.

A DNA test is available and may not be predictive of all populations. As the genotype-phenotype correlation is complex, and not always straightforward, one should refer to http://www.optigen.com/opt9_coloboma_res.html for a summary and more details of the molecular studies of CEA.

I. Optic nerve coloboma (without choroidal hypoplasia)

A congenital cavity in the optic nerve which, if large, may cause blindness or vision impairment.

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OCULAR DISORDERS REPORT
SHETLAND SHEEPDOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 14863 #	%	2000-2009 16694 #	%	2010-2016 7948 #	%
GLOBE							
0.110	microphthalmia	25	0.2%	29	0.2%	12	0.2%
10.000	glaucoma	1	0.0%	1	0.0%	0	
EYELIDS							
20.140	ectopic cilia	5	0.0%	4	0.0%	0	
21.000	entropion, unspecified	2	0.0%	4	0.0%	2	0.0%
22.000	ectropion, unspecified	3	0.0%	7	0.0%	0	
25.110	distichiasis	1172	7.9%	948	5.7%	426	5.4%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	3	0.0%	0		3	0.0%
40.910	keratoconjunctivitis sicca	1	0.0%	3	0.0%	3	0.0%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		3	0.0%	4	0.1%
52.110	prolapsed gland of the third eyelid	1	0.0%	2	0.0%	1	0.0%
CORNEA							
70.210	corneal pannus	5	0.0%	4	0.0%	0	
70.220	pigmentary keratitis	0		3	0.0%	1	0.0%
70.700	corneal dystrophy	416	2.8%	449	2.7%	211	2.7%
70.730	corneal endothelial degeneration	11	0.1%	19	0.1%	5	0.1%
UVEA							
90.250	pigmentary uveitis	0		0		1	0.0%
93.110	iris hypoplasia	0		1	0.0%	4	0.1%
93.140	corneal endothelial pigment without PPM	0		5	0.0%	0	
93.150	iris coloboma	10	0.1%	11	0.1%	5	0.1%
93.710	persistent pupillary membranes, iris to iris	460	3.1%	763	4.6%	442	5.6%
93.720	persistent pupillary membranes, iris to lens	55	0.4%	45	0.3%	21	0.3%
93.730	persistent pupillary membranes, iris to cornea	64	0.4%	98	0.6%	34	0.4%
93.740	persistent pupillary membranes, iris sheets	5	0.0%	24	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		15	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		2	0.0%	18	0.2%
93.810	uveal melanoma	0		0		1	0.0%
93.999	uveal cysts	1	0.0%	16	0.1%	8	0.1%
97.150	chorioretinal coloboma, congenital	0		0		4	0.1%
LENS							
100.200	cataract, unspecified	73	0.5%	0		0	
100.210	cataract, suspect not inherited	166	1.1%	283	1.7%	164	2.1%
100.301	punctate cataract, anterior cortex	34	0.2%	31	0.2%	9	0.1%
100.302	punctate cataract, posterior cortex	31	0.2%	22	0.1%	10	0.1%
100.303	punctate cataract, equatorial cortex	14	0.1%	12	0.1%	2	0.0%
100.304	punctate cataract, anterior sutures	1	0.0%	3	0.0%	1	0.0%
100.305	punctate cataract, posterior sutures	3	0.0%	3	0.0%	4	0.1%
100.306	punctate cataract, nucleus	6	0.0%	12	0.1%	4	0.1%
100.307	punctate cataract, capsular	1	0.0%	14	0.1%	11	0.1%
100.311	incipient cataract, anterior cortex	45	0.3%	72	0.4%	25	0.3%

OCULAR DISORDERS REPORT
SHETLAND SHEEPDOG

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.312	incipient cataract, posterior cortex	33	0.2%	49	0.3%	13	0.2%
100.313	incipient cataract, equatorial cortex	19	0.1%	30	0.2%	8	0.1%
100.314	incipient cataract, anterior sutures	3	0.0%	1	0.0%	1	0.0%
100.315	incipient cataract, posterior sutures	9	0.1%	4	0.0%	0	
100.316	incipient cataract, nucleus	15	0.1%	17	0.1%	4	0.1%
100.317	incipient cataract, capsular	2	0.0%	20	0.1%	7	0.1%
100.321	incomplete cataract, anterior cortex	0		0		2	0.0%
100.322	incomplete cataract, posterior cortex	0		0		3	0.0%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.0%
100.327	incomplete cataract, capsular	0		0		2	0.0%
100.330	generalized/complete cataract	19	0.1%	22	0.1%	4	0.1%
100.340	resorbing/hypermature cataract	0		0		1	0.0%
100.375	subluxation/luxation, unspecified	3	0.0%	3	0.0%	1	0.0%
100.999	*significant cataracts (summary)*	*308*	*2.1%*	*312*	*1.9%*	*112*	*1.4%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	45	0.3%	39	0.2%	9	0.1%
110.135	PHPV/PTVL	5	0.0%	8	0.0%	6	0.1%
110.320	vitreal degeneration	33	0.2%	55	0.3%	53	0.7%
FUNDUS							
97.110	choroidal hypoplasia	53	0.4%	50	0.3%	24	0.3%
97.120	coloboma	53	0.4%	25	0.1%	4	0.1%
RETINA							
120.170	retinal dysplasia, folds	29	0.2%	47	0.3%	13	0.2%
120.180	retinal dysplasia, geographic	9	0.1%	6	0.0%	1	0.0%
120.190	retinal dysplasia, detached	1	0.0%	2	0.0%	2	0.0%
120.310	generalized progressive retinal atrophy (PRA)	89	0.6%	100	0.6%	26	0.3%
120.910	retinal detachment without dialysis	8	0.1%	6	0.0%	4	0.1%
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		21	0.3%
OPTIC NERVE							
130.110	micropapilla	2	0.0%	8	0.0%	8	0.1%
130.120	optic nerve hypoplasia	19	0.1%	6	0.0%	0	
130.150	optic disc coloboma	104	0.7%	70	0.4%	19	0.2%
OTHER							
900.000	other, unspecified	0		85	0.5%	158	2.0%
900.100	other, not inherited	22	0.1%	536	3.2%	142	1.8%
900.110	other, suspected as inherited	116	0.8%	43	0.3%	13	0.2%
NORMAL							
0.000	normal globe	12221	82.2%	14553	87.2%	6619	83.3%

OCULAR DISORDERS REPORT

SHIBA INU

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-3	NO
B.	Distichiasis	Not defined	4	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	5	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	4, 5	Breeder option
E.	Cataract	Not defined	4	NO

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

A recent study found that a *SRBD1* polymorphism in exon 4 plays an important role in the development of glaucoma in the Shiba Inu. A genetic test is not yet available.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

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OCULAR DISORDERS REPORT
SHIBA INU

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 1221 #	%	2000-2009 2043 #	%	2010-2016 1361 #	%
GLOBE							
10.000	glaucoma	0		0		2	0.1%
EYELIDS							
20.140	ectopic cilia	0		2	0.1%	2	0.1%
20.160	macropalpebral fissure	2	0.2%	4	0.2%	0	
21.000	entropion, unspecified	4	0.3%	8	0.4%	0	
25.110	distichiasis	25	2.0%	45	2.2%	40	2.9%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		2	0.1%
40.910	keratoconjunctivitis sicca	0		0		1	0.1%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		2	0.1%
CORNEA							
70.210	corneal pannus	3	0.2%	1	0.0%	0	
70.220	pigmentary keratitis	1	0.1%	6	0.3%	3	0.2%
70.700	corneal dystrophy	14	1.1%	14	0.7%	5	0.4%
70.730	corneal endothelial degeneration	8	0.7%	0		2	0.1%
UVEA							
93.710	persistent pupillary membranes, iris to iris	36	2.9%	84	4.1%	67	4.9%
93.720	persistent pupillary membranes, iris to lens	6	0.5%	8	0.4%	1	0.1%
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	0		0	
93.740	persistent pupillary membranes, iris sheets	1	0.1%	0		0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		30	2.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		3	0.2%
93.999	uveal cysts	0		0		2	0.1%
LENS							
100.200	cataract, unspecified	10	0.8%	0		0	
100.210	cataract, suspect not inherited	41	3.4%	88	4.3%	64	4.7%
100.301	punctate cataract, anterior cortex	1	0.1%	3	0.1%	4	0.3%
100.302	punctate cataract, posterior cortex	8	0.7%	4	0.2%	3	0.2%
100.303	punctate cataract, equatorial cortex	0		3	0.1%	0	
100.304	punctate cataract, anterior sutures	0		2	0.1%	1	0.1%
100.305	punctate cataract, posterior sutures	8	0.7%	11	0.5%	5	0.4%
100.306	punctate cataract, nucleus	0		0		1	0.1%
100.307	punctate cataract, capsular	0		1	0.0%	1	0.1%
100.311	incipient cataract, anterior cortex	5	0.4%	16	0.8%	11	0.8%
100.312	incipient cataract, posterior cortex	8	0.7%	9	0.4%	8	0.6%
100.313	incipient cataract, equatorial cortex	2	0.2%	6	0.3%	4	0.3%
100.314	incipient cataract, anterior sutures	0		2	0.1%	0	
100.315	incipient cataract, posterior sutures	3	0.2%	5	0.2%	3	0.2%
100.316	incipient cataract, nucleus	0		1	0.0%	3	0.2%
100.317	incipient cataract, capsular	0		1	0.0%	1	0.1%
100.330	generalized/complete cataract	9	0.7%	7	0.3%	3	0.2%
100.375	subluxation/luxation, unspecified	0		3	0.1%	1	0.1%

OCULAR DISORDERS REPORT
SHIBA INU

LENS CONTINUED	1991-1999		2000-2009		2010-2016	
100.999 significant cataracts (summary)	*54*	*4.4%*	*71*	*3.5%*	*48*	*3.5%*
VITREOUS						
110.120 persistent hyaloid artery/remnant	4	0.3%	10	0.5%	5	0.4%
110.135 PHPV/PTVL	0		4	0.2%	0	
110.320 vitreal degeneration	9	0.7%	18	0.9%	5	0.4%
RETINA						
120.170 retinal dysplasia, folds	4	0.3%	2	0.1%	1	0.1%
120.180 retinal dysplasia, geographic	2	0.2%	0		0	
120.190 retinal dysplasia, detached	0		0		2	0.1%
120.310 generalized progressive retinal atrophy (PRA)	9	0.7%	15	0.7%	5	0.4%
120.400 retinal hemorrhage	0		1	0.0%	0	
120.910 retinal detachment without dialysis	0		1	0.0%	0	
120.960 retinopathy	0		0		1	0.1%
OPTIC NERVE						
130.120 optic nerve hypoplasia	3	0.2%	4	0.2%	0	
OTHER						
900.000 other, unspecified	0		4	0.2%	27	2.0%
900.100 other, not inherited	7	0.6%	85	4.2%	25	1.8%
900.110 other, suspected as inherited	11	0.9%	10	0.5%	4	0.3%
NORMAL						
0.000 normal globe	1018	83.4%	1759	86.1%	1112	81.7%

OCULAR DISORDERS REPORT

SHIH TZU

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Keratoconjunctivitis sicca	Not defined	1, 2	NO
B.	Glaucoma	Not defined	3	NO
C.	Entropion	Not defined	1	Breeder option
D.	Distichiasis	Not defined	1	Breeder option
E.	Ectopic cilia	Not defined	1	Breeder option
F.	Corneal dystrophy - epithelial/stromal	Not defined	4	Breeder option
G.	Exposure/pigmentary keratitis	Not defined	1, 5	Breeder option
H.	Persistent pupillary membranes - iris to iris	Not defined	6	Breeder option
I.	Cataract	Not defined	1	NO
J.	Persistent hyaloid artery	Not defined	4	Breeder option
K.	Vitreous degeneration	Not defined	6, 7	Breeder option
L.	Retinal detachment	Not defined	7, 8	NO
M.	Retinal atrophy - generalized	Not defined	1	NO
N.	Optic nerve hypoplasia	Not defined	9, 10	NO
O.	Micropapilla	Not defined	9	Breeder option
P.	Ciliated caruncle	Not defined	1	Breeder option
Q.	Retinal degeneration	Not defined	8	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Keratoconjunctivitis sicca (KCS)

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

B. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

A recent study found that a *SRBD1* polymorphism in intron 1 plays an important role in the development of glaucoma in the Shih Tzu. A genetic test is not yet available.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

E. Ectopic cilia

Hair emerging through the eyelid conjunctiva. Ectopic cilia occur more frequently in younger dogs and cause discomfort and corneal disease.

F. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

G. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

H. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

I. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

J. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

K. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

L. Retinal detachment

A separation of the sensory retina from the underlying tissue. It results in blindness when complete.

M. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

N. Optic nerve hypoplasia

A congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. May be unable to differentiate from micropapilla on a routine (dilated) screening ophthalmoscopic exam.

O. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

P. Ciliated caruncle

The caruncle is a normal structure (a mass of fleshy conjunctival tissue at the nasal canthus). In abnormal conditions, it may contain hair which, if contacting the cornea, may cause irritation and/or tearing.

Q. Retinal degeneration

A unilateral or bilateral retinal disease which can be progressive. When bilateral, the ophthalmoscopic lesions are sometimes asymmetrical, particularly in the early stages of the disease. Fundus examination shows initially single or multiple focal retinal lesions that appear active (local infiltrative inflammation or granulation) or inactive. The lesions can progress resulting in widespread retinal atrophy. The end-stage ophthalmoscopic lesions vary and may appear indistinguishable from PRA, or may be more characteristic of an inflammatory retinopathy. The asymmetry of the fundus abnormalities and the presence of inflammatory lesions in the retina and choroid help to differentiate this disorder from PRA. The mode of inheritance of this disease is not known; however, studies of different families suggest that it is possibly inherited. An intriguing aspect of the disease has been the preponderance of affected males compared to females. This has been confirmed in a recent unpublished survey.

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OCULAR DISORDERS REPORT
SHIH TZU

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 1038 #	%	2000-2009 926 #	%	2010-2016 765 #	%
GLOBE								
0.110	microphthalmia		1	0.1%	4	0.4%	1	0.1%
EYELIDS								
20.140	ectopic cilia		11	1.1%	25	2.7%	5	0.7%
20.160	macropalpebral fissure		18	1.7%	37	4.0%	2	0.3%
21.000	entropion, unspecified		48	4.6%	70	7.6%	72	9.4%
22.000	ectropion, unspecified		3	0.3%	1	0.1%	0	
25.110	distichiasis		219	21.1%	179	19.3%	103	13.5%
NASOLACRIMAL								
32.110	imperforate lower nasolacrimal punctum		3	0.3%	0		3	0.4%
40.910	keratoconjunctivitis sicca		2	0.2%	3	0.3%	19	2.5%
NICTITANS								
51.100	third eyelid cartilage anomaly		1	0.1%	0		0	
CORNEA								
70.210	corneal pannus		16	1.5%	9	1.0%	0	
70.220	pigmentary keratitis		53	5.1%	38	4.1%	74	9.7%
70.700	corneal dystrophy		9	0.9%	15	1.6%	9	1.2%
70.730	corneal endothelial degeneration		0		2	0.2%	2	0.3%
UVEA								
93.140	corneal endothelial pigment without PPM		0		1	0.1%	0	
93.150	iris coloboma		1	0.1%	2	0.2%	1	0.1%
93.710	persistent pupillary membranes, iris to iris		4	0.4%	16	1.7%	20	2.6%
93.720	persistent pupillary membranes, iris to lens		1	0.1%	1	0.1%	3	0.4%
93.730	persistent pupillary membranes, iris to cornea		1	0.1%	0		2	0.3%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		1	0.1%
93.999	uveal cysts		0		5	0.5%	0	
LENS								
100.200	cataract, unspecified		16	1.5%	0		0	
100.210	cataract, suspect not inherited		17	1.6%	21	2.3%	25	3.3%
100.301	punctate cataract, anterior cortex		7	0.7%	6	0.6%	1	0.1%
100.302	punctate cataract, posterior cortex		1	0.1%	4	0.4%	2	0.3%
100.303	punctate cataract, equatorial cortex		0		1	0.1%	0	
100.304	punctate cataract, anterior sutures		0		0		1	0.1%
100.305	punctate cataract, posterior sutures		2	0.2%	7	0.8%	0	
100.306	punctate cataract, nucleus		1	0.1%	0		0	
100.307	punctate cataract, capsular		0		2	0.2%	1	0.1%
100.311	incipient cataract, anterior cortex		8	0.8%	12	1.3%	2	0.3%
100.312	incipient cataract, posterior cortex		7	0.7%	10	1.1%	3	0.4%
100.313	incipient cataract, equatorial cortex		4	0.4%	7	0.8%	3	0.4%
100.314	incipient cataract, anterior sutures		0		1	0.1%	0	
100.315	incipient cataract, posterior sutures		1	0.1%	4	0.4%	2	0.3%
100.316	incipient cataract, nucleus		3	0.3%	3	0.3%	2	0.3%
100.317	incipient cataract, capsular		0		2	0.2%	0	
100.321	incomplete cataract, anterior cortex		0		0		1	0.1%
100.322	incomplete cataract, posterior cortex		0		0		1	0.1%

OCULAR DISORDERS REPORT
SHIH TZU

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.330	generalized/complete cataract	14	1.3%	9	1.0%	2	0.3%
100.375	subluxation/luxation, unspecified	2	0.2%	2	0.2%	0	
100.999	*significant cataracts (summary)*	*64*	*6.2%*	*68*	*7.3%*	*21*	*2.7%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	3	0.3%	1	0.1%	11	1.4%
110.320	vitreal degeneration	34	3.3%	80	8.6%	62	8.1%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.1%	0	
97.120	coloboma	1	0.1%	1	0.1%	0	
RETINA							
120.170	retinal dysplasia, folds	5	0.5%	4	0.4%	3	0.4%
120.180	retinal dysplasia, geographic	0		4	0.4%	0	
120.310	generalized progressive retinal atrophy (PRA)	25	2.4%	13	1.4%	3	0.4%
120.910	retinal detachment without dialysis	4	0.4%	5	0.5%	0	
120.920	retinal detachment with dialysis	0		0		1	0.1%
120.960	retinopathy	0		0		4	0.5%
OPTIC NERVE							
130.120	optic nerve hypoplasia	8	0.8%	2	0.2%	1	0.1%
130.150	optic disc coloboma	2	0.2%	2	0.2%	0	
OTHER							
900.000	other, unspecified	0		20	2.2%	23	3.0%
900.100	other, not inherited	9	0.9%	81	8.7%	57	7.5%
900.110	other, suspected as inherited	26	2.5%	21	2.3%	8	1.0%
NORMAL							
0.000	normal globe	630	60.7%	543	58.6%	439	57.4%

SHILOH SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option

Description and Comments

A. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Shiloh Shepherd breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

OCULAR DISORDERS REPORT
SHILOH SHEPHERD

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 9 #	%	2000-2009 150 #	%	2010-2016 104 #	%
EYELIDS								
25.110	distichiasis		0		0		2	1.9%
CORNEA								
70.210	corneal pannus		0		0		1	1.0%
70.700	corneal dystrophy		4	44.4%	15	10.0%	12	11.5%
70.730	corneal endothelial degeneration		0		0		1	1.0%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		2	1.3%	1	1.0%
93.999	uveal cysts		0		1	0.7%	1	1.0%
LENS								
100.210	cataract, suspect not inherited		0		6	4.0%	6	5.8%
100.302	punctate cataract, posterior cortex		0		1	0.7%	0	
100.307	punctate cataract, capsular		0		1	0.7%	0	
100.312	incipient cataract, posterior cortex		0		1	0.7%	0	
100.314	incipient cataract, anterior sutures		0		0		1	1.0%
100.330	generalized/complete cataract		0		1	0.7%	0	
100.999	*significant cataracts (summary)*		*0*		*4*	*2.7%*	*1*	*1.0%*
RETINA								
120.180	retinal dysplasia, geographic		0		1	0.7%	1	1.0%
OTHER								
900.000	other, unspecified		0		1	0.7%	0	
900.100	other, not inherited		0		4	2.7%	3	2.9%
NORMAL								
0.000	normal globe		5	55.6%	134	89.3%	83	79.8%

OCULAR DISORDERS REPORT

SIBERIAN HUSKY

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1-4	NO
B.	Distichiasis	Not defined	1	Breeder option
C.	Entropion	Not defined	1	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Presumed autosomal recessive	1, 5-8	NO
E.	Persistent pupillary membranes - iris to iris	Not defined	9, 10	Breeder option
F.	Cataract	Not defined	1, 4	NO
G.	Persistent hyperplastic primary vitreous	Not defined	11	NO
H.	Retinal atrophy - generalized * a DNA test is available	X-linked	1, 12, 13	NO
I.	Cone degeneration - (achromatopsia) * a DNA test is available	Autosomal recessive	17	NO
J.	Retinal dysplasia - geographic/ detached	Presumed autosomal recessive	1	NO
K.	Uveodermatologic syndrome	Not defined	1, 14-16	NO

OCULAR DISORDERS REPORT

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

C. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

D. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

In the Siberian Husky, the opacities are bilaterally symmetrical, round to oval and ring shaped. They occur early in life (0.5-2 years) and may progress to cause significant vision loss.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane,

persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Siberian Husky, cataracts begin in the axial posterior cortex at approximately one year of age. Progression is variable and vision impairment may occur. In cases with rapid progression, secondary lens-induced uveitis and glaucoma may be associated with partial cataract resorption.

G. Persistent hyperplastic primary vitreous (PHPV)

Persistent hyperplastic primary vitreous is a congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent hyperplastic tunica vasculosa lentis which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. In the Samoyed, one form of PRA, known as XLPRA1, is due to a mutation in the *RPGR* gene and is inherited as a recessive, sex-linked trait. A DNA test is available.

I. Cone degeneration - hemeralopia/achromatopsia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Afflicted puppies develop day-blindness, colorblindness, and photophobia between 8 and 12 weeks of age. Afflicted dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. A missense mutation in the same gene (*CNGB3*) that has been identified in CD-affected Alaskan Malamute-derived dogs has been detected in German Shorthaired Pointers affected with a clinically identical allelic disorder. A DNA test is available.

J. Retinal dysplasia - geographic/detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of

retinal dysplasia is not known for all breeds.

K. Uveodermatologic syndrome

Uveodermatologic syndrome in the Siberian Husky bears many similarities to a condition in people called Vogt-Koyanagi-Harada (or VKH) syndrome. Thus, the condition in dogs is often referred to as VKH or VKH-like syndrome. It is an immune-mediated disease in which pigmented cells (melanocytes) in the eye and in the skin are destroyed by white blood cells (lymphocytes). The first clinical signs are usually inflammation of the intraocular structures (or uveitis) in both eyes. Adhesions between the iris and lens (posterior synechia) and the peripheral iris and cornea (peripheral anterior synechia) develop rapidly. Other complications include cataract development, retinal degeneration, retinal separation or detachment, optic disc atrophy and secondary glaucoma. The uveitis is very difficult to control medically and ultimately results in blindness in most affected dogs. Whitening of the hair (poliosis) and skin (vitiligo) may also be noted in advanced cases. The genetics of this condition are unclear, but some genetic predisposition is indicated by the higher prevalence of this disorder in Siberian Huskies compared with other dog breeds. Affected dogs are generally young, ranging in age between 1 ½ to 4 years.

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OCULAR DISORDERS REPORT
SIBERIAN HUSKY

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 16961 #	%	2000-2009 13659 #	%	2010-2016 8496 #	%
GLOBE							
0.110	microphthalmia	5	0.0%	2	0.0%	0	
10.000	glaucoma	10	0.1%	2	0.0%	0	
EYELIDS							
20.110	eyelid dermoid	4	0.0%	0		0	
20.140	ectopic cilia	2	0.0%	0		1	0.0%
20.160	macropalpebral fissure	1	0.0%	0		0	
21.000	entropion, unspecified	12	0.1%	5	0.0%	3	0.0%
22.000	ectropion, unspecified	4	0.0%	0		0	
25.110	distichiasis	162	1.0%	133	1.0%	114	1.3%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	1	0.0%	0		0	
40.910	keratoconjunctivitis sicca	1	0.0%	0		2	0.0%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		2	0.0%
52.110	prolapsed gland of the third eyelid	1	0.0%	0		1	0.0%
CORNEA							
70.210	corneal pannus	11	0.1%	8	0.1%	3	0.0%
70.220	pigmentary keratitis	0		0		3	0.0%
70.700	corneal dystrophy	502	3.0%	371	2.7%	145	1.7%
70.730	corneal endothelial degeneration	21	0.1%	13	0.1%	3	0.0%
UVEA							
93.110	iris hypoplasia	0		1	0.0%	2	0.0%
93.140	corneal endothelial pigment without PPM	0		0		1	0.0%
93.150	iris coloboma	4	0.0%	1	0.0%	3	0.0%
93.710	persistent pupillary membranes, iris to iris	284	1.7%	392	2.9%	251	3.0%
93.720	persistent pupillary membranes, iris to lens	10	0.1%	13	0.1%	4	0.0%
93.730	persistent pupillary membranes, iris to cornea	26	0.2%	13	0.1%	16	0.2%
93.740	persistent pupillary membranes, iris sheets	2	0.0%	3	0.0%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		18	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		17	0.2%
93.810	uveal melanoma	0		1	0.0%	0	
93.999	uveal cysts	3	0.0%	11	0.1%	7	0.1%
97.150	chorioretinal coloboma, congenital	0		0		3	0.0%
LENS							
100.200	cataract, unspecified	576	3.4%	0		0	
100.210	cataract, suspect not inherited	271	1.6%	244	1.8%	202	2.4%
100.301	punctate cataract, anterior cortex	27	0.2%	22	0.2%	23	0.3%
100.302	punctate cataract, posterior cortex	106	0.6%	63	0.5%	33	0.4%
100.303	punctate cataract, equatorial cortex	18	0.1%	9	0.1%	12	0.1%
100.304	punctate cataract, anterior sutures	7	0.0%	3	0.0%	0	
100.305	punctate cataract, posterior sutures	64	0.4%	29	0.2%	10	0.1%
100.306	punctate cataract, nucleus	6	0.0%	11	0.1%	7	0.1%
100.307	punctate cataract, capsular	5	0.0%	13	0.1%	14	0.2%

OCULAR DISORDERS REPORT
SIBERIAN HUSKY

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.311	incipient cataract, anterior cortex	50	0.3%	55	0.4%	33	0.4%
100.312	incipient cataract, posterior cortex	584	3.4%	513	3.8%	206	2.4%
100.313	incipient cataract, equatorial cortex	28	0.2%	27	0.2%	12	0.1%
100.314	incipient cataract, anterior sutures	7	0.0%	8	0.1%	3	0.0%
100.315	incipient cataract, posterior sutures	137	0.8%	95	0.7%	30	0.4%
100.316	incipient cataract, nucleus	38	0.2%	38	0.3%	16	0.2%
100.317	incipient cataract, capsular	8	0.0%	47	0.3%	36	0.4%
100.321	incomplete cataract, anterior cortex	0		0		9	0.1%
100.322	incomplete cataract, posterior cortex	0		0		77	0.9%
100.323	incomplete cataract, equatorial cortex	0		0		4	0.0%
100.324	incomplete cataract, anterior sutures	0		0		2	0.0%
100.325	incomplete cataract, posterior sutures	0		0		7	0.1%
100.326	incomplete cataract, nucleus	0		0		13	0.2%
100.327	incomplete cataract, capsular	0		0		7	0.1%
100.330	generalized/complete cataract	290	1.7%	143	1.0%	38	0.4%
100.340	resorbing/hypermature cataract	0		0		2	0.0%
100.375	subluxation/luxation, unspecified	11	0.1%	0		2	0.0%
100.999	*significant cataracts (summary)*	*1951*	*11.5%*	*1076*	*7.9%*	*594*	*7.0%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	25	0.1%	15	0.1%	10	0.1%
110.135	PHPV/PTVL	1	0.0%	3	0.0%	2	0.0%
110.320	vitreal degeneration	14	0.1%	13	0.1%	11	0.1%
FUNDUS							
97.110	choroidal hypoplasia	21	0.1%	18	0.1%	10	0.1%
97.120	coloboma	8	0.0%	7	0.1%	1	0.0%
RETINA							
120.170	retinal dysplasia, folds	41	0.2%	34	0.2%	16	0.2%
120.180	retinal dysplasia, geographic	17	0.1%	19	0.1%	18	0.2%
120.190	retinal dysplasia, detached	4	0.0%	3	0.0%	6	0.1%
120.310	generalized progressive retinal atrophy (PRA)	58	0.3%	82	0.6%	25	0.3%
120.400	retinal hemorrhage	6	0.0%	1	0.0%	0	
120.910	retinal detachment without dialysis	12	0.1%	12	0.1%	3	0.0%
120.920	retinal detachment with dialysis	0		0		2	0.0%
120.960	retinopathy	0		0		22	0.3%
OPTIC NERVE							
130.110	micropapilla	0		2	0.0%	1	0.0%
130.120	optic nerve hypoplasia	6	0.0%	1	0.0%	0	
130.150	optic disc coloboma	1	0.0%	2	0.0%	0	
OTHER							
900.000	other, unspecified	0		103	0.8%	251	3.0%
900.100	other, not inherited	57	0.3%	688	5.0%	343	4.0%
900.110	other, suspected as inherited	175	1.0%	51	0.4%	13	0.2%
NORMAL							
0.000	normal globe	14127	83.3%	11787	86.3%	7107	83.7%

SILKEN WINDHOUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO
B.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma * a DNA test is available	Autosomal recessive	2, 3	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

B. Choroidal hypoplasia (Collie Eye Anomaly)
- Staphyloma/coloboma
- Retinal detachment
- Retinal hemorrhage
- Optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

References

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OCULAR DISORDERS REPORT
SILKEN WINDHOUND

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 35 #	%	2010-2016 337 #	%
EYELIDS								
25.110	distichiasis		0		0		5	1.5%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		0		1	0.3%
LENS								
100.210	cataract, suspect not inherited		0		0		19	5.6%
100.302	punctate cataract, posterior cortex		0		0		1	0.3%
100.305	punctate cataract, posterior sutures		0		0		1	0.3%
100.307	punctate cataract, capsular		0		0		2	0.6%
100.311	incipient cataract, anterior cortex		0		1	2.9%	0	
100.315	incipient cataract, posterior sutures		0		1	2.9%	0	
100.317	incipient cataract, capsular		0		1	2.9%	0	
100.999	*significant cataracts (summary)*		*0*		*3*	*8.6%*	*4*	*1.2%*
VITREOUS								
110.320	vitreal degeneration		0		0		7	2.1%
FUNDUS								
97.110	choroidal hypoplasia		0		0		1	0.3%
RETINA								
120.180	retinal dysplasia, geographic		0		0		3	0.9%
120.310	generalized progressive retinal atrophy (PRA)		0		0		1	0.3%
120.960	retinopathy		0		0		3	0.9%
OTHER								
900.000	other, unspecified		0		1	2.9%	1	0.3%
900.100	other, not inherited		0		0		10	3.0%
NORMAL								
0.000	normal globe		0		34	97.1%	301	89.3%

OCULAR DISORDERS REPORT

SILKY TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Corneal dystrophy - epithelial/stromal	Not defined	1, 2	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
C.	Cataract	Not defined	1-4	NO
D.	Vitreous degeneration	Not defined	2, 3, 5	Breeder option
E.	Retinal atrophy - generalized (*prcd)* *a DNA test is available	Autosomal recessive	6	NO

Description and Comments

A. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally in the neonatal period. These strands may bridge from iris to iris, iris to cornea, iris to lens, or from sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

D. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

E. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Silky Terrier is PRCD which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

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5. Koch SA. Cataracts in interrelated old English Sheepdogs. *J Am Vet Med Assoc*. 1972;160:299-301.

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OCULAR DISORDERS REPORT
SILKY TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 151 #	 %	2000-2009 310 #	 %	2010-2016 298 #	 %
EYELIDS							
21.000	entropion, unspecified	0		1	0.3%	0	
25.110	distichiasis	1	0.7%	1	0.3%	1	0.3%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		1	0.3%
CORNEA							
70.700	corneal dystrophy	7	4.6%	0		1	0.3%
UVEA							
93.140	corneal endothelial pigment without PPM	0		0		1	0.3%
93.710	persistent pupillary membranes, iris to iris	10	6.6%	25	8.1%	19	6.4%
93.720	persistent pupillary membranes, iris to lens	1	0.7%	0		0	
93.730	persistent pupillary membranes, iris to cornea	2	1.3%	1	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.3%	1	0.3%
LENS							
100.200	cataract, unspecified	4	2.6%	0		0	
100.210	cataract, suspect not inherited	5	3.3%	20	6.5%	13	4.4%
100.301	punctate cataract, anterior cortex	0		6	1.9%	3	1.0%
100.302	punctate cataract, posterior cortex	1	0.7%	2	0.6%	1	0.3%
100.303	punctate cataract, equatorial cortex	2	1.3%	2	0.6%	2	0.7%
100.304	punctate cataract, anterior sutures	0		0		1	0.3%
100.305	punctate cataract, posterior sutures	0		0		1	0.3%
100.306	punctate cataract, nucleus	0		1	0.3%	0	
100.311	incipient cataract, anterior cortex	3	2.0%	7	2.3%	3	1.0%
100.312	incipient cataract, posterior cortex	4	2.6%	8	2.6%	7	2.3%
100.313	incipient cataract, equatorial cortex	0		3	1.0%	6	2.0%
100.314	incipient cataract, anterior sutures	0		1	0.3%	0	
100.315	incipient cataract, posterior sutures	1	0.7%	1	0.3%	1	0.3%
100.316	incipient cataract, nucleus	0		0		1	0.3%
100.317	incipient cataract, capsular	0		1	0.3%	0	
100.321	incomplete cataract, anterior cortex	0		0		1	0.3%
100.322	incomplete cataract, posterior cortex	0		0		1	0.3%
100.330	generalized/complete cataract	17	11.3%	5	1.6%	0	
100.999	*significant cataracts (summary)*	*32*	*21.2%*	*37*	*11.9%*	*28*	*9.4%*
VITREOUS							
110.320	vitreal degeneration	5	3.3%	11	3.5%	20	6.7%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.3%	1	0.3%
RETINA							
120.170	retinal dysplasia, folds	1	0.7%	2	0.6%	1	0.3%
120.180	retinal dysplasia, geographic	0		1	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	2	1.3%	3	1.0%	4	1.3%
120.910	retinal detachment without dialysis	1	0.7%	0		0	

OCULAR DISORDERS REPORT
SILKY TERRIER

	1991-1999	2000-2009	2010-2016
OPTIC NERVE			
130.110 micropapilla	0	1 0.3%	0
OTHER			
900.000 other, unspecified	0	1 0.3%	11 3.7%
900.100 other, not inherited	0	23 7.4%	10 3.4%
900.110 other, suspected as inherited	1 0.7%	0	1 0.3%
NORMAL			
0.000 normal globe	111 73.5%	236 76.1%	221 74.2%

SLOUGHI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy-generalized (rcd1a) * a DNA test is available	Autosomal recessive	1	NO

Description and Comments

A. Retinal atrophy – generalized (rcd1a)

A later onset degenerative disease of the retinal visual cells with visual deficits detectable at 2 to 3 years of age and which progresses to blindness. This abnormality may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. It is inherited as an autosomal recessive trait.

In the Sloughi, the disease is due to an 8-bp insertion in exon 21 of the *PDE6B* gene causing the rcd1a form of PRA. The disease is genetically distinct from that in the Irish Setter and has a later age of onset. A DNA test is available.
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References

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OCULAR DISORDERS REPORT
SLOUGHI

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 10 #	%	2010-2016 22 #	%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		1	4.5%
UVEA							
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		2	9.1%
LENS							
100.210	cataract, suspect not inherited	0		0		1	4.5%
VITREOUS							
110.320	vitreal degeneration	0		1	10.0%	0	
OTHER							
900.000	other, unspecified	0		0		1	4.5%
NORMAL							
0.000	normal globe	0		10	100.0%	21	95.5%

SMOOTH FOX TERRIER*

*The Smooth Fox Terrier and the Wire Fox Terrier were originally considered two varieties of the same breed. They became separate breeds in 1985. It is likely that the same genetic diseases exist in both breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1, 2	NO
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	3	Breeder option
	- all other forms	Not defined	3	NO
C.	Cataract	Not defined	1	NO
D.	Lens luxation * a DNA test is available	Not defined	1, 4-7	NO

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The cataracts observed in the Smooth Fox Terrier begin in the posterior sub-capsular region and are progressive.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A DNA test is available.

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5. Curtis R and Barnett KC. Primary lens luxation in the dog. *J Small Anim Pract*. 1980 Dec;21:657-668.

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OCULAR DISORDERS REPORT
SMOOTH FOX TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 76 #	 %	2000-2009 153 #	 %	2010-2016 55 #	 %
UVEA								
93.710	persistent pupillary membranes, iris to iris		2	2.6%	8	5.2%	3	5.5%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		1	1.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		1	1.8%
LENS								
100.210	cataract, suspect not inherited		0		3	2.0%	0	
100.311	incipient cataract, anterior cortex		1	1.3%	0		0	
100.312	incipient cataract, posterior cortex		1	1.3%	0		1	1.8%
100.330	generalized/complete cataract		0		2	1.3%	0	
100.999	*significant cataracts (summary)*		*2*	*2.6%*	*2*	*1.3%*	*1*	*1.8%*
VITREOUS								
110.320	vitreal degeneration		0		3	2.0%	0	
RETINA								
120.170	retinal dysplasia, folds		0		1	0.7%	1	1.8%
120.310	generalized progressive retinal atrophy (PRA)		0		2	1.3%	1	1.8%
OTHER								
900.000	other, unspecified		0		0		1	1.8%
900.100	other, not inherited		0		6	3.9%	3	5.5%
NORMAL								
0.000	normal globe		72	94.7%	135	88.2%	45	81.8%

OCULAR DISORDERS REPORT

SOFT-COATED WHEATEN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Not defined	1	NO
B.	Distichiasis	Not defined	2	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	3	Breeder option
D.	Persistent pupillary membranes			
	- iris to iris	Not defined	1-3	Breeder option
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
E.	Cataract	Not defined	1, 2	NO
F	Persistent hyaloid artery	Not defined	1, 2	Breeder option
G.	Retinal dysplasia - folds	Not defined	2	Breeder option
H.	Choroidal hypoplasia	Not defined	5	NO

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (retinal dysplasia).

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

OCULAR DISORDERS REPORT

C. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

H. Choroidal hypoplasia

Inadequate development of the choroid present at birth and non-progressive. This condition is most commonly identified in the Collie breed where it is a manifestation of "Collie Eye Anomaly."

References

1. Van der Woerdt A. Multiple ocular anomalies in two related litters of Soft-Coated Wheaten Terriers. *Prog Vet Comp Ophthal*. 1995;5:78.

2. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

5. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

OCULAR DISORDERS REPORT
SOFT COATED WHEATEN TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 3101 #	%	2000-2009 3068 #	%	2010-2016 1423 #	%
GLOBE							
10.000	glaucoma	2	0.1%	0		0	
EYELIDS							
20.160	macropalpebral fissure	1	0.0%	0		0	
21.000	entropion, unspecified	1	0.0%	0		0	
25.110	distichiasis	46	1.5%	43	1.4%	54	3.8%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	6	0.2%	0		2	0.1%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		3	0.2%
CORNEA							
70.700	corneal dystrophy	21	0.7%	27	0.9%	8	0.6%
UVEA							
93.140	corneal endothelial pigment without PPM	0		1	0.0%	2	0.1%
93.150	iris coloboma	1	0.0%	0		0	
93.710	persistent pupillary membranes, iris to iris	62	2.0%	128	4.2%	63	4.4%
93.720	persistent pupillary membranes, iris to lens	4	0.1%	13	0.4%	1	0.1%
93.740	persistent pupillary membranes, iris sheets	1	0.0%	2	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.0%	56	3.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		6	0.4%
93.999	uveal cysts	0		12	0.4%	4	0.3%
LENS							
100.200	cataract, unspecified	24	0.8%	0		0	
100.210	cataract, suspect not inherited	82	2.6%	184	6.0%	94	6.6%
100.301	punctate cataract, anterior cortex	9	0.3%	14	0.5%	5	0.4%
100.302	punctate cataract, posterior cortex	3	0.1%	5	0.2%	2	0.1%
100.303	punctate cataract, equatorial cortex	3	0.1%	7	0.2%	3	0.2%
100.304	punctate cataract, anterior sutures	3	0.1%	1	0.0%	1	0.1%
100.305	punctate cataract, posterior sutures	1	0.0%	1	0.0%	2	0.1%
100.306	punctate cataract, nucleus	1	0.0%	2	0.1%	1	0.1%
100.307	punctate cataract, capsular	1	0.0%	10	0.3%	5	0.4%
100.311	incipient cataract, anterior cortex	8	0.3%	12	0.4%	10	0.7%
100.312	incipient cataract, posterior cortex	10	0.3%	14	0.5%	6	0.4%
100.313	incipient cataract, equatorial cortex	11	0.4%	6	0.2%	1	0.1%
100.314	incipient cataract, anterior sutures	1	0.0%	0		1	0.1%
100.315	incipient cataract, posterior sutures	8	0.3%	0		5	0.4%
100.316	incipient cataract, nucleus	5	0.2%	10	0.3%	2	0.1%
100.317	incipient cataract, capsular	0		11	0.4%	1	0.1%
100.322	incomplete cataract, posterior cortex	0		0		1	0.1%
100.330	generalized/complete cataract	14	0.5%	20	0.7%	1	0.1%
100.375	subluxation/luxation, unspecified	0		3	0.1%	1	0.1%
100.999	*significant cataracts (summary)*	*102*	*3.3%*	*113*	*3.7%*	*47*	*3.3%*

OCULAR DISORDERS REPORT
SOFT COATED WHEATEN TERRIER

		1991-1999		2000-2009		2010-2016	
VITREOUS							
110.120	persistent hyaloid artery/remnant	41	1.3%	24	0.8%	6	0.4%
110.135	PHPV/PTVL	4	0.1%	1	0.0%	1	0.1%
110.320	vitreal degeneration	2	0.1%	7	0.2%	4	0.3%
FUNDUS							
97.110	choroidal hypoplasia	0		17	0.6%	0	
97.120	coloboma	1	0.0%	0		0	
RETINA							
120.170	retinal dysplasia, folds	43	1.4%	19	0.6%	9	0.6%
120.180	retinal dysplasia, geographic	1	0.0%	1	0.0%	2	0.1%
120.190	retinal dysplasia, detached	2	0.1%	0		0	
120.310	generalized progressive retinal atrophy (PRA)	8	0.3%	6	0.2%	0	
120.910	retinal detachment without dialysis	1	0.0%	0		0	
120.960	retinopathy	0		0		2	0.1%
OPTIC NERVE							
130.110	micropapilla	3	0.1%	10	0.3%	1	0.1%
130.120	optic nerve hypoplasia	5	0.2%	0		0	
130.150	optic disc coloboma	3	0.1%	6	0.2%	0	
OTHER							
900.000	other, unspecified	0		12	0.4%	37	2.6%
900.100	other, not inherited	14	0.5%	169	5.5%	43	3.0%
900.110	other, suspected as inherited	11	0.4%	18	0.6%	1	0.1%
NORMAL							
0.000	normal globe	2735	88.2%	2656	86.6%	1156	81.2%

SPANISH WATER DOG

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- all other forms	Not defined	1	NO
B.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	2, 3	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that one form of PRA in the Spanish Water Dog is PRCD which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

1. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006;88:551-563.

OCULAR DISORDERS REPORT
SPANISH WATER DOG

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 110 #	%	2010-2016 154 #	%
EYELIDS							
25.110	distichiasis	0		2	1.8%	1	0.6%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		1	0.9%	0	
CORNEA							
70.700	corneal dystrophy	0		2	1.8%	1	0.6%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		1	0.9%	8	5.2%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.6%
LENS							
100.210	cataract, suspect not inherited	0		7	6.4%	9	5.8%
100.302	punctate cataract, posterior cortex	0		0		1	0.6%
100.306	punctate cataract, nucleus	0		1	0.9%	1	0.6%
100.313	incipient cataract, equatorial cortex	0		0		1	0.6%
100.316	incipient cataract, nucleus	0		0		1	0.6%
100.317	incipient cataract, capsular	0		1	0.9%	0	
100.999	*significant cataracts (summary)*	*0*		*2*	*1.8%*	*4*	*2.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.9%	0	
110.320	vitreal degeneration	0		0		1	0.6%
RETINA							
120.170	retinal dysplasia, folds	0		2	1.8%	5	3.2%
120.180	retinal dysplasia, geographic	0		0		4	2.6%
120.190	retinal dysplasia, detached	0		0		1	0.6%
120.310	generalized progressive retinal atrophy (PRA)	0		4	3.6%	3	1.9%
OTHER							
900.000	other, unspecified	0		0		4	2.6%
900.100	other, not inherited	0		7	6.4%	4	2.6%
900.110	other, suspected as inherited	0		1	0.9%	0	
NORMAL							
0.000	normal globe	0		99	90.0%	117	76.0%

SPINONE ITALIANO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1, 2	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	3	Breeder options
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
C.	Cataract	Not defined	5	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Spinone Italiano breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

2. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. ACVO Genetics Committee, 2015 and/or Data from CERF/OFA All-Breeds Report, 2010-2014.

5. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

OCULAR DISORDERS REPORT
SPINONE ITALIANO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 117 #	 %	2000-2009 1279 #	 %	2010-2016 747 #	 %
GLOBE							
0.110	microphthalmia	0		1	0.1%	0	
EYELIDS							
20.160	macropalpebral fissure	0		3	0.2%	0	
21.000	entropion, unspecified	2	1.7%	23	1.8%	6	0.8%
22.000	ectropion, unspecified	2	1.7%	5	0.4%	6	0.8%
25.110	distichiasis	2	1.7%	11	0.9%	14	1.9%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		1	0.1%	0	
NICTITANS							
51.100	third eyelid cartilage anomaly	0		2	0.2%	1	0.1%
52.110	prolapsed gland of the third eyelid	0		3	0.2%	0	
UVEA							
90.250	pigmentary uveitis	0		0		1	0.1%
93.150	iris coloboma	0		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	0		49	3.8%	42	5.6%
93.720	persistent pupillary membranes, iris to lens	0		1	0.1%	2	0.3%
93.730	persistent pupillary membranes, iris to cornea	0		1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	0		2	0.2%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		6	0.8%
93.999	uveal cysts	0		1	0.1%	2	0.3%
LENS							
100.200	cataract, unspecified	2	1.7%	0		0	
100.210	cataract, suspect not inherited	8	6.8%	65	5.1%	37	5.0%
100.301	punctate cataract, anterior cortex	0		5	0.4%	1	0.1%
100.302	punctate cataract, posterior cortex	0		2	0.2%	1	0.1%
100.303	punctate cataract, equatorial cortex	0		1	0.1%	0	
100.304	punctate cataract, anterior sutures	0		2	0.2%	1	0.1%
100.305	punctate cataract, posterior sutures	0		1	0.1%	2	0.3%
100.306	punctate cataract, nucleus	3	2.6%	9	0.7%	2	0.3%
100.307	punctate cataract, capsular	0		3	0.2%	0	
100.311	incipient cataract, anterior cortex	1	0.9%	9	0.7%	4	0.5%
100.312	incipient cataract, posterior cortex	3	2.6%	3	0.2%	0	
100.313	incipient cataract, equatorial cortex	0		5	0.4%	0	
100.314	incipient cataract, anterior sutures	0		1	0.1%	0	
100.315	incipient cataract, posterior sutures	0		4	0.3%	1	0.1%
100.316	incipient cataract, nucleus	0		5	0.4%	4	0.5%
100.317	incipient cataract, capsular	0		0		1	0.1%
100.322	incomplete cataract, posterior cortex	0		0		1	0.1%
100.330	generalized/complete cataract	0		5	0.4%	0	
100.375	subluxation/luxation, unspecified	0		3	0.2%	0	
100.999	*significant cataracts (summary)*	*9*	*7.7%*	*55*	*4.3%*	*18*	*2.4%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		2	0.2%	0	
110.320	vitreal degeneration	2	1.7%	10	0.8%	9	1.2%

OCULAR DISORDERS REPORT
SPINONE ITALIANO

	1991-1999	2000-2009	2010-2016
RETINA			
120.170 retinal dysplasia, folds	0	6 0.5%	4 0.5%
120.310 generalized progressive retinal atrophy (PRA)	0	1 0.1%	0
OTHER			
900.000 other, unspecified	0	7 0.5%	15 2.0%
900.100 other, not inherited	0	62 4.8%	18 2.4%
900.110 other, suspected as inherited	0	3 0.2%	0
NORMAL			
0.000 normal globe	103 88.0%	1134 88.7%	629 84.2%

OCULAR DISORDERS REPORT

STAFFORDSHIRE BULL TERRIER*

* Please note that since 1972 the AKC considers the Staffordshire Bull Terrier a different breed from the American Staffordshire Terrier.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes			
	- iris to iris	Not defined	2, 3	Breeder option
	- lens pigment foci/no strands	Not defined	4	Passes with no notation
C.	Cataract * a DNA test is available	Autosomal recessive	2, 5-8	NO
D.	Persistent hyperplastic primary vitreous (PHPV)	Not defined	4, 9, 10	NO
E.	Persistent hyaloid artery	Not defined	1	Breeder option
F.	Vitreous degeneration	Not defined	11	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Staffordshire Bull Terrier, cataracts usually develop by one year of age. There is initial opacification of the suture lines progressing to nuclear and cortical cataract formation; complete cataracts and blindness develop by three years of age. The condition is inherited as an autosomal recessive mutation in the HSF4 gene (*HSF4-1*). A DNA test is available.

D. Persistent hyperplastic primary vitreous (PHPV)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery (the primary vitreous) and the interaction of this blood vessel with the posterior lens capsule/cortex during embryogenesis. This condition is often associated with persistent tunica vasculosa lentis (PTVL) which results from failure of regression of the embryologic vascular network which surrounds the developing lens.

The majority of affected dogs have a retrolental fibrovascular plaque and variable lenticular defects which include posterior lenticonus/globus, colobomata, intralenticular hemorrhage and/or secondary cataracts. Vision impairment may result. The disease is an inherited disorder in the breed, but the mode of inheritance has not been defined. The results of current studies cannot rule out autosomal recessive or a dominant trait with incomplete penetrance.

E. Persistent hyaloid artery (PHA)

A congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

F. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

References

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.
2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.
3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.
4. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.
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8. Mellersh CS, McLaughlin B, Ahonen S, et al. Mutation in HSF4 is associated with hereditary cataract in the Australian Shepherd. *Vet Ophthalmol*. 2009;12:372-378.
9. Curtis R, Barnett KC, Leon A. Persistent hyperplastic primary vitreous in the Staffordshire Bull Terrier. *Vet Rec*. 1984;115:385.
10. Leon A, Curtis R, Barnett K. Hereditary persistent hyperplastic primary vitreous in the Staffordshire Bull Terrier. *J Am Anim Hosp Assoc*. 1986;22:765-774.
11. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

OCULAR DISORDERS REPORT
STAFFORDSHIRE BULL TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 147 #	 %	2000-2009 381 #	 %	2010-2016 386 #	 %
EYELIDS							
25.110	distichiasis	10	6.8%	45	11.8%	23	6.0%
CORNEA							
70.700	corneal dystrophy	0		1	0.3%	1	0.3%
UVEA							
93.710	persistent pupillary membranes, iris to iris	7	4.8%	6	1.6%	10	2.6%
93.720	persistent pupillary membranes, iris to lens	1	0.7%	1	0.3%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		6	1.6%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.3%
93.999	uveal cysts	0		2	0.5%	4	1.0%
LENS							
100.210	cataract, suspect not inherited	3	2.0%	19	5.0%	14	3.6%
100.301	punctate cataract, anterior cortex	0		3	0.8%	3	0.8%
100.302	punctate cataract, posterior cortex	0		0		1	0.3%
100.303	punctate cataract, equatorial cortex	0		1	0.3%	1	0.3%
100.304	punctate cataract, anterior sutures	0		1	0.3%	0	
100.305	punctate cataract, posterior sutures	0		0		1	0.3%
100.307	punctate cataract, capsular	0		1	0.3%	1	0.3%
100.311	incipient cataract, anterior cortex	0		0		2	0.5%
100.312	incipient cataract, posterior cortex	2	1.4%	1	0.3%	3	0.8%
100.313	incipient cataract, equatorial cortex	1	0.7%	2	0.5%	1	0.3%
100.315	incipient cataract, posterior sutures	0		1	0.3%	0	
100.317	incipient cataract, capsular	0		1	0.3%	1	0.3%
100.330	generalized/complete cataract	0		0		1	0.3%
100.999	*significant cataracts (summary)*	*3*	*2.0%*	*11*	*2.9%*	*15*	*3.9%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.3%	3	0.8%
110.320	vitreal degeneration	2	1.4%	7	1.8%	10	2.6%
RETINA							
120.170	retinal dysplasia, folds	1	0.7%	3	0.8%	1	0.3%
120.180	retinal dysplasia, geographic	0		3	0.8%	1	0.3%
120.310	generalized progressive retinal atrophy (PRA)	0		1	0.3%	0	
OTHER							
900.000	other, unspecified	0		3	0.8%	6	1.6%
900.100	other, not inherited	0		20	5.2%	16	4.1%
NORMAL							
0.000	normal globe	123	83.7%	316	82.9%	308	79.8%

OCULAR DISORDERS REPORT

STANDARD SCHNAUZER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Persistent pupillary membranes -iris to iris	Not defined	2	Breeder option
D.	Cataract	Not defined	1	NO
E.	Vitreous degeneration	Not defined	3	Breeder option
F.	Retinal atrophy - generalized	Presumed autosomal recessive	1	NO
G.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

OCULAR DISORDERS REPORT

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest potential threat to vision.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

There are apparently several forms of cataracts in the Standard Schnauzer: 1) posterior cortex and posterior/total nucleus involvement, with slow progression; 2) dense posterior polar opacity near the sub-capsular region which progresses rapidly to very dense posterior polar plaques in young animals; 3) dense posterior polar opacity like that reported in young animals but found in older animals with variable progression.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Standard Schnauzer breed. The conditions listed are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

3. ACVO Genetics Committee, 2014 and/or Data from OFA All-Breeds Reports, 2013-2014.

OCULAR DISORDERS REPORT
STANDARD SCHNAUZER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 735 #	%	2000-2009 1440 #	%	2010-2016 1020 #	%
GLOBE							
0.110	microphthalmia	0		1	0.1%	0	
10.000	glaucoma	2	0.3%	0		0	
EYELIDS							
20.140	ectopic cilia	0		0		1	0.1%
25.110	distichiasis	16	2.2%	30	2.1%	20	2.0%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		1	0.1%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		1	0.1%	1	0.1%
52.110	prolapsed gland of the third eyelid	0		0		2	0.2%
CORNEA							
70.700	corneal dystrophy	8	1.1%	10	0.7%	7	0.7%
70.730	corneal endothelial degeneration	0		0		1	0.1%
UVEA							
93.710	persistent pupillary membranes, iris to iris	2	0.3%	10	0.7%	3	0.3%
93.720	persistent pupillary membranes, iris to lens	2	0.3%	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	1	0.1%	2	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	1	0.1%	1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		8	0.8%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.1%
93.999	uveal cysts	0		1	0.1%	1	0.1%
LENS							
100.200	cataract, unspecified	2	0.3%	0		0	
100.210	cataract, suspect not inherited	26	3.5%	48	3.3%	45	4.4%
100.301	punctate cataract, anterior cortex	1	0.1%	4	0.3%	7	0.7%
100.302	punctate cataract, posterior cortex	1	0.1%	2	0.1%	4	0.4%
100.303	punctate cataract, equatorial cortex	3	0.4%	1	0.1%	1	0.1%
100.304	punctate cataract, anterior sutures	1	0.1%	0		1	0.1%
100.305	punctate cataract, posterior sutures	3	0.4%	1	0.1%	8	0.8%
100.306	punctate cataract, nucleus	1	0.1%	2	0.1%	2	0.2%
100.307	punctate cataract, capsular	0		6	0.4%	7	0.7%
100.311	incipient cataract, anterior cortex	3	0.4%	6	0.4%	4	0.4%
100.312	incipient cataract, posterior cortex	3	0.4%	7	0.5%	2	0.2%
100.313	incipient cataract, equatorial cortex	6	0.8%	5	0.3%	5	0.5%
100.314	incipient cataract, anterior sutures	1	0.1%	1	0.1%	0	
100.315	incipient cataract, posterior sutures	0		1	0.1%	1	0.1%
100.316	incipient cataract, nucleus	3	0.4%	4	0.3%	2	0.2%
100.317	incipient cataract, capsular	0		4	0.3%	0	
100.321	incomplete cataract, anterior cortex	0		0		1	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.1%
100.330	generalized/complete cataract	8	1.1%	5	0.3%	0	
100.375	subluxation/luxation, unspecified	1	0.1%	0		0	
100.999	*significant cataracts (summary)*	*36*	*4.9%*	*49*	*3.4%*	*46*	*4.5%*

OCULAR DISORDERS REPORT
STANDARD SCHNAUZER

	1991-1999		2000-2009		2010-2016	
VITREOUS						
110.120 persistent hyaloid artery/remnant	0		3	0.2%	0	
110.320 vitreal degeneration	3	0.4%	5	0.3%	10	1.0%
RETINA						
120.170 retinal dysplasia, folds	4	0.5%	21	1.5%	6	0.6%
120.180 retinal dysplasia, geographic	1	0.1%	2	0.1%	1	0.1%
120.310 generalized progressive retinal atrophy (PRA)	12	1.6%	10	0.7%	2	0.2%
120.910 retinal detachment without dialysis	1	0.1%	0		0	
OPTIC NERVE						
130.110 micropapilla	0		4	0.3%	1	0.1%
130.120 optic nerve hypoplasia	2	0.3%	0		1	0.1%
OTHER						
900.000 other, unspecified	0		7	0.5%	24	2.4%
900.100 other, not inherited	3	0.4%	66	4.6%	24	2.4%
900.110 other, suspected as inherited	5	0.7%	3	0.2%	2	0.2%
NORMAL						
0.000 normal globe	636	86.5%	1297	90.1%	902	88.4%

SUSSEX SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Ectropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	2	Breeder option
C.	Exposure/Pigmentary Keratitis/Pigmentary Keratopathy	Not defined		Breeder option
D.	Iris coloboma	Not defined	2	NO
E.	Cataract	Not defined	3	NO
F.	Persistent hyaloid artery	Not defined	1	Breeder option
G.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Ectropion

A conformational defect resulting in eversion of the eyelid(s), which may cause ocular irritation due to exposure. It is likely that ectropion is influenced by several genes (polygenic) defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Exposure/Pigmentary keratitis/Pigmentary keratopathy

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

D. Iris coloboma

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membranes, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Sussex Spaniel breed. The conditions listed are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

2. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

3. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
SUSSEX SPANIEL

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 198 #	%	2000-2009 167 #	%	2010-2016 84 #	%
EYELIDS								
20.160	macropalpebral fissure		7	3.5%	16	9.6%	0	
21.000	entropion, unspecified		1	0.5%	0		0	
22.000	ectropion, unspecified		13	6.6%	6	3.6%	11	13.1%
25.110	distichiasis		15	7.6%	6	3.6%	3	3.6%
NICTITANS								
52.110	prolapsed gland of the third eyelid		0		0		2	2.4%
CORNEA								
70.700	corneal dystrophy		0		2	1.2%	0	
UVEA								
93.110	iris hypoplasia		0		1	0.6%	1	1.2%
93.150	iris coloboma		5	2.5%	2	1.2%	0	
93.710	persistent pupillary membranes, iris to iris		1	0.5%	1	0.6%	0	
93.720	persistent pupillary membranes, iris to lens		3	1.5%	3	1.8%	0	
93.740	persistent pupillary membranes, iris sheets		0		1	0.6%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		2	2.4%
LENS								
100.210	cataract, suspect not inherited		4	2.0%	6	3.6%	5	6.0%
100.302	punctate cataract, posterior cortex		0		1	0.6%	0	
100.305	punctate cataract, posterior sutures		0		0		1	1.2%
100.307	punctate cataract, capsular		0		1	0.6%	0	
100.312	incipient cataract, posterior cortex		0		2	1.2%	0	
100.315	incipient cataract, posterior sutures		1	0.5%	0		1	1.2%
100.316	incipient cataract, nucleus		0		0		2	2.4%
100.317	incipient cataract, capsular		0		3	1.8%	1	1.2%
100.322	incomplete cataract, posterior cortex		0		0		1	1.2%
100.330	generalized/complete cataract		0		2	1.2%	0	
100.999	*significant cataracts (summary)*		*1*	*0.5%*	*9*	*5.4%*	*6*	*7.1%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		23	11.6%	10	6.0%	3	3.6%
110.135	PHPV/PTVL		1	0.5%	3	1.8%	0	
110.320	vitreal degeneration		1	0.5%	0		0	
RETINA								
120.170	retinal dysplasia, folds		13	6.6%	22	13.2%	8	9.5%
120.180	retinal dysplasia, geographic		0		2	1.2%	0	
OPTIC NERVE								
130.110	micropapilla		0		1	0.6%	0	
130.120	optic nerve hypoplasia		1	0.5%	0		0	
130.150	optic disc coloboma		3	1.5%	0		0	
OTHER								
900.000	other, unspecified		0		5	3.0%	5	6.0%
900.100	other, not inherited		3	1.5%	15	9.0%	4	4.8%
900.110	other, suspected as inherited		1	0.5%	1	0.6%	2	2.4%

OCULAR DISORDERS REPORT
SUSSEX SPANIEL

	1991-1999	2000-2009	2010-2016
NORMAL			
0.000 normal globe	120 60.6%	110 65.9%	55 65.5%

SWEDISH LAPPHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Retinal atrophy - generalized (prcd) * a DNA test is available	Autosomal recessive	1	NO

Description and Comments

A. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Swedish Lapphund is *prcd* which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Swedish Lapphund. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Zangerl B, Goldstein O, Philp AR, et al. Identical mutation in a novel retinal gene causes progressive rod-cone degeneration in dogs and retinitis pigmentosa in humans. *Genomics*. 2006 Nov;88:551-563.

OCULAR DISORDERS REPORT
SWEDISH LAPPHUND

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 0 #	%	2000-2009 0 #	%	2010-2016 3 #	%
LENS							
100.210	cataract, suspect not inherited	0		0		1	33.3%
100.305	punctate cataract, posterior sutures	0		0		1	33.3%
100.315	incipient cataract, posterior sutures	0		0		1	33.3%
100.999	*significant cataracts (summary)*	*0*		*0*		*2*	*66.7%*
RETINA							
120.310	generalized progressive retinal atrophy (PRA)	0		0		1	33.3%

OCULAR DISORDERS REPORT

SWEDISH VALLHUND

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1, 2	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	1	Breeder option
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	3, 4	Breeder option
	- iris to lens	Not defined	5	NO
D.	Cataract	Not defined	6	NO
E.	Vitreous degeneration	Not defined	6, 7	Breeder option
F.	Retinopathy * a DNA test is available	Presumed autosomal recessive	8-11	NO
G.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral. In the Swedish Vallhund, lesions are circular or semicircular central crystalline deposits in the anterior corneal stroma that appear between 2 and 5 years of age. It may be associated with exophthalmos and lagophthalmos common in these dogs.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinopathy

Swedish Vallhunds have a unique form of retinal degeneration compared to most forms of PRA. The condition is multifocal rather than diffuse and the age of onset and rate of progression vary dramatically, even between littermates. The clinical signs progress in three stages. (A. Komaromy, personal communication 2016)

- Stage one usually occurs between 2-3 years of age and is characterized by mottling or multifocal brown discoloration of the tapetal fundus – this should be marked as retinopathy even though visual deficits are not yet noted.

- In stage two, geographic thinning of the retina can be seen and subtle night vision deficits are observed.

- In stage three, the retinal thinning becomes more generalized with small islands of retinal sparing and deficits are noted in both photopic and scotopic vision. The disease has been associated with a mutation in the *MERTK* gene on canine chromosome 17. Dogs homozogous for the mutation have an 18 fold increased risk of developing the retinopathy. However, the actual causative mutation has not yet been identified.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 2008 and/or Data from CERF All-Breeds Report, 2003-2007.

2. ACVO Genetics Committee, 2007 and/or Data from CERF All-Breeds Report, 2002-2006.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report, 2010-2015.

6. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

7. ACVO Genetics Committee, 2009 and/or Data from CERF All-Breeds Report, 2008.

8. ACVO Genetics Committee, 2011 and/or Data from CERF All-Breeds Report, 2010.

9. ACVO Genetics Committee, 2015 and Data from OFA All-Breeds Report, 2014-2015.

10. Cooper AE, Ahonen S, Rowlan JS, et al. A novel form of progressive retinal atrophy in Swedish Vallhund dogs. *PloS one*. 2014;9:e106610.

11. Ahonen SJ, Arumilli M, Seppala E, et al. Increased expression of MERTK is associated with a unique form of canine retinopathy. *PloS one*. 2014;9:e114552.

OCULAR DISORDERS REPORT
SWEDISH VALLHUND

		1991-1999		2000-2009		2010-2016	
	TOTAL DOGS EXAMINED	43		673		793	
Diagnostic Name		#	%	#	%	#	%
EYELIDS							
20.140	ectopic cilia	0		1	0.1%	0	
25.110	distichiasis	0		27	4.0%	11	1.4%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		1	0.1%
CORNEA							
70.700	corneal dystrophy	0		12	1.8%	10	1.3%
UVEA							
93.140	corneal endothelial pigment without PPM	0		1	0.1%	0	
93.710	persistent pupillary membranes, iris to iris	0		120	17.8%	143	18.0%
93.720	persistent pupillary membranes, iris to lens	0		0		10	1.3%
93.730	persistent pupillary membranes, iris to cornea	0		0		3	0.4%
93.740	persistent pupillary membranes, iris sheets	0		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		2	0.3%	4	0.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.1%
93.810	uveal melanoma	0		0		2	0.3%
93.999	uveal cysts	0		4	0.6%	1	0.1%
LENS							
100.210	cataract, suspect not inherited	2	4.7%	117	17.4%	104	13.1%
100.301	punctate cataract, anterior cortex	0		4	0.6%	4	0.5%
100.302	punctate cataract, posterior cortex	0		1	0.1%	2	0.3%
100.303	punctate cataract, equatorial cortex	0		2	0.3%	0	
100.305	punctate cataract, posterior sutures	0		5	0.7%	8	1.0%
100.306	punctate cataract, nucleus	0		6	0.9%	6	0.8%
100.307	punctate cataract, capsular	0		0		1	0.1%
100.311	incipient cataract, anterior cortex	1	2.3%	4	0.6%	11	1.4%
100.312	incipient cataract, posterior cortex	0		2	0.3%	2	0.3%
100.313	incipient cataract, equatorial cortex	0		2	0.3%	5	0.6%
100.314	incipient cataract, anterior sutures	0		1	0.1%	3	0.4%
100.315	incipient cataract, posterior sutures	0		4	0.6%	2	0.3%
100.316	incipient cataract, nucleus	0		6	0.9%	8	1.0%
100.321	incomplete cataract, anterior cortex	0		0		1	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.1%
100.330	generalized/complete cataract	0		2	0.3%	5	0.6%
100.999	*significant cataracts (summary)*	*1*	*2.3%*	*39*	*5.8%*	*59*	*7.4%*
VITREOUS							
110.135	PHPV/PTVL	0		1	0.1%	0	
110.320	vitreal degeneration	0		25	3.7%	25	3.2%
RETINA							
120.170	retinal dysplasia, folds	0		10	1.5%	14	1.8%
120.180	retinal dysplasia, geographic	0		4	0.6%	0	
120.190	retinal dysplasia, detached	0		1	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		29	4.3%	16	2.0%
120.960	retinopathy	0		0		46	5.8%

OCULAR DISORDERS REPORT
SWEDISH VALLHUND

	1991-1999	2000-2009	2010-2016
OPTIC NERVE			
130.110 micropapilla	0	0	3 0.4%
130.150 optic disc coloboma	1 2.3%	0	0
OTHER			
900.000 other, unspecified	0	19 2.8%	28 3.5%
900.100 other, not inherited	0	69 10.3%	51 6.4%
900.110 other, suspected as inherited	0	16 2.4%	3 0.4%
NORMAL			
0.000 normal globe	40 93.0%	435 64.6%	460 58.0%

TEDDY ROOSEVELT TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Lens luxation * a DNA test is available	Not defined	1	NO

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Teddy Roosevelt Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
TEDDY ROOSEVELT TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	 %	2000-2009 0 #	 %	2010-2016 5 #	 %
LENS							
100.311	incipient cataract, anterior cortex	0		0		1	20.0%
100.312	incipient cataract, posterior cortex	0		0		1	20.0%
100.313	incipient cataract, equatorial cortex	0		0		1	20.0%
100.999	*significant cataracts (summary)*	*0*		*0*		*3*	*60.0%*
VITREOUS							
110.320	vitreal degeneration	0		0		1	20.0%
OTHER							
900.100	other, not inherited	0		0		2	40.0%
NORMAL							
0.000	normal globe	0		0		1	20.0%

TENTERFIELD TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Lens luxation * a DNA test is available.	Not defined	1	NO

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Tenterfield Terrier. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT

TIBETAN MASTIFF

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1	Breeder option
	- lens pigment foci/no strands	Not defined	1	Passes with no notation

Description and Comments

A. Persistent pupillary membranes (PPM)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Tibetan Mastiff breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
TIBETAN MASTIFF

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 0 #	%	2000-2009 3 #	%	2010-2016 48 #	%
EYELIDS							
21.000	entropion, unspecified	0		1	33.3%	2	4.2%
25.110	distichiasis	0		0		1	2.1%
CORNEA							
70.700	corneal dystrophy	0		1	33.3%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		5	10.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		5	10.4%
LENS							
100.210	cataract, suspect not inherited	0		0		2	4.2%
100.301	punctate cataract, anterior cortex	0		0		1	2.1%
100.307	punctate cataract, capsular	0		0		1	2.1%
100.315	incipient cataract, posterior sutures	0		0		1	2.1%
100.999	*significant cataracts (summary)*	*0*		*0*		*3*	*6.2%*
OTHER							
900.000	other, unspecified	0		0		2	4.2%
900.100	other, not inherited	0		0		1	2.1%
NORMAL							
0.000	normal globe	0		1	33.3%	35	72.9%

OCULAR DISORDERS REPORT

TIBETAN SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Entropion	Not defined	1	Breeder option
B.	Distichiasis	Not defined	1	Breeder option
C.	Exposure/pigmentary keratitis	Not defined	2	Breeder option
D.	Persistent pupillary membranes - iris to iris	Not defined	3, 4	Breeder option
E.	Cataract	Not defined	1	NO
F.	Retinal atrophy - generalized * a DNA test is available	Not defined/ autosomal recessive	1, 5, 6	NO
G.	Ceroid lipofuscinosis	Not defined	7	NO

Descriptions and Comments

A. Entropion

A conformational defect resulting in an "in rolling" of one or more of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

C. Exposure/pigmentary keratitis

A condition characterized by variable degrees of superficial vascularization, fibrosis and/or pigmentation of the cornea. May be associated with excessive exposure/irritation of the globe due to shallow orbits, lower eyelid medial entropion, lagophthalmos and macropalpebral fissure.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky and Samoyed, in most breeds studied to date, PRA is inherited as an autosomal recessive trait.

In the Tibetan Spaniel, a mutation in *FAM161A* causes a later onset (4-5 years) of PRA. This form is being called progressive retinal atrophy 3 (PRA3) and appears to be the causative mutation in about 60% of Tibetan Spaniels with PRA. This form is inherited as an autosomal recessive trait. A DNA test for PRA3 is available. This test will not detect PRA caused by other genetic mutations. At least one other form of PRA appears to be present in the Tibetan Spaniel.

G. Ceroid Lipofuscinosis

An inherited disease of man and animal characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease including blindness. (Also called Batten's disease.)

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2013-2014 and Data from OFA All-Breeds Report, 2013-2014.

3. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

4. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

5. Bjerkas E. Progressive retinal atrophy in dogs in Norway. *Norsk Veterinaertidsskrift*. 1991;103:601-610.

6. Downs LM, Mellersh CS. An Intronic SINE insertion in FAM161A that causes exon-skipping is associated with progressive retinal atrophy in Tibetan Spaniels and Tibetan Terriers. *PLoS One*. 2014;9:e93990.

7. Katz ML, Narfstrom K, Johnson GS, et al. Assessment of retinal function and characterization of lysosomal storage body accumulation in the retinas and brains of Tibetan Terriers with ceroid-lipofuscinosis. *Am J Vet Res*. 2005;66:67-76.

OCULAR DISORDERS REPORT
TIBETAN SPANIEL

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 930 #	%	2000-2009 1630 #	%	2010-2016 738 #	%
GLOBE								
0.110	microphthalmia		1	0.1%	0		1	0.1%
EYELIDS								
20.140	ectopic cilia		1	0.1%	2	0.1%	1	0.1%
20.160	macropalpebral fissure		2	0.2%	3	0.2%	0	
21.000	entropion, unspecified		21	2.3%	55	3.4%	13	1.8%
22.000	ectropion, unspecified		0		2	0.1%	0	
25.110	distichiasis		82	8.8%	120	7.4%	82	11.1%
NASOLACRIMAL								
32.110	imperforate lower nasolacrimal punctum		0		0		1	0.1%
40.910	keratoconjunctivitis sicca		2	0.2%	0		0	
NICTITANS								
51.100	third eyelid cartilage anomaly		0		2	0.1%	0	
52.110	prolapsed gland of the third eyelid		3	0.3%	3	0.2%	0	
CORNEA								
70.210	corneal pannus		7	0.8%	1	0.1%	0	
70.220	pigmentary keratitis		3	0.3%	9	0.6%	6	0.8%
70.700	corneal dystrophy		1	0.1%	6	0.4%	3	0.4%
70.730	corneal endothelial degeneration		0		1	0.1%	0	
UVEA								
93.110	iris hypoplasia		0		0		1	0.1%
93.150	iris coloboma		2	0.2%	1	0.1%	1	0.1%
93.710	persistent pupillary membranes, iris to iris		7	0.8%	30	1.8%	25	3.4%
93.720	persistent pupillary membranes, iris to lens		1	0.1%	3	0.2%	0	
93.730	persistent pupillary membranes, iris to cornea		0		3	0.2%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		3	0.4%
93.760	persistent pupillary membranes, endothelial opacity/no strands		0		0		1	0.1%
93.810	uveal melanoma		0		0		2	0.3%
93.999	uveal cysts		0		2	0.1%	0	
LENS								
100.200	cataract, unspecified		9	1.0%	0		0	
100.210	cataract, suspect not inherited		17	1.8%	42	2.6%	22	3.0%
100.301	punctate cataract, anterior cortex		0		2	0.1%	3	0.4%
100.302	punctate cataract, posterior cortex		1	0.1%	0		1	0.1%
100.303	punctate cataract, equatorial cortex		0		1	0.1%	1	0.1%
100.304	punctate cataract, anterior sutures		0		1	0.1%	0	
100.305	punctate cataract, posterior sutures		3	0.3%	1	0.1%	8	1.1%
100.306	punctate cataract, nucleus		0		0		1	0.1%
100.307	punctate cataract, capsular		0		1	0.1%	0	
100.311	incipient cataract, anterior cortex		4	0.4%	13	0.8%	4	0.5%
100.312	incipient cataract, posterior cortex		3	0.3%	8	0.5%	1	0.1%
100.313	incipient cataract, equatorial cortex		0		5	0.3%	1	0.1%
100.314	incipient cataract, anterior sutures		0		2	0.1%	0	
100.315	incipient cataract, posterior sutures		2	0.2%	2	0.1%	0	

OCULAR DISORDERS REPORT
TIBETAN SPANIEL

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.316	incipient cataract, nucleus	0		5	0.3%	2	0.3%
100.317	incipient cataract, capsular	0		2	0.1%	0	
100.325	incomplete cataract, posterior sutures	0		0		1	0.1%
100.330	generalized/complete cataract	0		1	0.1%	0	
100.375	subluxation/luxation, unspecified	0		0		1	0.1%
100.999	*significant cataracts (summary)*	*22*	*2.4%*	*44*	*2.7%*	*23*	*3.1%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	5	0.5%	3	0.2%	0	
110.135	PHPV/PTVL	0		0		1	0.1%
110.320	vitreal degeneration	2	0.2%	7	0.4%	5	0.7%
RETINA							
120.170	retinal dysplasia, folds	3	0.3%	3	0.2%	3	0.4%
120.180	retinal dysplasia, geographic	0		0		1	0.1%
120.190	retinal dysplasia, detached	0		2	0.1%	0	
120.310	generalized progressive retinal atrophy (PRA)	6	0.6%	18	1.1%	4	0.5%
120.960	retinopathy	0		0		2	0.3%
OPTIC NERVE							
130.120	optic nerve hypoplasia	0		2	0.1%	0	
130.150	optic disc coloboma	5	0.5%	1	0.1%	1	0.1%
OTHER							
900.000	other, unspecified	0		8	0.5%	24	3.3%
900.100	other, not inherited	3	0.3%	72	4.4%	23	3.1%
900.110	other, suspected as inherited	4	0.4%	9	0.6%	1	0.1%
NORMAL							
0.000	normal globe	776	83.4%	1346	82.6%	562	76.2%

TIBETAN TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
C.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	 Not defined Not defined	 1 3	 Breeder option Passes with no notation
D.	Cataract	Not defined	1	NO
E.	Lens luxation * a DNA test is available	Autosomal recessive	1, 4-9	NO
F.	Vitreous degeneration	Not defined	10	Breeder option
G.	Retinal atrophy - generalized * a DNA test is available	Not defined	1, 5, 11-14	NO
H.	Retinal atrophy - Rod-cone dysplasia (rcd4) * a DNA test is available	Autosomal recessive	15	NO
I.	Ceroid lipofuscinosis	Not defined	16, 17	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the

incidence is a logical goal. When diagnosed, distichiasis should be recorded and breeding discretion is advised.

B. Corneal dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

F. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky and Samoyed, in most breeds studied to date, PRA is inherited as an autosomal recessive trait.

There are ERG studies to indicate that there is depression of the B wave at 10-12 weeks of

age in the second variety and slower depression in the first variety. Some may have no obvious signs at 5-6 years of age, only to develop clinical signs at 6-7 years of age. It is logical that any animal found with signs of bilateral atrophy should not be bred. Members of the family of the affected animal should be carefully screened. Perhaps, ERG in animals less than 4 years of age is logical, especially if the animal is intended for breed foundation.

In the Tibetan Terrier a mutation in *FAM161A* causes a later onset (4-5 years) of PRA. This form is being called progressive retinal atrophy 3 (PRA3). This form is inherited as an autosomal recessive trait. A DNA test for PRA3 is available. This test will not detect PRA caused by other genetic mutations. At least one other form of PRA appears to be present in the Tibetan Terrier.

H. Rod-cone dysplasia, type 4 (*rcd4*)

A form of PRA initially identified in the Gordon and Irish Setter breeds. Clinical night blindness is observed on average as late as 10 years of age and progresses to total blindness. This form of PRA has been referred to as late-onset PRA (LOPRA). The disorder is caused by a mutation present in the *C2orf71* gene. A mutation-based gene test is now available that will unequivocally identify genetically normal, affected and carrier dogs. The test is accurate only for this mutation and is of no value in identifying other forms of PRA.

I. Ceroid Lipofuscinosis

An inherited disease of man and animal characterized by the accumulation of lipopigment in various tissues of the body including the eye. It results in progressive neurologic disease. In the Tibetan Terrier, moderate visual impairment can occur in low-light conditions.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

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17. Drogemuller C, Wohlke A, Distl O. Characterization of candidate genes for neuronal ceroid lipofuscinosis in dog. *J Hered*. 2005;96:735-738.

OCULAR DISORDERS REPORT
TIBETAN TERRIER

	TOTAL DOGS EXAMINED	1991-1999 2213		2000-2009 4142		2010-2016 2189	
Diagnostic Name		#	%	#	%	#	%
GLOBE							
0.110	microphthalmia	2	0.1%	2	0.0%	0	
10.000	glaucoma	2	0.1%	1	0.0%	0	
EYELIDS							
21.000	entropion, unspecified	0		1	0.0%	0	
25.110	distichiasis	34	1.5%	60	1.4%	28	1.3%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		2	0.1%
NICTITANS							
52.110	prolapsed gland of the third eyelid	1	0.0%	1	0.0%	2	0.1%
CORNEA							
70.220	pigmentary keratitis	1	0.0%	2	0.0%	0	
70.700	corneal dystrophy	17	0.8%	59	1.4%	13	0.6%
70.730	corneal endothelial degeneration	1	0.0%	0		0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	34	1.5%	278	6.7%	191	8.7%
93.720	persistent pupillary membranes, iris to lens	2	0.1%	16	0.4%	3	0.1%
93.730	persistent pupillary membranes, iris to cornea	11	0.5%	25	0.6%	4	0.2%
93.740	persistent pupillary membranes, iris sheets	7	0.3%	3	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		1	0.0%	37	1.7%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		12	0.5%
LENS							
100.200	cataract, unspecified	34	1.5%	0		0	
100.210	cataract, suspect not inherited	66	3.0%	209	5.0%	123	5.6%
100.301	punctate cataract, anterior cortex	15	0.7%	28	0.7%	31	1.4%
100.302	punctate cataract, posterior cortex	11	0.5%	15	0.4%	12	0.5%
100.303	punctate cataract, equatorial cortex	1	0.0%	7	0.2%	5	0.2%
100.304	punctate cataract, anterior sutures	2	0.1%	10	0.2%	0	
100.305	punctate cataract, posterior sutures	2	0.1%	2	0.0%	2	0.1%
100.306	punctate cataract, nucleus	1	0.0%	2	0.0%	7	0.3%
100.307	punctate cataract, capsular	0		10	0.2%	4	0.2%
100.311	incipient cataract, anterior cortex	16	0.7%	22	0.5%	28	1.3%
100.312	incipient cataract, posterior cortex	23	1.0%	27	0.7%	19	0.9%
100.313	incipient cataract, equatorial cortex	7	0.3%	23	0.6%	6	0.3%
100.314	incipient cataract, anterior sutures	1	0.0%	5	0.1%	7	0.3%
100.315	incipient cataract, posterior sutures	4	0.2%	8	0.2%	2	0.1%
100.316	incipient cataract, nucleus	2	0.1%	2	0.0%	7	0.3%
100.317	incipient cataract, capsular	0		5	0.1%	0	
100.321	incomplete cataract, anterior cortex	0		0		6	0.3%
100.322	incomplete cataract, posterior cortex	0		0		3	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		2	0.1%
100.326	incomplete cataract, nucleus	0		0		1	0.0%
100.330	generalized/complete cataract	22	1.0%	14	0.3%	2	0.1%
100.340	resorbing/hypermature cataract	0		0		1	0.0%

OCULAR DISORDERS REPORT
TIBETAN TERRIER

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.375	subluxation/luxation, unspecified	2	0.1%	14	0.3%	1	0.0%
100.999	*significant cataracts (summary)*	*141*	*6.4%*	*180*	*4.3%*	*145*	*6.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.0%	2	0.0%	1	0.0%
110.135	PHPV/PTVL	0		1	0.0%	1	0.0%
110.320	vitreal degeneration	5	0.2%	24	0.6%	11	0.5%
FUNDUS							
97.110	choroidal hypoplasia	0		1	0.0%	0	
97.120	coloboma	0		1	0.0%	0	
RETINA							
120.170	retinal dysplasia, folds	0		7	0.2%	3	0.1%
120.180	retinal dysplasia, geographic	2	0.1%	1	0.0%	1	0.0%
120.190	retinal dysplasia, detached	0		3	0.1%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	49	2.2%	62	1.5%	13	0.6%
120.400	retinal hemorrhage	2	0.1%	1	0.0%	0	
120.910	retinal detachment without dialysis	1	0.0%	2	0.0%	0	
120.960	retinopathy	0		0		4	0.2%
OPTIC NERVE							
130.110	micropapilla	0		2	0.0%	0	
130.120	optic nerve hypoplasia	2	0.1%	2	0.0%	0	
OTHER							
900.000	other, unspecified	0		26	0.6%	56	2.6%
900.100	other, not inherited	9	0.4%	138	3.3%	43	2.0%
900.110	other, suspected as inherited	14	0.6%	12	0.3%	0	
NORMAL							
0.000	normal globe	1920	86.8%	3557	85.9%	1795	82.0%

OCULAR DISORDERS REPORT

TOY AUSTRALIAN SHEPHERD

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia with multiple ocular defects	Presumed autosomal recessive with incomplete penetrance	1-6	NO
B.	Distichiasis	Not defined	1, 7	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	8	Breeder option
D.	Iris coloboma	Not defined	1	NO
E.	Iris hypoplasia	Not defined	9	Breeder option
F.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
G.	Cataract * a DNA test is available	Autosomal co-dominant	1, 10, 11	NO
H.	Persistent hyaloid artery	Not defined	8	Breeder option
I.	Retinal atrophy - generalized (*prcd*) * a DNA test is available	Autosomal recessive	1, 9, 12, 13	NO
J.	Cone degeneration - day blindness * a DNA test is available	Autosomal recessive	14	NO

OCULAR DISORDERS REPORT

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
K.	Multifocal retinopathy - cmr1 * a DNA test is available	Autosomal recessive	15	Breeder option
L.	Retinal dysplasia - folds	Not defined	8	Breeder option
M.	Choroidal hypoplasia (Collie Eye Anomaly) - Optic nerve coloboma - Retinal detachment - Retinal hemorrhage - Staphyloma/coloboma * a DNA test is available	Autosomal recessive	1, 7, 16-19	NO
N.	Coloboma/staphyloma without microphthalmia	Not defined	1	NO
O.	Micropapilla	Not defined	20	Breeder option

It is recommended that this breed be examined prior to pharmacological dilation to best facilitate identification of iris coloboma.

Description and Comments

A. Microphthalmia with multiple ocular defects

Microphthalmia is a congenital defect characterized by a small eye with associated defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (dysplasia). In the Australian Shepherd, microphthalmia has long been suspected to be associated with merled coat coloration but a definitive genetic relationship has not been established. The eyes of affected homozygous merle (usually white) dogs have extreme forms of this entity and are usually blind at birth. Affected heterozygous merle-coated dogs demonstrate less severe manifestations.

OCULAR DISORDERS REPORT

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

C. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Iris coloboma

A congenital abnormality in iris development usually characterized by a full-thickness defect in iris tissue, commonly (though not exclusively) located at the 6 o'clock position associated with failure of closure of the optic fissure. A partial-thickness defect in iris tissue should be recorded as iris hypoplasia on the OFA form.

E. Iris hypoplasia

A congenital abnormality in iris development usually characterized by a reduced quantity of tissue identified as a partial-thickness defect in iris tissue. Full-thickness iris hypoplasia is rare and should be recorded as an iris coloboma on the OFA form.

F. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

G. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Australian Shepherd, a mutation in *HSF4* (heat shock transcription factor 4), the HSF4-2 mutation, has been shown to increase the likelihood of cataract formation. The mutation is inherited in a co-dominant manner. Dogs with one copy of the mutation develop bilateral posterior cataracts and homozygotes develop a nuclear cataract that typically progresses to a mature cataract. A DNA test is available for this mutation. Other genetic factors can contribute to cataract formation in this breed and will not be detected by this test.

H. Persistent hyaloid artery (PHA)

Congenital defect resulting from abnormalities in the development and regression of the hyaloid artery. The blood vessel remnant can be present in the vitreous as a small patent vascular strand (PHA) or as a non-vascular strand that appears gray-white (persistent hyaloid remnant).

I. Retinal atrophy - generalized (*prcd*)

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. With limited exceptions, most PRAs are recessively inherited.

Studies have shown that the principal form of PRA in the Australian Shepherd is PRCD which is a late-onset form of PRA inherited as autosomal recessive. The mutation is allelic to that present in Miniature Poodles, Labrador Retrievers, English and American Cocker Spaniels, and others. The locus is termed the progressive rod-cone degeneration (*prcd*) gene and at least 30+ breeds are affected. In most affected dogs to date, the disease is recognized clinically in dogs 3-6 years of age or older. This photoreceptor degeneration is characterized by slow death of visual cells following their normal development. The disease begins clinically with signs of night blindness followed by day blindness. A DNA test is available.

J. Cone degeneration - day blindness or hemeralopia

Autosomal recessively inherited early degeneration of the cone photoreceptors. Affected puppies develop day-blindness, colorblindness, and photophobia between 8 and 12 weeks of age. Affected dogs remain ophthalmoscopically normal their entire life. Electroretinography is required to definitively diagnose the disorder. Genetically, the condition results from a mutation in the *CNGB3* gene. A DNA test is available.

K. Multifocal retinopathy

Canine Multifocal Retinopathy type 1 (cmr1) is characterized by numerous distinct (i.e. multifocal), roughly circular patches of elevated retina (multifocal bullous retinal detachments). There may be a serous subretinal fluid, or accumulation of subretinal material that produces gray-tan-pink colored lesions. These lesions, looking somewhat like blisters, vary in location and size, although typically they are present in both eyes of the affected dog.

The disease generally develops in young dogs between 11-20 weeks of age and there is minimal progression after 1 year of age. The lesions may flatten, leaving areas of retinal thinning and RPE hypertrophy, hyperplasia, and pigmentation. Discrete areas of tapetal hyper-reflectivity may be seen in areas of previous retinal and RPE detachments. Most dogs exhibit no noticeable problem with vision or electroretinographic abnormalities despite their abnormal appearing retinas.

Canine Multifocal Retinopathy type 1 is caused by a mutation in the Bestrophin 1 gene (*BEST1*) and is described to be recessively inherited in the Great Pyrenees, Dogue de Bordeaux, Bullmastiff, and Mastiff.

L. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

M. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly." The choroidal hypoplasia component is caused by a 7799 base pair deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

N. Coloboma/staphyloma (unassociated with microphthalmia)

A coloboma is a congenital defect which may affect the iris, choroid or optic disc. Iris colobomas are seen as notches in the pupillary margin. Scleral ectasia is defined as a congenital thinning and secondary distention of the sclera; when lined by uveal tissue it is called a staphyloma. These may be anteriorly located, apparent as a bulge beneath the upper eyelid or posteriorly located, requiring visualization with an ophthalmoscope. These conditions may or may not be genetically related to the same anomalies seen associated with microphthalmia (entity "A" above).

O. Micropapilla

Micropapilla refers to a small optic disc which is not associated with vision impairment. Optic nerve hypoplasia refers to a congenital defect of the optic nerve which causes blindness and abnormal pupil response in the affected eye. It may be difficult to differentiate between micropapilla and optic nerve hypoplasia on a routine (dilated) screening ophthalmoscopic exam.

References

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OCULAR DISORDERS REPORT
TOY AUSTRALIAN SHEPHERD

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 494 #	%	2010-2016 475 #	%
GLOBE							
0.110	microphthalmia	0		2	0.4%	2	0.4%
EYELIDS							
25.110	distichiasis	0		15	3.0%	30	6.3%
CORNEA							
70.700	corneal dystrophy	0		0		3	0.6%
UVEA							
93.110	iris hypoplasia	0		4	0.8%	15	3.2%
93.150	iris coloboma	0		7	1.4%	11	2.3%
93.710	persistent pupillary membranes, iris to iris	0		67	13.6%	39	8.2%
93.720	persistent pupillary membranes, iris to lens	0		3	0.6%	4	0.8%
93.730	persistent pupillary membranes, iris to cornea	0		0		2	0.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.2%
LENS							
100.210	cataract, suspect not inherited	0		5	1.0%	7	1.5%
100.302	punctate cataract, posterior cortex	0		1	0.2%	0	
100.303	punctate cataract, equatorial cortex	0		1	0.2%	0	
100.305	punctate cataract, posterior sutures	0		1	0.2%	0	
100.306	punctate cataract, nucleus	0		0		1	0.2%
100.311	incipient cataract, anterior cortex	0		2	0.4%	2	0.4%
100.312	incipient cataract, posterior cortex	0		1	0.2%	0	
100.313	incipient cataract, equatorial cortex	0		1	0.2%	1	0.2%
100.317	incipient cataract, capsular	0		2	0.4%	0	
100.330	generalized/complete cataract	0		1	0.2%	0	
100.999	*significant cataracts (summary)*	*0*		*10*	*2.0%*	*4*	*0.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		3	0.6%	2	0.4%
110.135	PHPV/PTVL	0		2	0.4%	0	
110.320	vitreal degeneration	0		0		2	0.4%
RETINA							
120.170	retinal dysplasia, folds	0		1	0.2%	2	0.4%
120.180	retinal dysplasia, geographic	0		1	0.2%	0	
120.310	generalized progressive retinal atrophy (PRA)	0		1	0.2%	0	
OPTIC NERVE							
130.110	micropapilla	0		5	1.0%	5	1.1%
130.120	optic nerve hypoplasia	0		1	0.2%	1	0.2%
OTHER							
900.000	other, unspecified	0		1	0.2%	5	1.1%
900.100	other, not inherited	0		6	1.2%	6	1.3%
900.110	other, suspected as inherited	0		1	0.2%	2	0.4%

OCULAR DISORDERS REPORT
TOY AUSTRALIAN SHEPHERD

	1991-1999	2000-2009	2010-2016
NORMAL			
0.000 normal globe	0	431 87.2%	389 81.9%

TOY FOX TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
B.	Lens luxation * a DNA test is available	Not defined	2	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

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OCULAR DISORDERS REPORT
TOY FOX TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 12 #	 %	2000-2009 109 #	 %	2010-2016 86 #	 %
EYELIDS							
25.110	distichiasis	0		1	0.9%	1	1.2%
CORNEA							
70.730	corneal endothelial degeneration	0		0		1	1.2%
UVEA							
93.710	persistent pupillary membranes, iris to iris	1	8.3%	7	6.4%	11	12.8%
93.720	persistent pupillary membranes, iris to lens	0		0		2	2.3%
93.730	persistent pupillary membranes, iris to cornea	0		0		1	1.2%
LENS							
100.210	cataract, suspect not inherited	0		3	2.8%	0	
100.311	incipient cataract, anterior cortex	2	16.7%	1	0.9%	2	2.3%
100.312	incipient cataract, posterior cortex	0		0		1	1.2%
100.375	subluxation/luxation, unspecified	0		1	0.9%	0	
100.999	*significant cataracts (summary)*	*2*	*16.7%*	*1*	*0.9%*	*3*	*3.5%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		1	0.9%	0	
110.320	vitreal degeneration	1	8.3%	1	0.9%	2	2.3%
RETINA							
120.170	retinal dysplasia, folds	0		4	3.7%	3	3.5%
120.310	generalized progressive retinal atrophy (PRA)	0		2	1.8%	0	
OPTIC NERVE							
130.120	optic nerve hypoplasia	0		2	1.8%	0	
OTHER							
900.000	other, unspecified	0		1	0.9%	1	1.2%
900.100	other, not inherited	0		3	2.8%	6	7.0%
NORMAL							
0.000	normal globe	9	75.0%	96	88.1%	61	70.9%

OCULAR DISORDERS REPORT

VIZSLA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Entropion	Not defined	2	NO
C.	Prolapse of gland of third eyelid	Not defined	3	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	2	Breeder option
E.	Persistent pupillary membranes			
	- iris to iris	Not defined	4	Breeder option
	- lens pigment foci/no strands	Not defined	5	Passes with no notation
F.	Cataract	Not defined	6	NO
G.	Vitreous degeneration	Not defined	3	Breeder option

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull. The Vizsla Club of America, recognizing entropion as an unacceptable problem in their breed, has requested that entropion be given a “NO” rating.

C. Prolapse of the gland of the third eyelid

Protrusion of the tear gland associated with the third eyelid. The mode of inheritance of this disorder is unknown. The exposed gland may become irritated. Commonly referred to as "cherry eye."

D. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore is not noted on the certificate.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

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OCULAR DISORDERS REPORT
VIZSLA

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 407 #	1991-1999 407 %	2000-2009 1314 #	2000-2009 1314 %	2010-2016 1417 #	2010-2016 1417 %
EYELIDS							
20.140	ectopic cilia	0		1	0.1%	0	
21.000	entropion, unspecified	1	0.2%	2	0.2%	0	
22.000	ectropion, unspecified	1	0.2%	2	0.2%	0	
25.110	distichiasis	4	1.0%	11	0.8%	11	0.8%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		0		1	0.1%
NICTITANS							
51.100	third eyelid cartilage anomaly	0		0		5	0.4%
52.110	prolapsed gland of the third eyelid	0		0		7	0.5%
CORNEA							
70.700	corneal dystrophy	13	3.2%	19	1.4%	10	0.7%
70.730	corneal endothelial degeneration	0		2	0.2%	0	
UVEA							
93.710	persistent pupillary membranes, iris to iris	5	1.2%	26	2.0%	35	2.5%
93.720	persistent pupillary membranes, iris to lens	7	1.7%	5	0.4%	0	
93.740	persistent pupillary membranes, iris sheets	0		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		6	0.5%	103	7.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		1	0.1%
93.999	uveal cysts	0		1	0.1%	1	0.1%
LENS							
100.200	cataract, unspecified	4	1.0%	0		0	
100.210	cataract, suspect not inherited	7	1.7%	58	4.4%	46	3.2%
100.301	punctate cataract, anterior cortex	0		5	0.4%	5	0.4%
100.302	punctate cataract, posterior cortex	2	0.5%	7	0.5%	6	0.4%
100.303	punctate cataract, equatorial cortex	0		2	0.2%	0	
100.305	punctate cataract, posterior sutures	1	0.2%	3	0.2%	1	0.1%
100.307	punctate cataract, capsular	0		7	0.5%	2	0.1%
100.311	incipient cataract, anterior cortex	1	0.2%	11	0.8%	4	0.3%
100.312	incipient cataract, posterior cortex	0		8	0.6%	16	1.1%
100.313	incipient cataract, equatorial cortex	4	1.0%	11	0.8%	4	0.3%
100.314	incipient cataract, anterior sutures	0		0		1	0.1%
100.315	incipient cataract, posterior sutures	0		3	0.2%	1	0.1%
100.316	incipient cataract, nucleus	0		2	0.2%	1	0.1%
100.317	incipient cataract, capsular	0		2	0.2%	4	0.3%
100.330	generalized/complete cataract	2	0.5%	0		0	
100.375	subluxation/luxation, unspecified	0		2	0.2%	0	
100.999	*significant cataracts (summary)*	*14*	*3.4%*	*61*	*4.6%*	*45*	*3.2%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	2	0.5%	0		2	0.1%
110.135	PHPV/PTVL	0		1	0.1%	0	
110.320	vitreal degeneration	0		6	0.5%	11	0.8%

OCULAR DISORDERS REPORT
VIZSLA

	1991-1999		2000-2009		2010-2016	
RETINA						
120.170 retinal dysplasia, folds	2	0.5%	1	0.1%	0	
120.310 generalized progressive retinal atrophy (PRA)	2	0.5%	3	0.2%	0	
120.960 retinopathy	0		0		3	0.2%
OPTIC NERVE						
130.120 optic nerve hypoplasia	1	0.2%	0		0	
OTHER						
900.000 other, unspecified	0		10	0.8%	41	2.9%
900.100 other, not inherited	5	1.2%	66	5.0%	56	4.0%
900.110 other, suspected as inherited	3	0.7%	4	0.3%	3	0.2%
NORMAL						
0.000 normal globe	347	85.3%	1210	92.1%	1159	81.8%

VOLPINO ITALIANO

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Lens luxation * a DNA test is available	Not defined	1	NO

Description and Comments

A. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma), causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

There are no breed eye screening examination statistics providing detailed descriptions of hereditary ocular conditions of the Volpino Italiano. The condition listed above is currently noted solely due to the availability of a genetic test for the disease.

1. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol*. 2011; 14: 378-384.

OCULAR DISORDERS REPORT
VOLPINO ITALIANO

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 0 #	%	2010-2016 1 #	%
NORMAL							
0.000 normal globe		0		0		1	100.0%

OCULAR DISORDERS REPORT

WEIMARANER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Entropion	Not defined	1	Breeder option
C.	Everted cartilage of the third eyelid	Not defined	1	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	2, 3	Breeder option
E.	Persistent pupillary membranes - iris to iris	Not defined	3	Breeder option
F.	Cataract	Not defined	1	NO
G.	Retinal atrophy - generalized	Not defined	1, 4	NO

Description and Comments

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

In the Weimaraner, because there is significant clinical disease associated with the abnormal hairs, breeding should be discouraged.

OCULAR DISORDERS REPORT

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Everted cartilage of the third eyelid

A scroll-like curling of the cartilage of the third eyelid, usually everting the margin. This condition may occur in one or both eyes and may cause mild ocular irritation.

D. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

4. Kropatsch R, Akkad D, Frank M, et al. A large deletion in RPGR causes XLPRA in Weimarener dogs. Canine Genetics and Epidemiol. 2016; 3:7.

OCULAR DISORDERS REPORT
WEIMARANER

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 397 #	 %	2000-2009 738 #	 %	2010-2016 644 #	 %
EYELIDS							
21.000	entropion, unspecified	2	0.5%	1	0.1%	0	
25.110	distichiasis	122	30.7%	204	27.6%	193	30.0%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.2%
NICTITANS							
51.100	third eyelid cartilage anomaly	3	0.8%	6	0.8%	5	0.8%
CORNEA							
70.700	corneal dystrophy	5	1.3%	16	2.2%	12	1.9%
70.730	corneal endothelial degeneration	0		2	0.3%	3	0.5%
UVEA							
93.150	iris coloboma	1	0.3%	0		1	0.2%
93.710	persistent pupillary membranes, iris to iris	3	0.8%	7	0.9%	5	0.8%
93.720	persistent pupillary membranes, iris to lens	1	0.3%	2	0.3%	0	
93.730	persistent pupillary membranes, iris to cornea	0		1	0.1%	4	0.6%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.2%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		2	0.3%
93.810	uveal melanoma	0		1	0.1%	0	
93.999	uveal cysts	3	0.8%	1	0.1%	1	0.2%
LENS							
100.200	cataract, unspecified	2	0.5%	0		0	
100.210	cataract, suspect not inherited	14	3.5%	52	7.0%	37	5.7%
100.301	punctate cataract, anterior cortex	3	0.8%	5	0.7%	6	0.9%
100.302	punctate cataract, posterior cortex	1	0.3%	3	0.4%	1	0.2%
100.303	punctate cataract, equatorial cortex	1	0.3%	4	0.5%	4	0.6%
100.304	punctate cataract, anterior sutures	0		1	0.1%	0	
100.305	punctate cataract, posterior sutures	1	0.3%	0		0	
100.306	punctate cataract, nucleus	1	0.3%	3	0.4%	6	0.9%
100.307	punctate cataract, capsular	0		0		2	0.3%
100.311	incipient cataract, anterior cortex	9	2.3%	26	3.5%	8	1.2%
100.312	incipient cataract, posterior cortex	4	1.0%	5	0.7%	3	0.5%
100.313	incipient cataract, equatorial cortex	5	1.3%	2	0.3%	9	1.4%
100.314	incipient cataract, anterior sutures	0		1	0.1%	2	0.3%
100.315	incipient cataract, posterior sutures	1	0.3%	1	0.1%	0	
100.316	incipient cataract, nucleus	2	0.5%	2	0.3%	0	
100.317	incipient cataract, capsular	0		1	0.1%	0	
100.321	incomplete cataract, anterior cortex	0		0		2	0.3%
100.323	incomplete cataract, equatorial cortex	0		0		1	0.2%
100.330	generalized/complete cataract	4	1.0%	1	0.1%	0	
100.375	subluxation/luxation, unspecified	0		0		1	0.2%
100.999	*significant cataracts (summary)*	*34*	*8.6%*	*55*	*7.5%*	*44*	*6.8%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	1	0.3%	3	0.4%	0	
110.320	vitreal degeneration	0		0		5	0.8%

OCULAR DISORDERS REPORT
WEIMARANER

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	0		2	0.3%	0	
120.180	retinal dysplasia, geographic	1	0.3%	1	0.1%	2	0.3%
120.310	generalized progressive retinal atrophy (PRA)	3	0.8%	2	0.3%	1	0.2%
120.400	retinal hemorrhage	0		1	0.1%	0	
120.960	retinopathy	0		0		1	0.2%
OTHER							
900.000	other, unspecified	0		3	0.4%	9	1.4%
900.100	other, not inherited	4	1.0%	46	6.2%	23	3.6%
900.110	other, suspected as inherited	2	0.5%	0		1	0.2%
NORMAL							
0.000	normal globe	245	61.7%	494	66.9%	397	61.6%

OCULAR DISORDERS REPORT

WELSH SPRINGER SPANIEL

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Presumed autosomal dominant	1-4	NO
B.	Entropion	Not defined	5, 6	Breeder option
C.	Distichiasis	Not defined	1	Breeder option
D.	Corneal dystrophy - epithelial/stromal	Not defined	5, 6	Breeder option
E.	Persistent pupillary membranes - iris to iris	Not defined	1	Breeder option
F.	Cataract	Presumed autosomal recessive	1, 7, 8	NO
G.	Vitreous degeneration	Not defined	9	Breeder option
H.	Retinal atrophy - generalized	Not defined	1, 10	NO
I.	Retinal dysplasia - folds	Not defined	6	Breeder option

Description and Comments

A. Glaucoma

An elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of IOP (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam. Due to the increased incidence of PLD in the breed and the increased progression observed with age, it may be prudent to perform repeated gonioscopy examinations over time.

Primary angle closure glaucoma has been reported in the Welsh Springer Spaniel. Females

are affected more than males. Onset ranges from 10 weeks to 10 years. At the iridocorneal angle, the pectinate ligaments appear sparse and wispy in contrast to the sturdy fibers seen in other breeds. A dominant mode of inheritance is reported.

B. Entropion

A conformational defect resulting in an "in-rolling" of one or both of the eyelids which may cause ocular irritation. It is likely that entropion is influenced by several genes (polygenic), defining the skin and other structures which make up the eyelids, the amount and weight of the skin covering the head and face, the orbital contents, and the conformation of the skull.

C. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regard to breeding dogs with this entity. The hereditary basis has not been established, although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded; breeding discretion is advised.

D. Corneal Dystrophy - epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

E. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

F. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

In the Welsh Springer Spaniel, lesions may be seen as early as 8-12 weeks of age and progress rapidly to complete cataract, impairing vision. A recessive mode of inheritance is reported.

G. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

H. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

I. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Cottrell B, Barnett K. Primary glaucoma in the Welsh Springer Spaniel. *J Small Anim Pract*. 1988;29:185-199.

3. Gelatt KN, MacKay EO. Prevalence of the breed-related glaucomas in pure-bred dogs in North America. *Vet Ophthalmol*. 2004;7:97-111. Epub 2004/02/26.

4. Oliver JA, Ekiri A, Mellersh. Prevalence and Progression of Pectinate Ligament Dysplasia in the Welsh Springer Spaniel. J Sm Anim Pract. 2016;57: 416-421.

5. ACVO Genetics Committee, 2002-2003 and/or Data from CERF All-Breeds Report, 2002-2003.

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7. Barnett KC. Hereditary cataract in the Welsh Springer Spaniel. *J Small Anim Pract*. 1980;21:621-625. Epub 1980/11/01.

8. Barnett KC. The diagnosis and differential diagnosis of cataract in the dog. *J Small Anim Pract*. 1985;26:305.

9. ACVO Genetics Committee, 2006 and/or Data from CERF All-Breeds Report, 2001-2005.

10. Priester W. Canine progressive retinal atrophy: Occurrence by age, breed, and sex. *Am J Vet Res*. 1974;35:571-574.

OCULAR DISORDERS REPORT
WELSH SPRINGER SPANIEL

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 615 #	%	2000-2009 1225 #	%	2010-2016 875 #	%
GLOBE							
10.000	glaucoma	1	0.2%	0		0	
EYELIDS							
21.000	entropion, unspecified	11	1.8%	17	1.4%	13	1.5%
22.000	ectropion, unspecified	0		3	0.2%	0	
25.110	distichiasis	78	12.7%	132	10.8%	111	12.7%
NASOLACRIMAL							
32.110	imperforate lower nasolacrimal punctum	0		0		1	0.1%
CORNEA							
70.700	corneal dystrophy	12	2.0%	22	1.8%	12	1.4%
70.730	corneal endothelial degeneration	0		0		2	0.2%
UVEA							
93.150	iris coloboma	1	0.2%	0		0	
93.710	persistent pupillary membranes, iris to iris	43	7.0%	323	26.4%	251	28.7%
93.720	persistent pupillary membranes, iris to lens	1	0.2%	1	0.1%	0	
93.730	persistent pupillary membranes, iris to cornea	0		1	0.1%	0	
93.740	persistent pupillary membranes, iris sheets	0		1	0.1%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		5	0.6%
93.999	uveal cysts	0		0		2	0.2%
97.150	chorioretinal coloboma, congenital	0		0		1	0.1%
LENS							
100.200	cataract, unspecified	6	1.0%	0		0	
100.210	cataract, suspect not inherited	27	4.4%	79	6.4%	27	3.1%
100.301	punctate cataract, anterior cortex	4	0.7%	4	0.3%	5	0.6%
100.302	punctate cataract, posterior cortex	2	0.3%	1	0.1%	0	
100.303	punctate cataract, equatorial cortex	1	0.2%	0		0	
100.304	punctate cataract, anterior sutures	0		1	0.1%	1	0.1%
100.306	punctate cataract, nucleus	1	0.2%	0		1	0.1%
100.307	punctate cataract, capsular	0		0		1	0.1%
100.311	incipient cataract, anterior cortex	0		1	0.1%	3	0.3%
100.312	incipient cataract, posterior cortex	0		1	0.1%	1	0.1%
100.313	incipient cataract, equatorial cortex	0		2	0.2%	0	
100.316	incipient cataract, nucleus	1	0.2%	1	0.1%	0	
100.317	incipient cataract, capsular	0		1	0.1%	1	0.1%
100.330	generalized/complete cataract	1	0.2%	0		0	
100.375	subluxation/luxation, unspecified	1	0.2%	0		0	
100.999	*significant cataracts (summary)*	*16*	*2.6%*	*12*	*1.0%*	*13*	*1.5%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	4	0.7%	3	0.2%	3	0.3%
110.135	PHPV/PTVL	0		1	0.1%	0	
110.320	vitreal degeneration	0		5	0.4%	0	
FUNDUS							
97.120	coloboma	0		2	0.2%	0	

OCULAR DISORDERS REPORT
WELSH SPRINGER SPANIEL

		1991-1999		2000-2009		2010-2016	
RETINA							
120.170	retinal dysplasia, folds	8	1.3%	18	1.5%	4	0.5%
120.180	retinal dysplasia, geographic	0		4	0.3%	0	
120.310	generalized progressive retinal atrophy (PRA)	6	1.0%	1	0.1%	1	0.1%
OPTIC NERVE							
130.110	micropapilla	0		3	0.2%	0	
130.120	optic nerve hypoplasia	1	0.2%	5	0.4%	2	0.2%
130.150	optic disc coloboma	0		4	0.3%	0	
OTHER							
900.000	other, unspecified	0		11	0.9%	8	0.9%
900.100	other, not inherited	3	0.5%	44	3.6%	19	2.2%
900.110	other, suspected as inherited	4	0.7%	4	0.3%	6	0.7%
NORMAL							
0.000	normal globe	454	73.8%	809	66.0%	526	60.1%

OCULAR DISORDERS REPORT

WELSH TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Distichiasis	Not defined	1	Breeder option
B.	Persistent pupillary membranes - iris to iris	Not defined	1-3	Breeder option
C.	Glaucoma	Not defined	1	NO
D.	Cataract	Not defined	1	NO
E.	Lens luxation * a DNA test is available	Not defined	1, 4	NO

Description and Comment

A. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests is part of a routine breed eye screening exam.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

E. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2000-2002 and/or Data from CERF All-Breeds Report, 2000-2002.

3. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

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OCULAR DISORDERS REPORT
WELSH TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 67 #	%	2000-2009 239 #	%	2010-2016 64 #	%
GLOBE								
10.000	glaucoma		1	1.5%	0		0	
EYELIDS								
20.140	ectopic cilia		0		1	0.4%	0	
25.110	distichiasis		2	3.0%	8	3.3%	3	4.7%
NASOLACRIMAL								
40.910	keratoconjunctivitis sicca		1	1.5%	0		0	
CORNEA								
70.700	corneal dystrophy		0		4	1.7%	0	
70.730	corneal endothelial degeneration		0		0		3	4.7%
UVEA								
93.710	persistent pupillary membranes, iris to iris		3	4.5%	22	9.2%	5	7.8%
93.720	persistent pupillary membranes, iris to lens		0		2	0.8%	0	
93.730	persistent pupillary membranes, iris to cornea		2	3.0%	1	0.4%	0	
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		1	0.4%	3	4.7%
LENS								
100.200	cataract, unspecified		1	1.5%	0		0	
100.210	cataract, suspect not inherited		3	4.5%	15	6.3%	4	6.2%
100.301	punctate cataract, anterior cortex		0		1	0.4%	1	1.6%
100.302	punctate cataract, posterior cortex		1	1.5%	0		1	1.6%
100.307	punctate cataract, capsular		0		1	0.4%	0	
100.311	incipient cataract, anterior cortex		1	1.5%	2	0.8%	0	
100.312	incipient cataract, posterior cortex		0		2	0.8%	0	
100.313	incipient cataract, equatorial cortex		0		1	0.4%	0	
100.317	incipient cataract, capsular		0		2	0.8%	0	
100.375	subluxation/luxation, unspecified		1	1.5%	2	0.8%	0	
100.999	*significant cataracts (summary)*		*3*	*4.5%*	*9*	*3.8%*	*2*	*3.1%*
RETINA								
120.170	retinal dysplasia, folds		0		0		1	1.6%
OTHER								
900.000	other, unspecified		0		1	0.4%	5	7.8%
900.100	other, not inherited		2	3.0%	11	4.6%	0	
900.110	other, suspected as inherited		0		1	0.4%	0	
NORMAL								
0.000	normal globe		52	77.6%	200	83.7%	49	76.6%

WEST HIGHLAND WHITE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Microphthalmia	Not defined	1	NO
B.	Keratoconjunctivitis sicca	Not defined	1-5	NO
C.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 6	Breeder option
	- iris to lens	Not defined	7	NO
D.	Cataract	Presumed autosomal recessive	1, 6	NO
E.	Vitreous degeneration	Not defined	8	Breeder option
F.	Retinal atrophy - generalized	Not defined	1	NO
G.	Retinal dysplasia - folds	Not defined	1	Breeder option

Description and Comments

A. Microphthalmia

Microphthalmia is a congenital defect characterized by a small eye. The condition may be seen alone without vision impairment but it is most often associated with defects of the cornea, iris (coloboma), anterior chamber, lens (cataract) and/or retina (retinal dysplasia).

B Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment.

In the West Highland White Terrier, this disease has been reported more commonly in females than males.

C. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

In the West Highland White Terrier, these membranes, when present, often bridge from the iris to the lens and may result in cataract with vision impairment.

D. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

The cataract described in the West Highland White Terrier initially involves the posterior Y sutures and may infrequently progress, resulting in vision impairment. The age of onset is less than 6 months of age. A recessive mode of inheritance is suggested by the pedigrees which have been studied.

E. Vitreous degeneration

Liquefaction of the vitreous gel which may predispose to retinal detachment.

F. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

G. Retinal dysplasia - folds

Linear, triangular, curved or curvilinear foci of retinal folding that may be single or multiple. When seen in puppies, this condition may partially or completely resolve with maturity. Its significance to vision is unknown. There are two other forms of retinal dysplasia (geographic, detached) which are known to be inherited in other breeds and, in their most severe form, cause blindness. The genetic relationship between folds and more severe forms of retinal dysplasia is undetermined.

References

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OCULAR DISORDERS REPORT
WEST HIGHLAND WHITE TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 270 #	%	2000-2009 416 #	%	2010-2016 792 #	%
GLOBE							
0.110	microphthalmia	4	1.5%	1	0.2%	0	
EYELIDS							
25.110	distichiasis	0		1	0.2%	1	0.1%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	0		1	0.2%	2	0.3%
CORNEA							
70.210	corneal pannus	1	0.4%	0		0	
70.700	corneal dystrophy	1	0.4%	0		0	
70.730	corneal endothelial degeneration	0		2	0.5%	1	0.1%
UVEA							
93.710	persistent pupillary membranes, iris to iris	8	3.0%	34	8.2%	81	10.2%
93.720	persistent pupillary membranes, iris to lens	11	4.1%	3	0.7%	9	1.1%
93.730	persistent pupillary membranes, iris to cornea	1	0.4%	3	0.7%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		4	1.0%	15	1.9%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		1	0.2%	3	0.4%
LENS							
100.200	cataract, unspecified	21	7.8%	0		0	
100.210	cataract, suspect not inherited	13	4.8%	38	9.1%	66	8.3%
100.301	punctate cataract, anterior cortex	1	0.4%	7	1.7%	11	1.4%
100.302	punctate cataract, posterior cortex	1	0.4%	5	1.2%	4	0.5%
100.303	punctate cataract, equatorial cortex	3	1.1%	0		0	
100.304	punctate cataract, anterior sutures	1	0.4%	0		0	
100.305	punctate cataract, posterior sutures	3	1.1%	5	1.2%	10	1.3%
100.306	punctate cataract, nucleus	2	0.7%	2	0.5%	5	0.6%
100.307	punctate cataract, capsular	0		1	0.2%	9	1.1%
100.311	incipient cataract, anterior cortex	8	3.0%	14	3.4%	14	1.8%
100.312	incipient cataract, posterior cortex	9	3.3%	10	2.4%	3	0.4%
100.313	incipient cataract, equatorial cortex	2	0.7%	0		3	0.4%
100.314	incipient cataract, anterior sutures	0		2	0.5%	0	
100.315	incipient cataract, posterior sutures	3	1.1%	0		2	0.3%
100.316	incipient cataract, nucleus	3	1.1%	3	0.7%	8	1.0%
100.317	incipient cataract, capsular	0		2	0.5%	8	1.0%
100.321	incomplete cataract, anterior cortex	0		0		1	0.1%
100.322	incomplete cataract, posterior cortex	0		0		2	0.3%
100.325	incomplete cataract, posterior sutures	0		0		4	0.5%
100.330	generalized/complete cataract	15	5.6%	8	1.9%	7	0.9%
100.999	*significant cataracts (summary)*	*72*	*26.7%*	*59*	*14.2%*	*91*	*11.5%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	0		0		2	0.3%
110.320	vitreal degeneration	1	0.4%	2	0.5%	10	1.3%

OCULAR DISORDERS REPORT
WEST HIGHLAND WHITE TERRIER

	1991-1999		2000-2009		2010-2016	
RETINA						
120.170 retinal dysplasia, folds	8	3.0%	16	3.8%	24	3.0%
120.180 retinal dysplasia, geographic	2	0.7%	1	0.2%	0	
120.190 retinal dysplasia, detached	1	0.4%	0		0	
120.310 generalized progressive retinal atrophy (PRA)	9	3.3%	5	1.2%	1	0.1%
120.910 retinal detachment without dialysis	1	0.4%	0		0	
120.920 retinal detachment with dialysis	0		0		2	0.3%
120.960 retinopathy	0		0		1	0.1%
OPTIC NERVE						
130.150 optic disc coloboma	0		1	0.2%	1	0.1%
OTHER						
900.000 other, unspecified	0		13	3.1%	20	2.5%
900.100 other, not inherited	6	2.2%	7	1.7%	28	3.5%
900.110 other, suspected as inherited	4	1.5%	1	0.2%	4	0.5%
NORMAL						
0.000 normal globe	180	66.7%	319	76.7%	577	72.9%

OCULAR DISORDERS REPORT

WHIPPET

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes - iris to iris	Not defined	1, 2	Breeder option
B.	Cataract	Not defined	3	NO
C.	Vitreous degeneration	Not defined	2-4	Breeder option
D.	Choroidal hypoplasia (Collie Eye Anomaly) - staphyloma/coloboma - retinal detachment - retinal hemorrhage - optic nerve coloboma * a DNA test is available	Autosomal recessive	5, 6	NO
E.	Retinal atrophy – generalized	Not defined	7	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

C. Vitreous degeneration

A liquefaction of the vitreous gel which may predispose to retinal detachment. This is a significant problem in the Whippet.

D. Choroidal hypoplasia (Collie Eye Anomaly)
- staphyloma/coloboma
- retinal detachment
- retinal hemorrhage
- optic nerve coloboma

A spectrum of malformations present at birth and ranging from inadequate development of the choroid (choroidal hypoplasia) to defects of the choroid, sclera, and/or optic nerve (coloboma/staphyloma) to complete retinal detachment (with or without hemorrhage). Mildly affected animals will have no detectable vision deficit.

This disorder is collectively referred to as "Collie Eye Anomaly" and has been identified in the longhaired Whippet. The choroidal hypoplasia component is caused by a 7799 base pairs deletion with the gene *NHEJ1.* The mutation is a recessive trait. A DNA test is available and is diagnostic only for the choroidal hypoplasia component of CEA. For colobomas to develop, an additional mutation in a second gene has to be present; that gene is still unknown.

E. Retinal atrophy – generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. Except for X-linked PRA in the Siberian Husky, in all breeds studied to date, PRA is inherited as an autosomal recessive trait.

References

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OCULAR DISORDERS REPORT
WHIPPET

Diagnostic Name		1991-1999 TOTAL DOGS EXAMINED 3171 #	%	2000-2009 4940 #	%	2010-2016 3406 #	%
GLOBE							
0.110	microphthalmia	1	0.0%	0		0	
EYELIDS							
20.140	ectopic cilia	1	0.0%	1	0.0%	0	
22.000	ectropion, unspecified	0		1	0.0%	0	
25.110	distichiasis	3	0.1%	4	0.1%	2	0.1%
NICTITANS							
50.210	pannus of third eyelid	0		0		1	0.0%
52.110	prolapsed gland of the third eyelid	0		0		1	0.0%
CORNEA							
70.210	corneal pannus	0		4	0.1%	1	0.0%
70.700	corneal dystrophy	13	0.4%	16	0.3%	9	0.3%
70.730	corneal endothelial degeneration	4	0.1%	1	0.0%	1	0.0%
UVEA							
93.110	iris hypoplasia	0		0		2	0.1%
93.140	corneal endothelial pigment without PPM	0		1	0.0%	0	
93.710	persistent pupillary membranes, iris to iris	25	0.8%	44	0.9%	36	1.1%
93.720	persistent pupillary membranes, iris to lens	3	0.1%	5	0.1%	2	0.1%
93.730	persistent pupillary membranes, iris to cornea	3	0.1%	3	0.1%	5	0.1%
93.740	persistent pupillary membranes, iris sheets	1	0.0%	14	0.3%	1	0.0%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		9	0.3%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		4	0.1%
93.999	uveal cysts	2	0.1%	9	0.2%	7	0.2%
LENS							
100.200	cataract, unspecified	11	0.3%	0		0	
100.210	cataract, suspect not inherited	92	2.9%	183	3.7%	152	4.5%
100.301	punctate cataract, anterior cortex	14	0.4%	23	0.5%	13	0.4%
100.302	punctate cataract, posterior cortex	6	0.2%	11	0.2%	5	0.1%
100.303	punctate cataract, equatorial cortex	9	0.3%	9	0.2%	5	0.1%
100.304	punctate cataract, anterior sutures	1	0.0%	3	0.1%	1	0.0%
100.305	punctate cataract, posterior sutures	0		4	0.1%	6	0.2%
100.306	punctate cataract, nucleus	4	0.1%	10	0.2%	3	0.1%
100.307	punctate cataract, capsular	0		0		3	0.1%
100.311	incipient cataract, anterior cortex	16	0.5%	23	0.5%	15	0.4%
100.312	incipient cataract, posterior cortex	11	0.3%	18	0.4%	8	0.2%
100.313	incipient cataract, equatorial cortex	10	0.3%	30	0.6%	15	0.4%
100.314	incipient cataract, anterior sutures	0		1	0.0%	0	
100.315	incipient cataract, posterior sutures	5	0.2%	3	0.1%	1	0.0%
100.316	incipient cataract, nucleus	1	0.0%	11	0.2%	2	0.1%
100.317	incipient cataract, capsular	0		15	0.3%	4	0.1%
100.321	incomplete cataract, anterior cortex	0		0		3	0.1%
100.322	incomplete cataract, posterior cortex	0		0		2	0.1%
100.323	incomplete cataract, equatorial cortex	0		0		2	0.1%
100.330	generalized/complete cataract	5	0.2%	10	0.2%	1	0.0%
100.375	subluxation/luxation, unspecified	13	0.4%	18	0.4%	2	0.1%

OCULAR DISORDERS REPORT
WHIPPET

LENS CONTINUED		1991-1999		2000-2009		2010-2016	
100.999	*significant cataracts (summary)*	*93*	*2.9%*	*171*	*3.5%*	*89*	*2.6%*
VITREOUS							
110.120	persistent hyaloid artery/remnant	4	0.1%	8	0.2%	4	0.1%
110.135	PHPV/PTVL	5	0.2%	4	0.1%	3	0.1%
110.320	vitreal degeneration	175	5.5%	304	6.2%	158	4.6%
FUNDUS							
97.110	choroidal hypoplasia	0		18	0.4%	1	0.0%
97.120	coloboma	0		4	0.1%	0	
RETINA							
120.170	retinal dysplasia, folds	4	0.1%	18	0.4%	10	0.3%
120.180	retinal dysplasia, geographic	1	0.0%	2	0.0%	1	0.0%
120.190	retinal dysplasia, detached	1	0.0%	2	0.0%	1	0.0%
120.310	generalized progressive retinal atrophy (PRA)	14	0.4%	22	0.4%	5	0.1%
120.400	retinal hemorrhage	0		0		1	0.0%
120.910	retinal detachment without dialysis	1	0.0%	3	0.1%	0	
120.920	retinal detachment with dialysis	0		0		1	0.0%
120.960	retinopathy	0		0		8	0.2%
OPTIC NERVE							
130.110	micropapilla	0		3	0.1%	0	
130.120	optic nerve hypoplasia	2	0.1%	1	0.0%	0	
130.150	optic disc coloboma	5	0.2%	8	0.2%	1	0.0%
OTHER							
900.000	other, unspecified	0		28	0.6%	86	2.5%
900.100	other, not inherited	26	0.8%	205	4.1%	106	3.1%
900.110	other, suspected as inherited	25	0.8%	7	0.1%	2	0.1%
NORMAL							
0.000	normal globe	2779	87.6%	4396	89.0%	2987	87.7%

OCULAR DISORDERS REPORT

WIRE FOX TERRIER*

*The Wire Fox Terrier and the Smooth Fox Terrier were originally considered two varieties of the same breed. They became separate breeds in 1985. It is likely that the same genetic diseases exist in both breeds.

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Glaucoma	Not defined	1, 2	NO
B.	Persistent pupillary membranes - iris to iris	Not defined	3, 4	Breeder option
C.	Cataract	Not defined	1	NO
D.	Lens luxation * a DNA test is available	Not defined	5	NO

Description and Comments

A. Glaucoma

Glaucoma is characterized by an elevation of intraocular pressure (IOP) which, when sustained, causes intraocular damage resulting in blindness. The elevated IOP occurs because the fluid cannot leave through the iridocorneal angle. Diagnosis and classification of glaucoma requires measurement of the intraocular pressure (tonometry) and examination of the iridocorneal angle (gonioscopy). Neither of these tests are part of a routine breed eye screening exam.

B. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

C. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely

(diffuse) or in a localized region. The cataracts observed in Wire Fox Terrier begin in the posterior subcapsular region and are progressive.

D. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

References

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OCULAR DISORDERS REPORT
WIRE FOX TERRIER

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 75 #	 %	2000-2009 126 #	 %	2010-2016 115 #	 %
GLOBE								
0.110	microphthalmia		1	1.3%	0		0	
EYELIDS								
25.110	distichiasis		3	4.0%	2	1.6%	3	2.6%
CORNEA								
70.700	corneal dystrophy		2	2.7%	0		1	0.9%
70.730	corneal endothelial degeneration		1	1.3%	0		0	
UVEA								
93.710	persistent pupillary membranes, iris to iris		9	12.0%	42	33.3%	56	48.7%
93.720	persistent pupillary membranes, iris to lens		2	2.7%	1	0.8%	2	1.7%
93.730	persistent pupillary membranes, iris to cornea		2	2.7%	3	2.4%	0	
93.740	persistent pupillary membranes, iris sheets		0		1	0.8%	0	
LENS								
100.200	cataract, unspecified		4	5.3%	0		0	
100.210	cataract, suspect not inherited		0		1	0.8%	1	0.9%
100.301	punctate cataract, anterior cortex		0		2	1.6%	1	0.9%
100.311	incipient cataract, anterior cortex		1	1.3%	2	1.6%	2	1.7%
100.312	incipient cataract, posterior cortex		1	1.3%	3	2.4%	1	0.9%
100.313	incipient cataract, equatorial cortex		0		1	0.8%	1	0.9%
100.314	incipient cataract, anterior sutures		0		1	0.8%	0	
100.321	incomplete cataract, anterior cortex		0		0		1	0.9%
100.322	incomplete cataract, posterior cortex		0		0		1	0.9%
100.326	incomplete cataract, nucleus		0		0		1	0.9%
100.330	generalized/complete cataract		1	1.3%	6	4.8%	1	0.9%
100.999	*significant cataracts (summary)*		*7*	*9.3%*	*15*	*11.9%*	*9*	*7.8%*
VITREOUS								
110.120	persistent hyaloid artery/remnant		0		1	0.8%	0	
110.320	vitreal degeneration		0		1	0.8%	0	
RETINA								
120.170	retinal dysplasia, folds		1	1.3%	0		0	
120.310	generalized progressive retinal atrophy (PRA)		0		4	3.2%	0	
OTHER								
900.000	other, unspecified		0		1	0.8%	2	1.7%
900.100	other, not inherited		0		12	9.5%	0	
900.110	other, suspected as inherited		0		1	0.8%	0	
NORMAL								
0.000	normal globe		54	72.0%	74	58.7%	55	47.8%

WIREHAIRED POINTING GRIFFON

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Wirehaired Pointing Griffon breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
WIREHAIRED POINTING GRIFFON

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 46 #	1991-1999 46 %	2000-2009 158 #	2000-2009 158 %	2010-2016 331 #	2010-2016 331 %
GLOBE							
0.110	microphthalmia	0		0		1	0.3%
EYELIDS							
21.000	entropion, unspecified	1	2.2%	2	1.3%	0	
25.110	distichiasis	0		1	0.6%	4	1.2%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		1	0.3%
CORNEA							
70.700	corneal dystrophy	0		0		1	0.3%
70.730	corneal endothelial degeneration	2	4.3%	1	0.6%	0	
UVEA							
93.110	iris hypoplasia	0		0		1	0.3%
93.710	persistent pupillary membranes, iris to iris	0		1	0.6%	7	2.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		1	0.3%
LENS							
100.210	cataract, suspect not inherited	0		2	1.3%	42	12.7%
100.302	punctate cataract, posterior cortex	0		0		1	0.3%
100.306	punctate cataract, nucleus	0		1	0.6%	1	0.3%
100.311	incipient cataract, anterior cortex	1	2.2%	0		1	0.3%
100.313	incipient cataract, equatorial cortex	0		1	0.6%	0	
100.316	incipient cataract, nucleus	0		0		2	0.6%
100.999	*significant cataracts (summary)*	*1*	*2.2%*	*2*	*1.3%*	*5*	*1.5%*
VITREOUS							
110.320	vitreal degeneration	0		0		7	2.1%
RETINA							
120.170	retinal dysplasia, folds	0		1	0.6%	4	1.2%
120.180	retinal dysplasia, geographic	0		1	0.6%	0	
120.400	retinal hemorrhage	1	2.2%	0		0	
OTHER							
900.000	other, unspecified	0		1	0.6%	5	1.5%
900.100	other, not inherited	0		2	1.3%	11	3.3%
NORMAL							
0.000	normal globe	41	89.1%	147	93.0%	270	81.6%

OCULAR DISORDERS REPORT

WIREHAIRED VIZSLA

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Persistent pupillary membranes			
	- iris to iris	Not defined	1, 2	Breeder option
	- lens pigment foci/no strands	Not defined	3	Passes with no notation
B.	Cataract	Not defined	1	NO

Description and Comments

A. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

B. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary conditions of the Wirehaired Vizsla breed. The conditions listed above are generally recognized to exist in this breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. ACVO Genetics Committee, 2005 and/or Data from CERF All-Breeds Report, 2003-2004.

3. ACVO Genetics Committee, 2016 and/or Data from CERF/OFA All-Breeds Report 2010-2015.

OCULAR DISORDERS REPORT
WIREHAIRED VIZSLA

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 5 #	%	2010-2016 123 #	%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		3	2.4%
UVEA							
93.710	persistent pupillary membranes, iris to iris	0		0		10	8.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		11	8.9%
LENS							
100.210	cataract, suspect not inherited	0		0		20	16.3%
VITREOUS							
110.320	vitreal degeneration	0		0		2	1.6%
RETINA							
120.910	retinal detachment without dialysis	0		0		1	0.8%
OTHER							
900.000	other, unspecified	0		0		4	3.3%
900.100	other, not inherited	0		0		3	2.4%
NORMAL							
0.000	normal globe	0		5	100.0%	92	74.8%

OCULAR DISORDERS REPORT

XOLOITZCUINTLI

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Cataract	Not defined	1	NO

Description and Comments

A. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

References

There are no references providing detailed descriptions of hereditary ocular conditions of the Xoloitzcuintli breed. The conditions listed above are generally recognized to exist in the breed, as evidenced by identification on breed eye screening examinations and/or clinical experience of veterinary ophthalmologists.

1. ACVO Genetics Committee, 2017 and/or Data from CERF/OFA All-Breeds Report, 2010-2016.

OCULAR DISORDERS REPORT
XOLOITZCUINTLI

Diagnostic Name		TOTAL DOGS EXAMINED	1991-1999 0 #	%	2000-2009 3 #	%	2010-2016 68 #	%
EYELIDS								
25.110	distichiasis		0		0		1	1.5%
UVEA								
93.710	persistent pupillary membranes, iris to iris		0		0		3	4.4%
93.750	persistent pupillary membranes, lens pigment foci/no strands		0		0		1	1.5%
LENS								
100.311	incipient cataract, anterior cortex		0		0		2	2.9%
100.312	incipient cataract, posterior cortex		0		0		6	8.8%
100.313	incipient cataract, equatorial cortex		0		0		2	2.9%
100.317	incipient cataract, capsular		0		0		3	4.4%
100.999	*significant cataracts (summary)*		*0*		*0*		*13*	*19.1%*
RETINA								
120.180	retinal dysplasia, geographic		0		0		1	1.5%
OTHER								
900.110	other, suspected as inherited		0		0		1	1.5%
NORMAL								
0.000	normal globe		0		3	100.0%	56	82.4%

YORKSHIRE TERRIER

	DISORDER	INHERITANCE	REFERENCE	BREEDING ADVICE
A.	Keratoconjunctivitis sicca	Not defined	1, 2	NO
B.	Distichiasis	Not defined	3	Breeder option
C.	Corneal dystrophy - epithelial/stromal	Not defined	4	Breeder option
D.	Persistent pupillary membranes - iris to iris - lens pigment foci/no strands	Not defined Not defined	1, 3 4	Breeder option Passes with no notation
E.	Cataract	Not defined	1	NO
F.	Lens luxation *a DNA test is available	Not defined	5, 6, 7	NO
G.	Retinal atrophy - generalized *a DNA test is available	Not defined	1	NO
H.	Retinal dysplasia - geographic/detached	Not defined	7, 8	NO
I.	Ligneous conjunctivitis	Not defined	9	NO

Description and Comment

A. Keratoconjunctivitis sicca

An abnormality of the tear film, most commonly a deficiency of the aqueous portion, although the mucin and/or lipid layers may be affected; results in ocular irritation and/or vision impairment. There is evidence that Yorkshire Terriers sometimes present with severe, congenital, unilateral keratoconjunctivitis sicca (KCS) and it is suspected this is due to hypoplasia or aplasia of the gland.

OCULAR DISORDERS REPORT

B. Distichiasis

Eyelashes abnormally located on the eyelid margin which may cause ocular irritation. Distichiasis may occur at any time in the life of a dog. It is difficult to make a strong recommendation with regards to breeding dogs with this entity. The hereditary basis has not been established although it seems probable due to the high incidence in some breeds. Reducing the incidence is a logical goal. When diagnosed, distichiasis should be recorded. Breeding discretion is advised.

C. Corneal dystrophy-epithelial/stromal

A non-inflammatory corneal opacity (white to gray) present in one or more of the corneal layers; usually inherited and bilateral.

D. Persistent pupillary membranes (PPMs)

Persistent blood vessel remnants in the anterior chamber of the eye which fail to regress normally by 3 months of age. These strands may bridge from iris to iris, iris to cornea, iris to lens, or form sheets of tissue in the anterior chamber. The last three forms pose the greatest threat to vision and when severe, vision impairment or blindness may occur.

Lens pigment foci/no strands is considered an insignificant finding and therefore not noted on the certificate.

E. Cataract

A partial or complete opacity of the lens and/or its capsule. In cases where cataracts are complete and affect both eyes, blindness results. The prudent approach is to assume cataracts to be hereditary except in cases known to be associated with trauma, other causes of ocular inflammation, specific metabolic diseases, persistent pupillary membrane, persistent hyaloid, or nutritional deficiencies. Cataracts may involve the lens completely (diffuse) or in a localized region.

F. Lens luxation

Partial (subluxation) or complete displacement of the lens from the normal anatomic site behind the pupil. Lens luxation not associated with trauma or inflammation is presumed to be inherited. Lens luxation may result in elevated intraocular pressure (glaucoma) causing vision impairment or blindness. A mutation in *ADAMTS17* has been associated with primary lens luxation. A DNA test is available.

G. Retinal atrophy - generalized

A degenerative disease of the retinal visual cells which progresses to blindness. This abnormality, also known as progressive retinal atrophy or PRA, may be detected by electroretinogram (not part of a routine eye screening examination) before it is apparent clinically. PRA is inherited as an autosomal recessive trait in most breeds.

H. Retinal dysplasia - geographic/detached

Abnormal development of the retina present at birth.

Retinal dysplasia - geographic: Any irregularly shaped area of abnormal retinal development containing both areas of thinning and areas of elevation representing folds and retinal disorganization.

Retinal dysplasia - detached: Severe retinal disorganization associated with separation (detachment) of the retina.

These two forms are associated with vision impairment or blindness. Retinal dysplasia is known to be inherited in many breeds. The genetic relationship among the three forms of retinal dysplasia is not known for all breeds.

I. Ligneous conjunctivitis

A rare type of conjunctivitis characterized by the formation of thick membranes covering conjunctiva of the nictitans and eyelids of affected dogs. This condition has been diagnosed in four unrelated Doberman Pinschers, three of which had life-threatening systemic disease. Ligneous conjunctivitis has also been reported in one Yorkshire terrier.

References

1. ACVO Genetics Committee, 1999 and/or Data from CERF All-Breeds Report, 1991-1998.

2. Herrera HD, Weichsler N, Gomez JR, et al. Severe, unilateral, unresponsive keratoconjunctivitis sicca in 16 juvenile Yorkshire Terriers. *Vet Ophthalmol.* 2007;10:285-288.

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5. Gould D, Pettitt L, McLaughlin B, et al. ADAMTS17 mutation associated with primary lens luxation is widespread among breeds. *Vet Ophthalmol.* 2011;14:378-384.

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9. Torres MD, Leiva M, Tabar MD, et al. Ligneous conjunctivitis in a plasminogen-deficient dog: clinical management and 2-year follow-up. *Vet Ophthalmol.* 2009;12:248-253.

OCULAR DISORDERS REPORT
YORKSHIRE TERRIER

Diagnostic Name	TOTAL DOGS EXAMINED	1991-1999 403 #	1991-1999 403 %	2000-2009 403 #	2000-2009 403 %	2010-2016 878 #	2010-2016 878 %
GLOBE							
0.110	microphthalmia	2	0.5%	1	0.2%	1	0.1%
10.000	glaucoma	0		1	0.2%	0	
EYELIDS							
25.110	distichiasis	2	0.5%	10	2.5%	22	2.5%
NASOLACRIMAL							
40.910	keratoconjunctivitis sicca	1	0.2%	3	0.7%	2	0.2%
NICTITANS							
52.110	prolapsed gland of the third eyelid	0		0		1	0.1%
CORNEA							
70.210	corneal pannus	4	1.0%	0		0	
70.220	pigmentary keratitis	0		0		4	0.5%
70.700	corneal dystrophy	3	0.7%	4	1.0%	6	0.7%
70.730	corneal endothelial degeneration	0		1	0.2%	0	
UVEA							
93.110	iris hypoplasia	0		0		1	0.1%
93.710	persistent pupillary membranes, iris to iris	21	5.2%	37	9.2%	101	11.5%
93.720	persistent pupillary membranes, iris to lens	0		4	1.0%	0	
93.730	persistent pupillary membranes, iris to cornea	0		3	0.7%	1	0.1%
93.750	persistent pupillary membranes, lens pigment foci/no strands	0		0		13	1.5%
93.760	persistent pupillary membranes, endothelial opacity/no strands	0		0		2	0.2%
LENS							
100.200	cataract, unspecified	23	5.7%	0		0	
100.210	cataract, suspect not inherited	8	2.0%	16	4.0%	29	3.3%
100.301	punctate cataract, anterior cortex	5	1.2%	6	1.5%	17	1.9%
100.302	punctate cataract, posterior cortex	2	0.5%	3	0.7%	7	0.8%
100.303	punctate cataract, equatorial cortex	3	0.7%	1	0.2%	2	0.2%
100.304	punctate cataract, anterior sutures	0		1	0.2%	2	0.2%
100.305	punctate cataract, posterior sutures	1	0.2%	0		3	0.3%
100.306	punctate cataract, nucleus	1	0.2%	0		1	0.1%
100.311	incipient cataract, anterior cortex	6	1.5%	7	1.7%	15	1.7%
100.312	incipient cataract, posterior cortex	5	1.2%	6	1.5%	6	0.7%
100.313	incipient cataract, equatorial cortex	3	0.7%	5	1.2%	9	1.0%
100.314	incipient cataract, anterior sutures	0		1	0.2%	2	0.2%
100.315	incipient cataract, posterior sutures	3	0.7%	0		0	
100.316	incipient cataract, nucleus	2	0.5%	1	0.2%	0	
100.317	incipient cataract, capsular	0		0		1	0.1%
100.321	incomplete cataract, anterior cortex	0		0		2	0.2%
100.326	incomplete cataract, nucleus	0		0		1	0.1%
100.330	generalized/complete cataract	15	3.7%	12	3.0%	1	0.1%
100.375	subluxation/luxation, unspecified	0		1	0.2%	0	
100.999	*significant cataracts (summary)*	*69*	*17.1%*	*43*	*10.7%*	*69*	*7.9%*

OCULAR DISORDERS REPORT
YORKSHIRE TERRIER

	1991-1999		2000-2009		2010-2016	
VITREOUS						
110.120 persistent hyaloid artery/remnant	1	0.2%	0		1	0.1%
110.135 PHPV/PTVL	3	0.7%	0		1	0.1%
110.320 vitreal degeneration	5	1.2%	5	1.2%	12	1.4%
RETINA						
120.170 retinal dysplasia, folds	0		2	0.5%	7	0.8%
120.310 generalized progressive retinal atrophy (PRA)	30	7.4%	13	3.2%	11	1.3%
120.960 retinopathy	0		0		4	0.5%
OPTIC NERVE						
130.120 optic nerve hypoplasia	3	0.7%	0		0	
130.150 optic disc coloboma	0		0		1	0.1%
OTHER						
900.000 other, unspecified	0		9	2.2%	10	1.1%
900.100 other, not inherited	2	0.5%	20	5.0%	14	1.6%
900.110 other, suspected as inherited	5	1.2%	6	1.5%	4	0.5%
NORMAL						
0.000 normal globe	294	73.0%	323	80.1%	664	75.6%