

Breeding healthy puppies and sustaining your breed: the goal and how do you get there?

Integration of appropriate health testing into the breeding of healthy dogs and breeding populations

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Embark Health Summit April 2022

Think Globally, Act Locally



Brenda Bonnett, DVM, PhD



- Veterinarian
- Epidemiologist
- Veterinary Science Officer, former CEO, International Partnership for Dogs
- Formerly tenured Associate Professor Univ. of Guelph, Canada
- 70+ refereed research publications, several book chapters on evidence-based medicine, animal welfare, population health, veterinary-client communication, human-animal interactions, etc.
- Swedish collaboration since mid-1990's with Agria Insurance, Swedish KC, and the Swedish veterinary college
- Consultant on welfare initiatives in the USA include pet overpopulation, responsible pet ownership, pet relinquishment, shelter issues, etc.

Why the International Partnership for Dogs -IPFD?

... to enhance health, well-being and welfare of dogs and to support great human-dog interactions!



- **International** – as is the dog world
- **Multi-stakeholder** ...
 - With collaborators from many sectors IPFD can take a broad view
- **IPFD is impartial and evidence-based**
- Both scientific AND conscious of human-dog interactions, i.e. the emotional side of the dog world
- **Collaboration and sharing** ...

Outline



- **Breeding is complex and requires an understanding of the 'Big Picture'**
 - What are the pieces of that puzzle?
 - Making the most of genetic testing, while avoiding pitfalls.
 - What are key resources you need to consider and where can you find them?
- **The International Partnership for Dogs (IPFD) / [DogWellNet.com](https://dogwellnet.com)**
 - What resources are there to support breeding decisions?

What is the 'Big Picture' in dog breeding?

Code of Ethics (COE) for the Rhodesian Ridgeback Club of Canada (RRCC)

- Members of The Rhodesian Ridgeback Club of Canada (the "Club") have an obligation to the Rhodesian Ridgeback breed **to preserve and improve the breed** without exploiting it.



What is the 'Big Picture' in dog breeding?

- **Preserve and Improve the breed**
 - In its 'original' format – **fit for function**
DOG first, breed second.
- **See, Breathe, Move freely**
- **Basic welfare The 5 Freedoms:**
 1. Freedom from Hunger and Thirst
 2. Freedom from Discomfort
 3. Freedom from Pain, Injury, and Disease
 4. Freedom to express Normal Behavior (For dogs!
Not reduced for the breed)
 5. Freedom from Fear and Distress
- **Preserve and Improve**
 - **Longevity**
 - **Genetic Diversity**

Applied to breeding – these should be protected for
ALL OFFSPRING

1. Up to the owner(s)
2. Aspects of inherited conformation – hips, spine, breathing, chronic skin conditions?
3. Predisposition to injury, breed-increased risk of disease
4. Able to groom whole body, facial and tail expressions, etc.
5. Temperament AND e.g. distress from hampered breathing.

What is the 'Big Picture' in dog breeding?

- **Preserve and Improve the breed**
 - In its 'original' format – **fit for function**
DOG first, breed second.

- **See, Breathe, Move freely**

- **Basic welfare The 5 Freedoms:**

Many depend on a knowledgeable, careful selection of breeding animals.

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2. Freedom from Pain, Injury, and Disease
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Not reduced for the breed)
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- **Preserve and Improve**
 - **Longevity**
 - **Genetic Diversity**

Applied to breeding – these should be protected for
ALL OFFSPRING

Health tests?
- some yes
- many no

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3. Predisposition to injury, breed-increased risk of disease
4. Able to groom whole body, facial and tail expressions, etc.
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Think
about it!

Breeding decisions ... Ideally? In reality?

- **Short term goals – which comes first?**
 - Produce show winning puppies? ... how many per litter? What about the rest?
Or...
 - Produce healthy offspring?
 - **Can there be a balance? ... While protecting the breed?**
- **Long term goals:**
 - Develop 'your' line?
OR...
 - Breed health and sustainability?
 - Or, really, just have some fun with your dogs???

Breeding decisions ... Ideally? In reality?

- **Short term goals – which comes first?**

- Produce show winning puppies? ... how many per litter? What about the rest?
Or...

- Produce healthy offspring?

- **Can there be a balance? ... While protecting the breed?**

- **'Show winning' and good health and welfare should not have to be in conflict!
And aren't in many breeds.**

- **Long term goals:**

- Develop 'your' line?
OR...

- Breed health and sustainability?

- Or, really, just have some fun with your dogs???

What people want... what dogs need... **and deserve!** Breeding for dog health and welfare ...



One can hope that human concerns should be secondary to dog health and welfare, but even “Pandemic Puppies” taught us that reality is very different.

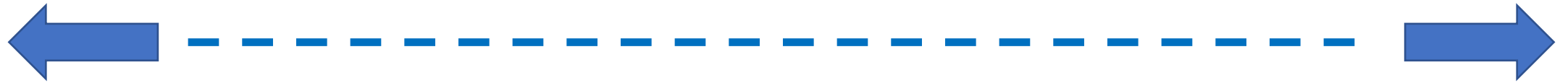
Can we understand the **spectrum...**
and achieve a reasonable **balance?**

Definitions: Health and Welfare in Dogs

- **Everyone wants healthy dogs with good welfare – everyone says just that.**
- BUT – specific definitions are challenging and conflicts arise

Spectrum of Definitions – dog health and welfare:

words matter!



Health – absence of disease



Absence of **preventable** disease... or just an *acceptable level* of disease? **Rate?** **Risk?**

Welfare – absence of **pain and suffering**

Adequate, acceptable welfare
And how is that defined?

- Additional problems arise when we generalize across cultures, across diseases, breeds, etc!
- Human-animal bond/interactions!!

“Maximising good health, welfare and temperament overrides all other considerations for dogs”



Summary

- The BWG agree to place this concept at the hub of all BWG decision-making because we believe that prioritizing the needs of the dog will promote the best possible outcomes for brachycephalic dogs.
- The BWG urges **all other stakeholders and anyone with an interest in dogs** to adopt this BWG focus that prioritises the needs of the dog for their decision-making

Health testing for breeding decisions

- Health testing encompasses everything from **behavioral assessment to radiographic grading for, e.g. hips and elbows, to clinical exams, e.g. eye exams and of course genetic testing.**
- Many of **the most important/common/severe conditions do not now nor will they soon have a simple health or DNA test** – most are complex diseases in terms of inheritance and environmental influences.
- So the **‘Big Picture’ is important** when choosing dogs for mating and for the breed.
 - (See, for example: [The Big Picture - in the Dog World as a Whole and for your next Breeding Decision](https://dogwellnet.com/blogs/entry/186-the-big-picture-in-the-dog-world-as-a-whole-and-for-your-next-breeding-decision/)) (<https://dogwellnet.com/blogs/entry/186-the-big-picture-in-the-dog-world-as-a-whole-and-for-your-next-breeding-decision/>)



Health testing, yes, but... ACT APPROPRIATELY

- Hips, elbows, spine etc. – just x-ray? Or *do you follow the rules and recommendations?* Voluntary programs don't tend to work. **Where testing is regulated – results are seen.**

Health Tested does not equal HEALTHY!
- Not for the sire/dam – not for the puppies.

- Genetic testing –
 - Rank conditions based on the BIG Picture! (HGTD)
 - One **tool** in your breeding decisions.
 - **Don't eliminate carriers!** Simple, straightforward – *is it followed?*

References:

[HGTD This Week: What does it mean when a dog is promoted as "genetically tested?"](#)

Common Sense: Not all dams and sires with 'clear' test results will be good choices for breeding.

See: <https://dogwellnet.com/blogs/entry/158-not-all-puppies-from-health-tested-parents-will-be-healthy/>

- The Big Picture approach employs all inputs that define good breeding, using **common sense, observation, health testing, and a deep knowledge of your dogs and the breed.**
- *Good breeders* use appropriate health testing ... and act appropriately on the results!
- **BUT – health-testing alone does not make someone a good breeder.**
- *Common sense:* signs of disease (skin, eyes, breathing difficulties, other) in any dog should preclude it from breeding. This is law in some countries.



Why IPFD? **TOOLS**

- Health issues include those for which there are genetic tests, but also many others which may be common and important. The [Harmonization of Genetic Testing \(HGTD\)](#) database, expert input for health and genetic counseling, and the
- [Health Strategies Database for Dogs \(HSDD*\)](#) List of *all conditions* of interest in a breed by Health Strategy Provider (breed and kennel clubs). Closer to the Big Picture.

More TOOLS

- **Breeds data base** <https://dogwellnet.com/breeds/pedigreed/>
 - International Clubs/ standards/
 - Health surveys
 - Other links
- **Swedish Agria insurance breed-specific statistics – 190 Breeds**
<https://dogwellnet.com/breeds/additional-breed-resources/breeds-with-swedish-insurance-data-r111/>
- **Breed-specific breeding strategies**
 - Sweden, Norway, Finland
<https://dogwellnet.com/breeds/additional-breed-resources/breeds-with-summaries-of-swedish-kc-finnish-kc-or-norwegian-kc-breeding-strategies-r179/>
 - Translations
 - Template

Get a GRIHP!

(and in WSAVA
Bulletin articles)

<https://dogwellnet.com/breeds/additional-breed-resources/dog-breeds-what-you-need-to-know-ipfd-feature-in-wsava-bulletin-r222/>



WSAVA
Global Veterinary Community

IPFD 
DogWellNet



Harmonization of Genetic Testing for Dogs

HGTD GOAL: Improve standardization of, and access to, robust genetic testing to support health improvements and a sustainable future for healthy dogs. *The portal for information on Genetic Testing Providers (labs); genetic tests, and tests by breed.* There are two major components: the Quality Testing

Database and Genetic Counselling resources. [See Full Description](#)

Note: IPFD cannot be held responsible for inaccurate content or any outcome from the use of information or resources found on this site. Listing in the HGTD Database does not represent an accreditation or endorsement of any Genetic Test Provider.

[More >>](#)

Search by Breed, Test/Disease(Phone) or Lab

HGTD - Quality Testing Database

Search By Breed



Search By Test/Disease



Search By GTP/Lab



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Breed Relevance Ratings

- Evidence for use of that test in a given breed.
- Not a recommendation about how 'important' the condition is in The Big Picture.
- Remember DNA tests are important BUT - DNA) tests are **tools** not **goals or outcomes**
 - and except for rare, simple gene disorders – NOT A MAGIC BULLET!

Reference:

[HGTD - What is a Breed Relevance Rating?](#)

HGTD and Sponsors

- IPFD has collaborative work with Sponsor of HGTD – like Embark – on improving reporting of breed-specific test results.



Search Term: Bernese mountain dog

**Many more tests may be available
– for ‘all dogs’, coat characteristics,
identification, etc.**

Results

NOTE: The pawprints to the right of each genetic test represent research-based evidence for the use of the test in this breed. Green pawprints indicate there is some research available to support test usage in the breed but does not reflect the importance of the test or the frequency or clinical impacts of the condition/disease in the breed. Hover over the pawprints for a brief description. For more information, see article [“What is a relevance rating?”](#)

RESULTS FOR BERNESE MOUNTAIN DOG

Genetic Disease/Disorder


Degenerative Myelopathy 🐾 🔍

Histiocytic Sarcoma (Markers) 🐾

Von Willebrand Disease I 🐾

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Other Genetic Traits

Coat Colour Dilution, dilution, MLPH-related 🐾

ADDITIONAL TESTS AVAILABLE FOR ALL DOGS...

Diagnostic Tool

C-Kit Somatic Mutation - exon 11 🐾

C-Kit Somatic Mutation - exon 14 🐾

C-Kit Somatic Mutation - exon 17 🐾

C-Kit Somatic Mutation - exon 8 🐾

C-Kit Somatic Mutation - exon 9 🐾

Carbapenemase Genes Resistance Detection 🐾

Clonality Test 🐾

Invasive Transitional Cell Carcinoma - BRAF mutation 🐾

Methicillin-Resistant Staphylococcus Aureus (MRSA) 🐾

Minimal Residual Disease (MRM) 🐾

Multidrug Resistance 1 (MDR1) 🐾

Genetic Disease/Disorder

Hyperuricosuria and Hyperuricemia (HUU) 🐾

Malignant Hyperthermia 🐾

Periodic Fever Syndrome 🐾


Other Genetic Traits


Coat Colour H-locus (Harlequin) 🐾

Coat Colour Merle 🐾


Improper Coat/Furnishings 🐾


Tail length, Short 🐾

Albinism, caL-allele 🐾 

Coat Colour Brown 🐾 


Coat Colour Em-locus 🐾

Coat Colour Panda White Spotting 🐾 

Coat Colour Saddle Tan vs Black-and-Tan 🐾 


Coat Colour, Agouti 🐾

Coat Colour, Dominant Black 🐾

Coat Colour, Extension 🐾 

Curly Coat 🐾

Furnishings (moustache and eyebrows) 🐾

Hair, Long 🐾 

Piebald, Extreme White Spotting 🐾

Shedding 🐾

Parentage/Kinship/Identity/Scan

Breed/Type/Variety Identification 🐾

CanineHD Whole-Genome Genotyping 🐾

DNA Banking 🐾

DNA Profile Dog 🐾

Genetic Diversity - genetic coefficient of inbreeding (gCOI) 🐾

Genetic Diversity - SNP based 🐾


Genetic Diversity - STR based 🐾

ISAG 2020 Parentage Panel (Primary and/or Secondary) 🐾

Maternity Verification Dog 🐾

Parentage Verification Dog 🐾

Paternity Verification Dog 🐾

Breed Diversity 🐾 

The full list – include coat characteristics, parentage and dog identification, MDR1, and other conditions offered to 'all'



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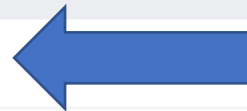
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Von Willebrand Disease I 🐾



New information VERY IMPORTANT

Correcting the confusion around Degenerative Myelopathy

- IPFD blog on Dr. Jerold Bell's article:
- <https://dogwellnet.com/blogs/entry/236-correcting-the-confusion-around-degenerative-myelopathy/>
- And:
- **Infographic - Quick Facts on Degenerative Myelopathy and Genetic Testing**
<https://dogwellnet.com/blogs/entry/237-infographic-quick-facts-on-degenerative-myelopathy-and-genetic-testing/>



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HGTD - Quality Testing Database

Search By Breed



Search By Test/Disease








Search By GTP/Lab



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HSDD – Health Strategies Data Base – coming soon!

RESULTS FOR BERNESE MOUNTAIN DOG

Health Issue/County Strongest Recommendation	 United States	 United Kingdom	 Sweden	 Finland	 France	International	UK
Cancer	R2		R3				
Cardiac Disease	R2						
Degenerative Myelopathy	R2						R3
Elbow Dysplasia	R2	R1	R2	R1			
Eye Disease	R2	R1					
Hip Dysplasia	R2	R1	R2	R1	R3		
Von Willebrands	R2						
Population Genetic Diversity						R3	
Other breed-specific considerations	R2						
Renal Disease			R3				
Reproductive		R2					

Globally Relevant Integrated Health Profile

Get a GRIHP! on breed health.

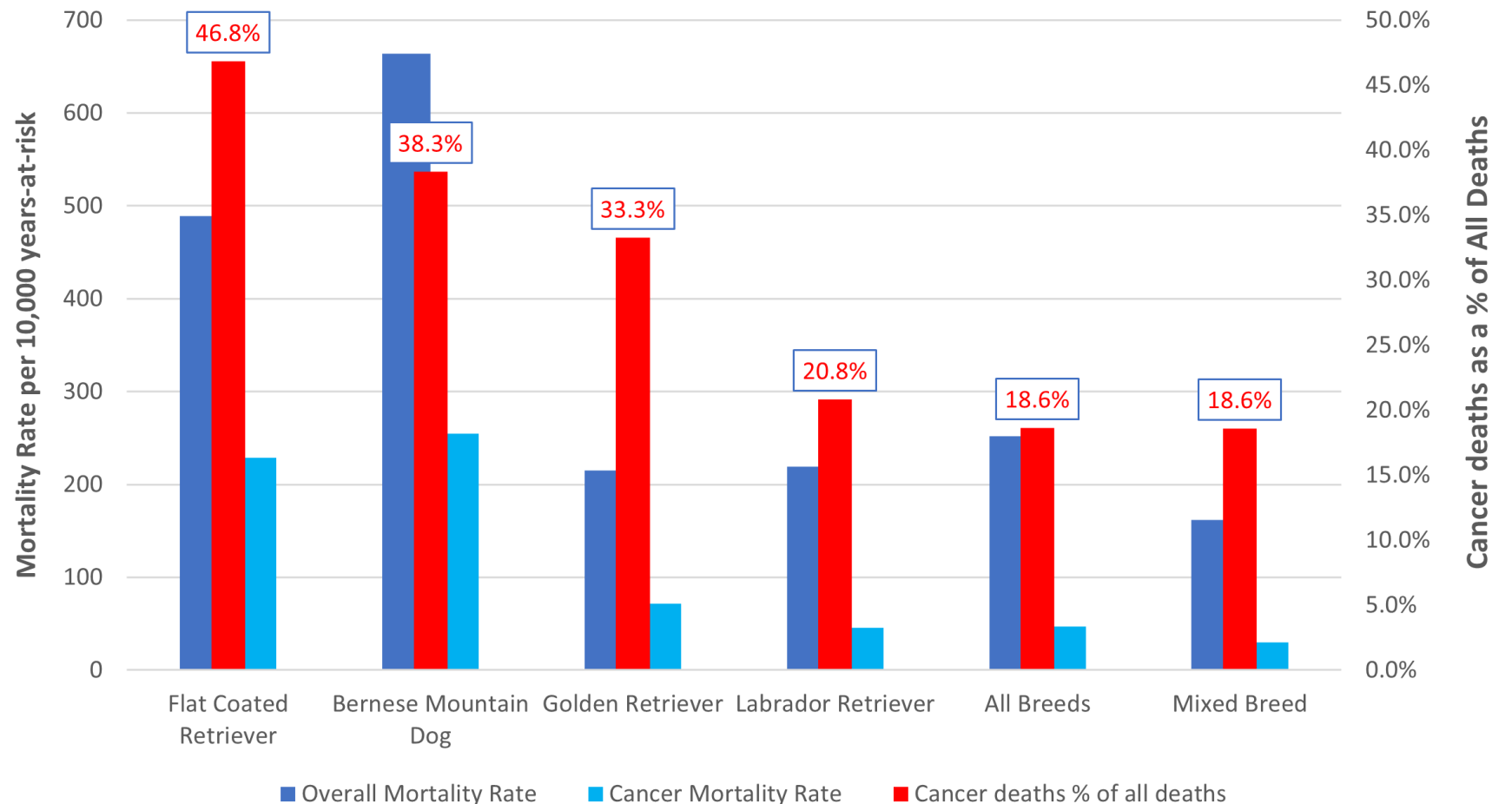
<https://dogwellnet.com/content/health-and-breeding/breeds/breed-specific-health-reports/>
Dachshunds, Salukis, French Bulldogs, Corgis, Golden Retrievers, Bernese Mountain Dogs, and more, soon.

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Get a GRIHP! on Golden Retrievers
<https://dogwellnet.com/content/health-and-breeding/breeds/breed-specific-health-reports/get-a-grihp-on-golden-retrievers-r729/>

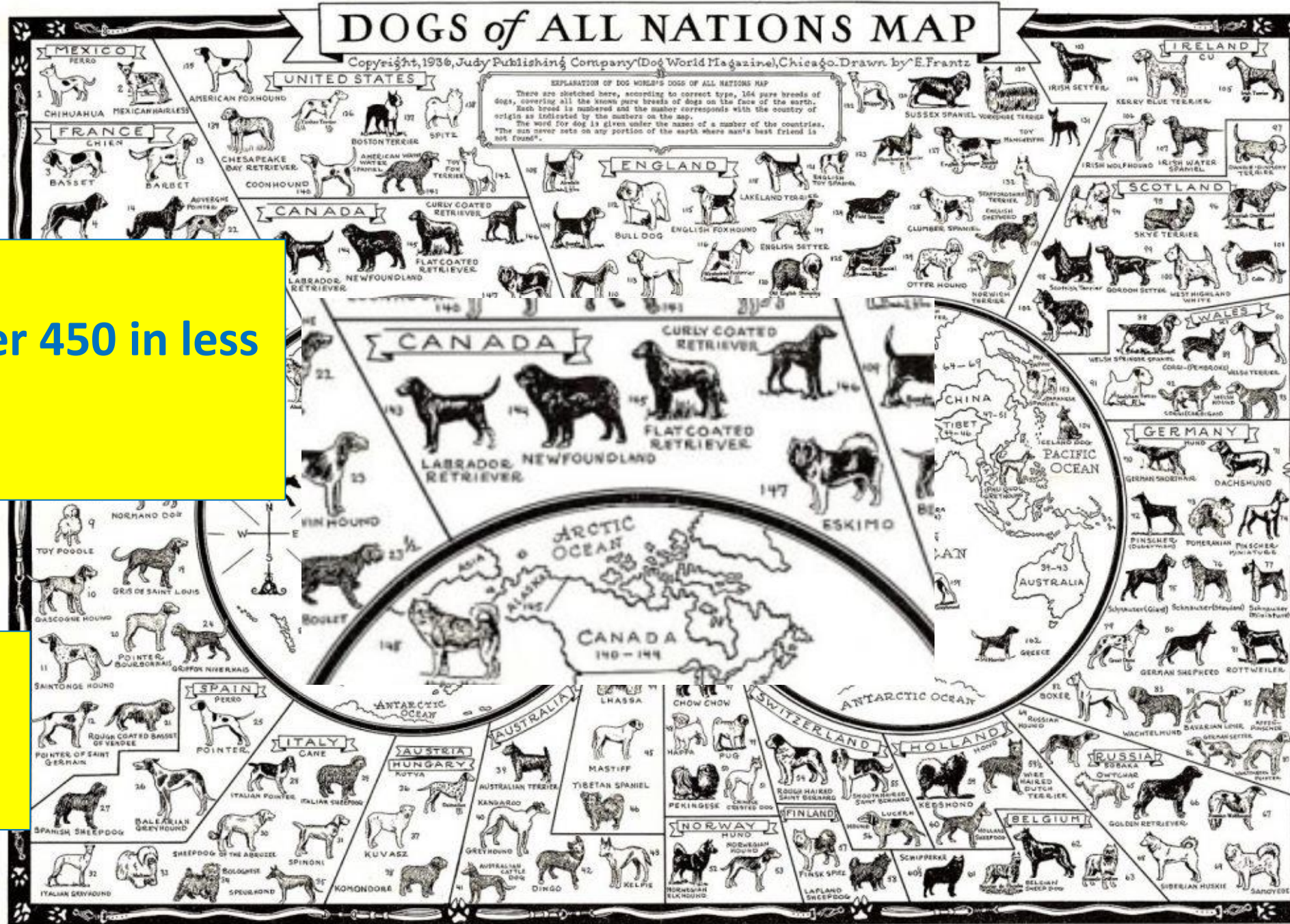
Overall Mortality Rate, Cancer Rate and Percent of Deaths due to Cancer:
Swedish Insurance Data 2011-2016



created by E. Frantz for
Dog World Magazine

- 164 became over 450 in less than 100 years.
- Based on 'type'

Breeds happened through
selective breeding.
Which means
linebreeding/ inbreeding.





Selective breeding has also produced special traits, skills, and abilities

Inbreeding (linebreeding) vs. Genetic Diversity

- **The Downside of Inbreeding: It's time for a new approach.**

C.A. Sharpe

1999 !

- **Popular Sires**

- “It is becoming more and more apparent that the short term gains of inbreeding are outweighed by the long term costs. Present day breeders need to rethink their strategies.”

Other Resources:

Brenda's Blog

The Downside of Inbreeding...

- <https://dogwellnet.com/blogs/entry/238-the-downside-of-inbreeding/>

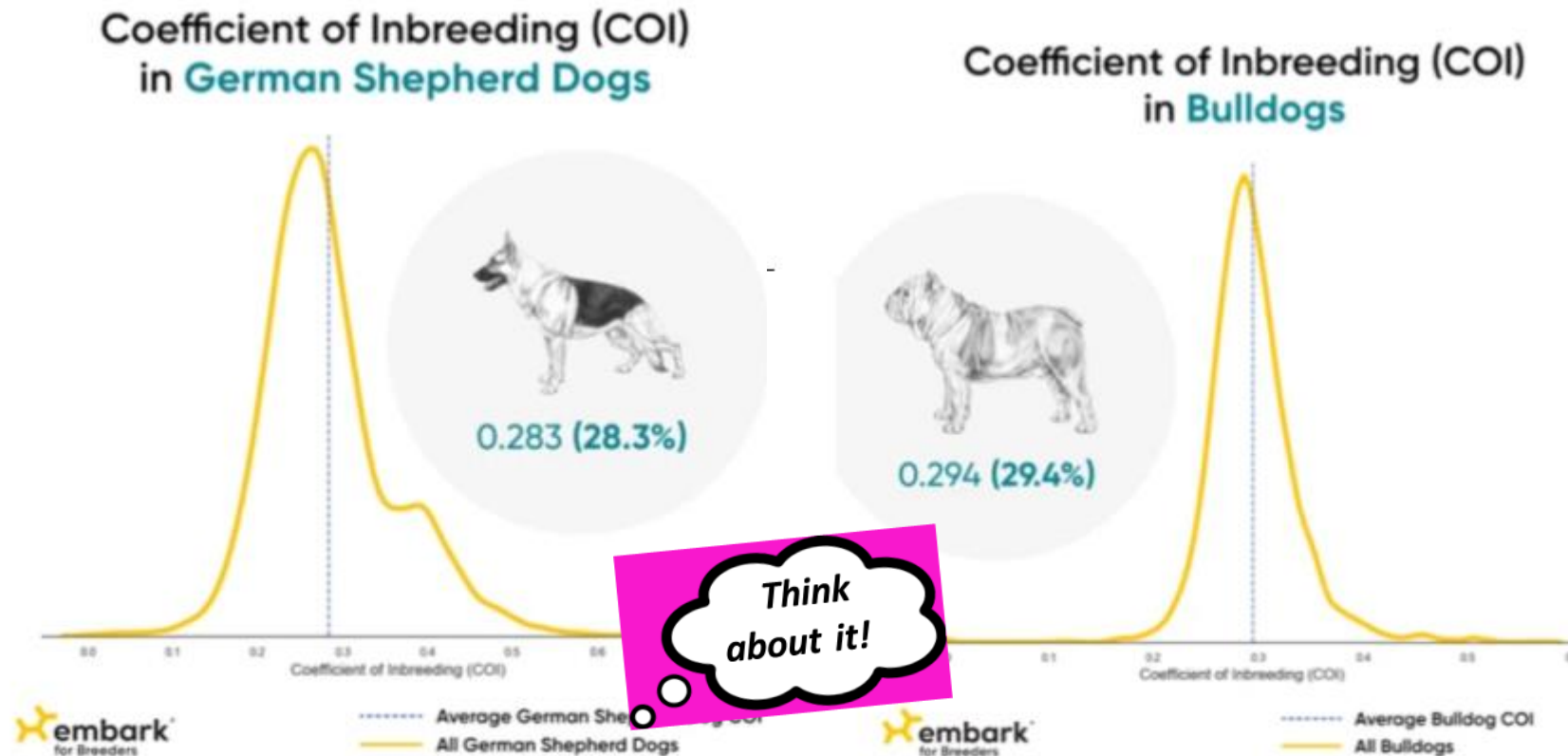
- Lots of links to information on Genomic vs. Pedigree COIs and on Linebreeding vs. Inbreeding.

Inbreeding how it can be reduced

- The Nordic breed clubs are careful to keep the inbreeding rate low to maintain health.
- **Maximum recommended number of offspring per individual dog:**
 - Sweden, Norway and Finland have breed-specific and overall limits.
- **Great Danes in Germany – use of older dogs in breeding... based on longevity and health of dog and offspring.**
- **Average inbreeding coefficients (pedigree-based):**
 - Sweden: **The inbreeding coefficient of a litter should not exceed the average value for the breed...**
 - The average inbreeding coefficient in Finland is monitored, e.g. for Ridgebacks - **Breed Club recommendation is to keep the maximum five-generation inbreeding coefficients of litters at 6.25 %.**

Embark COI's

Firstly, remember that a brother-sister mating results in a COI of 25%. **That is inbreeding.** Look at these values from Embark, as examples.



Both the German Shepherd Dog and the Bulldog have average COIs above that level... meaning that many of the dogs have values that are higher still. **On average, dogs with a COI >25% share more genetic material from common ancestors than would arise from a brother-sister mating.**

Reference:

[Ask Aimee: What's the difference between pedigree COI and genomic COI?](#)

AKC numbers...

- **2020 – 32.9% of litter complement individually registered.**
- Less than 1/3rd of puppies born (litter complement) end up being registered. – **That represents the ‘potential’ breeding stock.**
- That mean 2/3’s of the current genetic diversity is lost.
- If the selection of breeding stock is further narrowed – by only showing very specific ‘types’, only using show winning males, using dogs and bitches for too many litters... this decreases further.
- Bernese Mountain Dog estimates – 43% of pups registered in 2020. Overall, estimates that are that **9-12%** of eligible dogs are bred.
 - **Hmmm.... Low lifespan, cancer, reproductive problems.**



Where are you at now?

What you see is what you got from what you did.

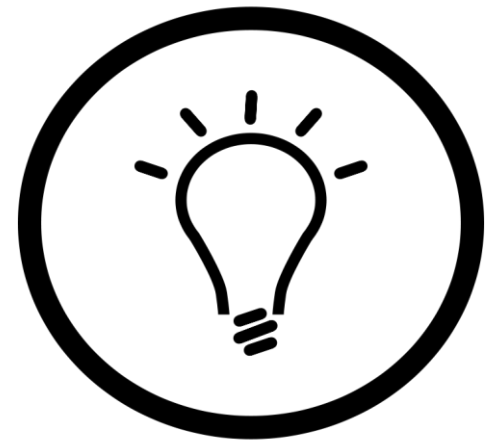
- What is the evidence that people in your breed have been selecting for health, longevity and good temperament?
- What is the evidence that people are selecting for the benefit of the breed vs. their personal achievement?
- Are dog exhibitions/ shows embracing the diversity within the breed... “We have always only judged for soundness.”
- If you want long-lived dogs you should bring longevity into your breeding decisions!

What criteria have been used in selection??

- (Over)Use of popular, show winning sires?
- Narrow view of 'type' - desirable appearance?
VS.
- Broad and informed view of overall health, longevity, performance, etc?
- **If you SAY: 'we want healthy, long-lived dogs with good temperaments' ...
and then CHOOSE based on the likelihood of getting a BIS puppy ...
you are unlikely to achieve the former.**
- DATA: Genetic studies of hunting dogs... higher frequency of genes for improved physiology, intelligence, endurance compared to companion/terrier. Because selecting on performance/ those attributes.



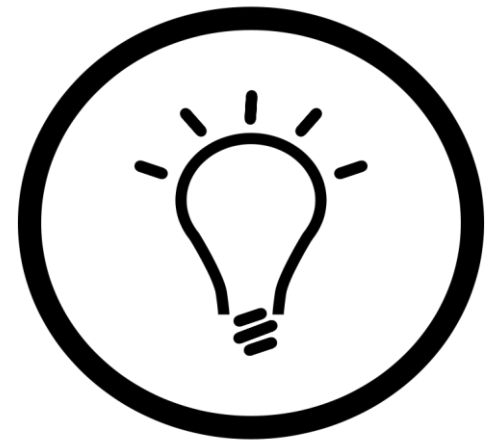
Solutions?



- Review the criteria being used for selection. Use the Big Picture approach.
- Reduce relatedness of sire to dam – **TOOL: Coefficient of Inbreeding**
- Limit numbers of offspring by individual dogs (*popular sire and his bros and sons!*)
- Use **higher proportion of** available **healthy (in the broadest sense)** stock
- Within-breed “crossing” (working vs. showing)
- Make use of overseas bloodlines (depends...)
- Outcross for challenged breeds – carefully planned and monitored

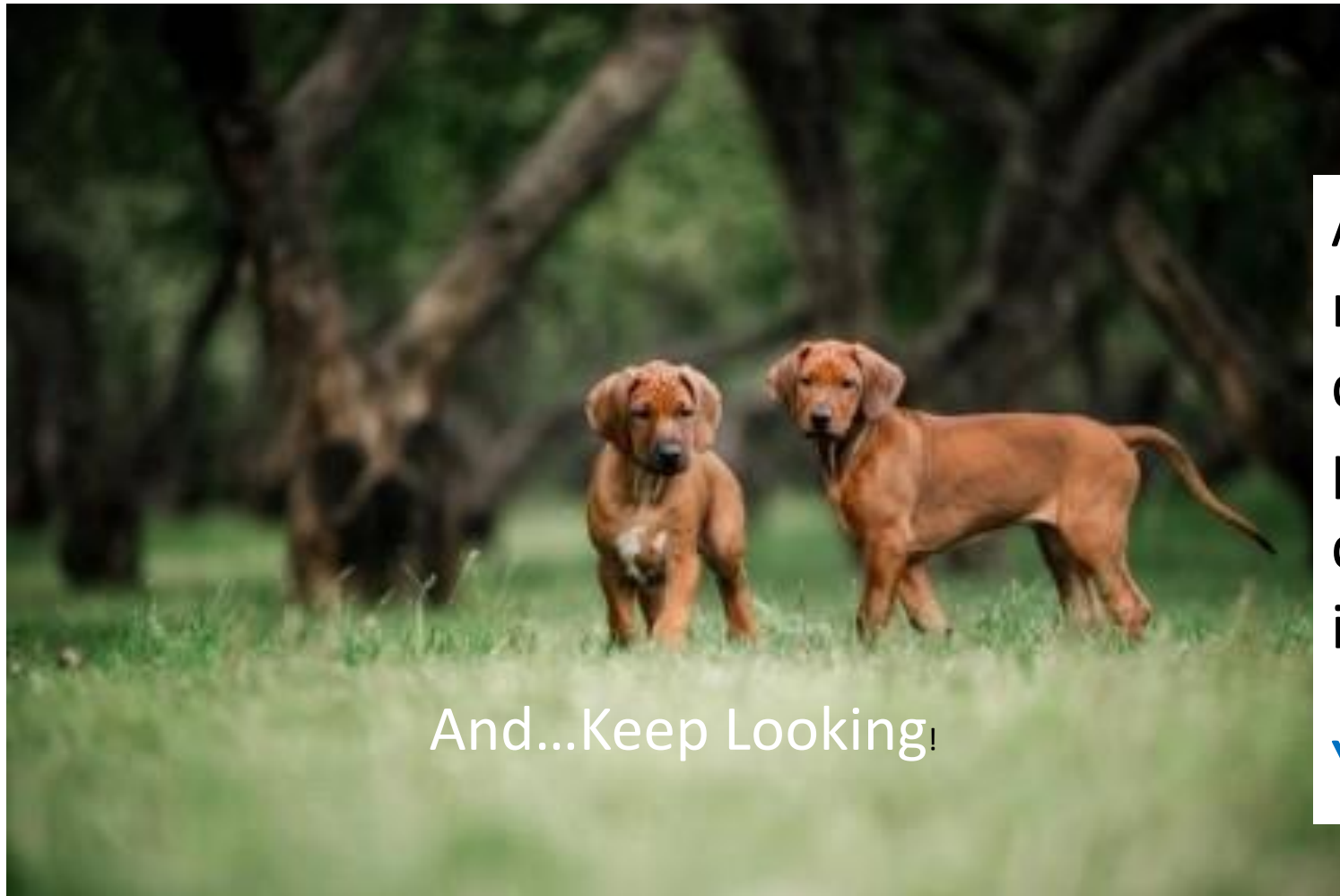
References on cross-breeding:
[Cross-breeding](#) programs and information

Solutions?



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- Make use of overseas bloodlines (depends...)
- Outcross for challenged breeds – carefully planned and monitored
- *Do dog shows need to change? Could have health tests BEFORE dogs enter the ring, e.g.*





And...Keep Looking!

All the information you need to make breeding decisions to support and preserve the health of your dogs and sustain your breed is available.

You just have to use it.