

Genomic Typing Project

FROM DLA DIVERSITY TO WHOLE GENOMIC DIVERSITY

Pilot study started in April 2016 in cooperation with Dr. Mészáros from the University of Natural Resources and Life Sciences in Vienna and is still ongoing.



DLA Typing Project

HOW IS THE DLA GENETIC DIVERSITY IN THE RHODESIAN RIDGEBACK?



Genetic Diversity And Disorders

Definition: "The more different gene variants (alleles) are available within a population, the better is the adaptability to different environmental conditions. Genetic diversity is the fundamental for genetic fitness (vitality, resistance to diseases, fertility)"



Solve The Genetic Puzzle

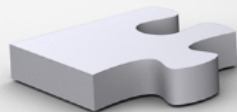
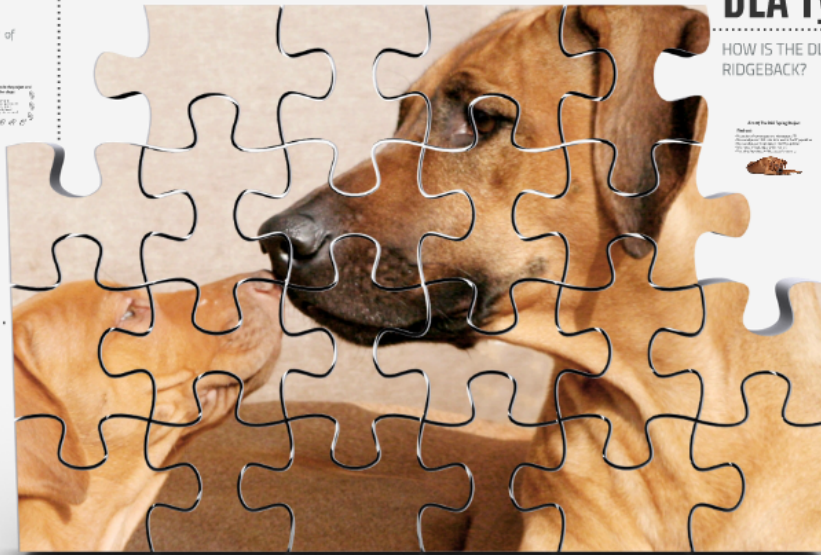
WHAT CAN WE DO?

It will be necessary to rethink breeding and selection strategies

Genetic diversity is important in functional genes like DLA's but also in the whole genome to reduce the risk of genetic autoimmune disorders

It will be necessary to maintain genetic diversity in single dogs but also in a whole population

Breeding needs to become a collaboration of breeders with practical experiences, vets and geneticists having analytical possibilities to maintain breed diversity



Strategies For Maintaining Genetic Diversity In The Rhodesian Ridgeback

NEW CHALLENGES FOR FUTURE BREEDING

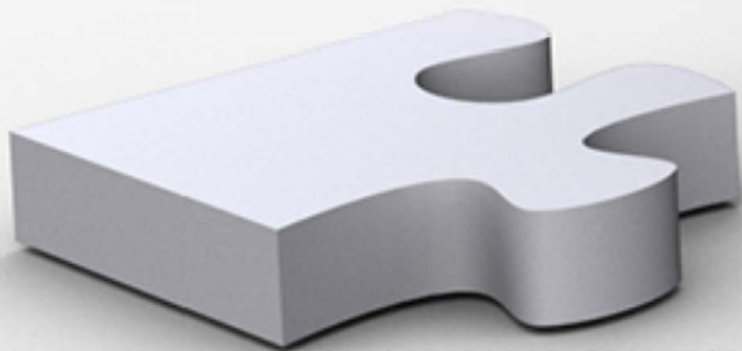
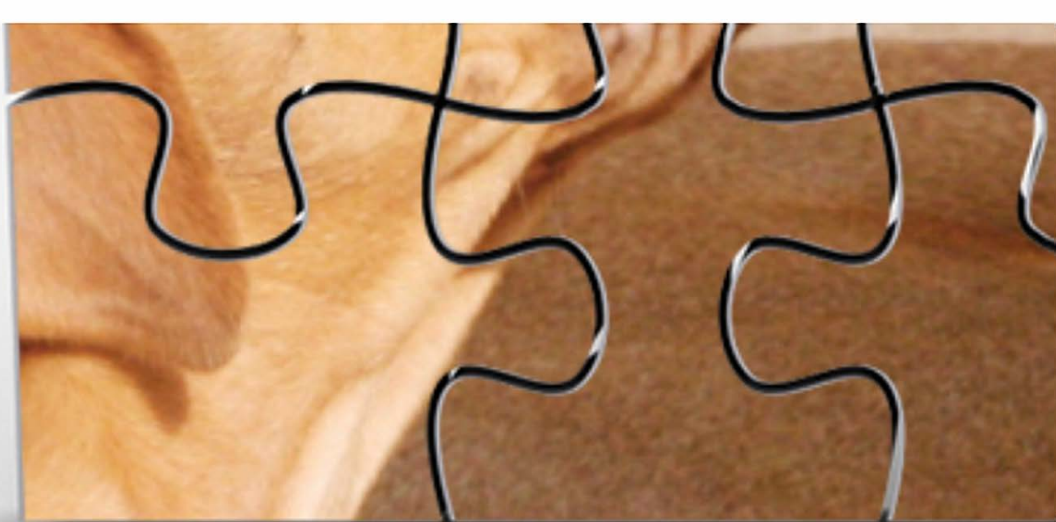
Dr. Anja Geretschlöger

Purebred Dogs

Closed Populations since more than 100 years

Studbooks where closed and only dogs with ancestries are used for breeding





Strategies For Maintaining Genetic Diversity In The Rhodesian Ridgeback

NEW CHALLENGES FOR FUTURE BREEDING

Dr. Anja Geretschläger

resistance to diseases, fertility

Purebred Dogs

Closed Populations since more than 100 years

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Advantages of closed populations

- fast genetic fixing of favoured breed characteristics
- homozygosity of desirable genes
- breeds get a recognition value

Closed Population:

Sexual isolation compared to other Populations



Open Population:

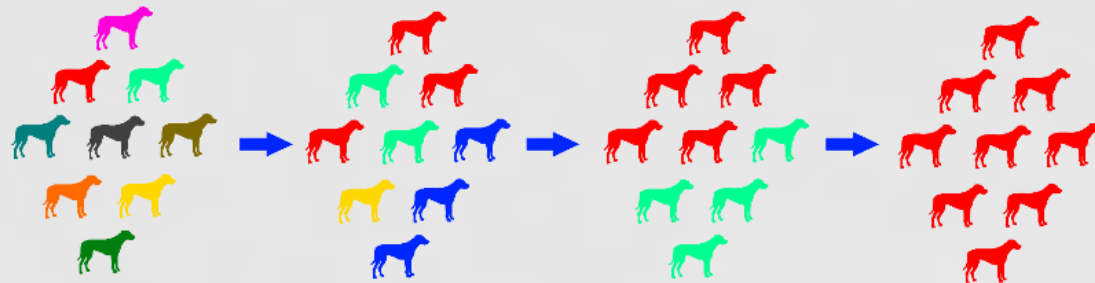
Exchange of genes with other Populations is possible



Problems of closed populations

Breeding of purbred animals = LOSS OF GENETIC DIVERSITY

*Phenotypic and genetic diversity decrease from generation to generation.
This proceeds the faster the smaller a population is.*



Effective Breeding Population

***"We have no limitation in genetic diversity -
we have a huge population!"***

*Crucial is not the number of dogs in the whole population!
But the effective breeding population!*

Effective Breeding Population

Whole Population
of a Breed



- breeding dog
- puppies
- young dogs
- old dogs
- family dogs
- working dogs
-

BREEDING DOGS



**SELECTION
DISORDERS**

*HD, ED, OCD, cardiac disorders,
epilepsy, dermoid cyst, genetic
disorders*



**SELECTION
PHENOTYPIC**

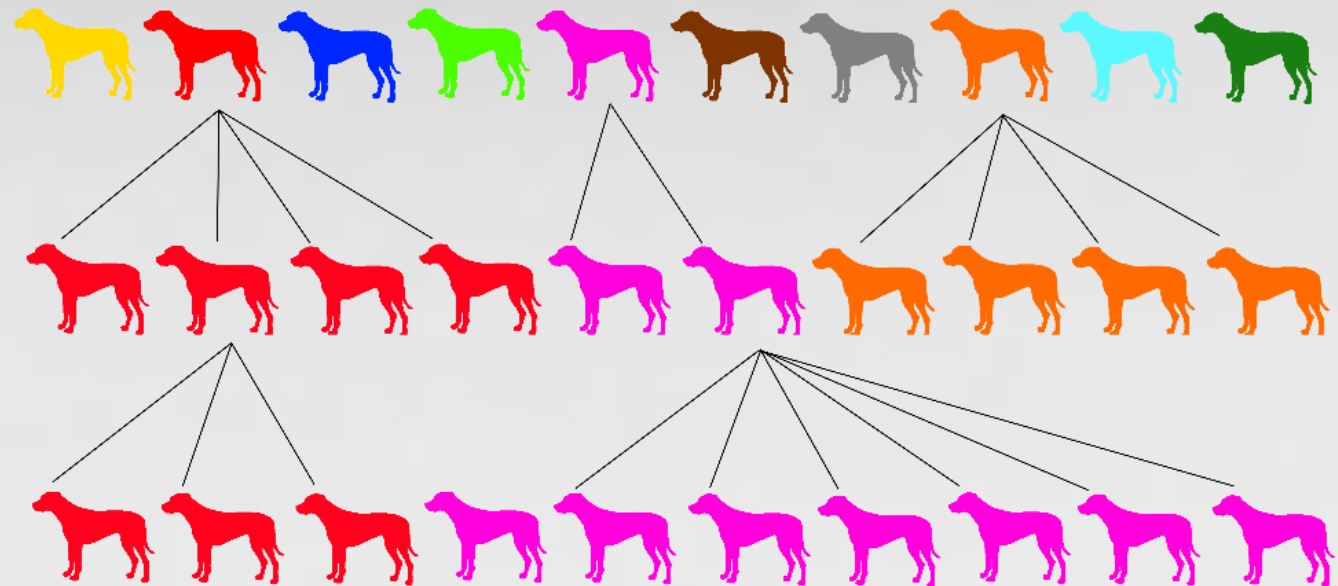
color, size, faulty ridge

LUCKY SURVIVORS



Popular Sire Effect

LUCKY SURVIVORS



Important Note

Not the whole population but the effective population is the determining factor!

*Whole population includes a lot of important genetic material unfortunately most of them is **DEAD GENETIC MATERIAL!***

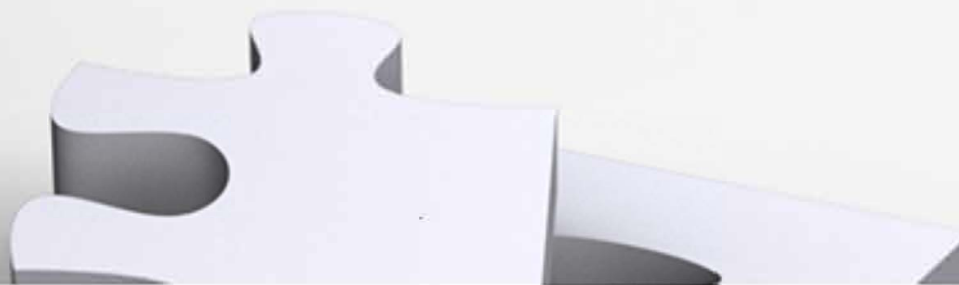
HOW IS THE DIVERSITY IN THE
HUMAN GENOME?

⚙ Genetic Diversity And Disorders

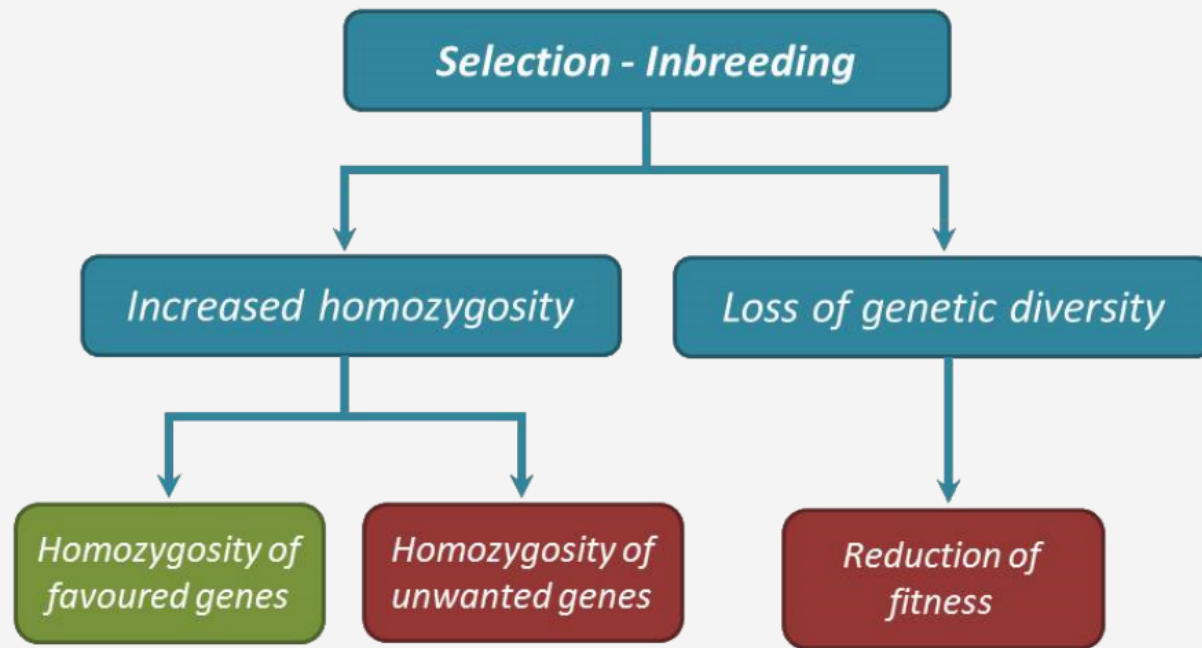
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Dogs

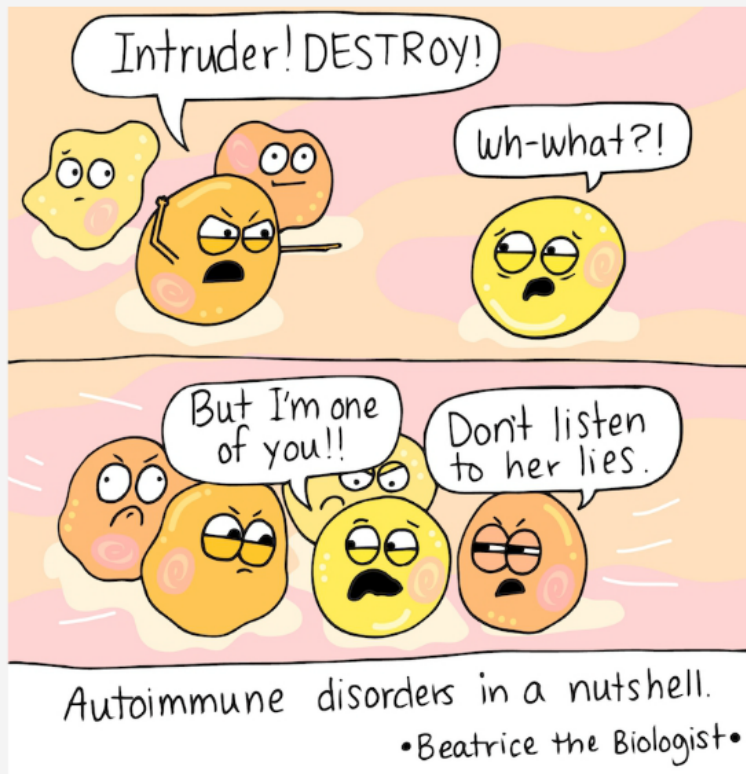


Loss Of Genetic Diversity



Increased homozygosity and loss of genetic diversity favours genetic disorders and complex disorders like autoimmune diseases

Autoimmune disorders

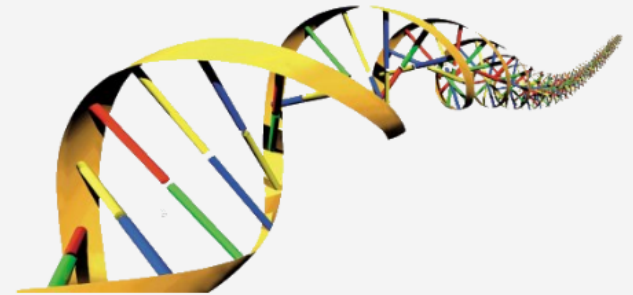


- Autoimmune disorders = complex disorders
- Involve genetic predisposition and environmental factors
- Immune system decides to attack healthy cells of the own body - dysfunction
- Can affect different body tissues
- Can cause abnormal organ growth, changes and damage of organs and their function
- Often an infection precedes before development of an autoimmune disorder

Dog Leukocyte Antigen - DLA genes

Common name = MHC class II genes
Dog specific name = DLA genes

DLA genes are part of the immune system in the early immune response



Dual function:

they are indispensable for the functionality of the immune system
special gene variants are associated with different autoimmune disorders

Highly polymorph genes

DLA-DRB1	106 gene variants (alleles)
DLA-DQA1	26 gene variants (alleles)
DLA-DQB1	62 gene variants (alleles)

Combinations of 3 genes = HAPLOTYPES

More than 150 haplotypes in different breeds are known

BUT

***on average only 7 of these 150 possible
haplotypes per breed***

DLA diversity and heterozygosity

Heterozygosity

Inheritance of different DLA haplotypes from mother and father

- *Heterozygosity might lead to a higher resistance against infections*
 - *Minimum number of haplotypes is necessary for survival of a population*
- *Limited number of haplotypes enhances the risk of breed extinction due to new disorders, infections or changing environmental conditions*



DLA Typing Project

FERAGEN
Labor für genetische Veterinärdiagnostik



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RHODESIAN RIDGEBACK?

Genetic Diversity At

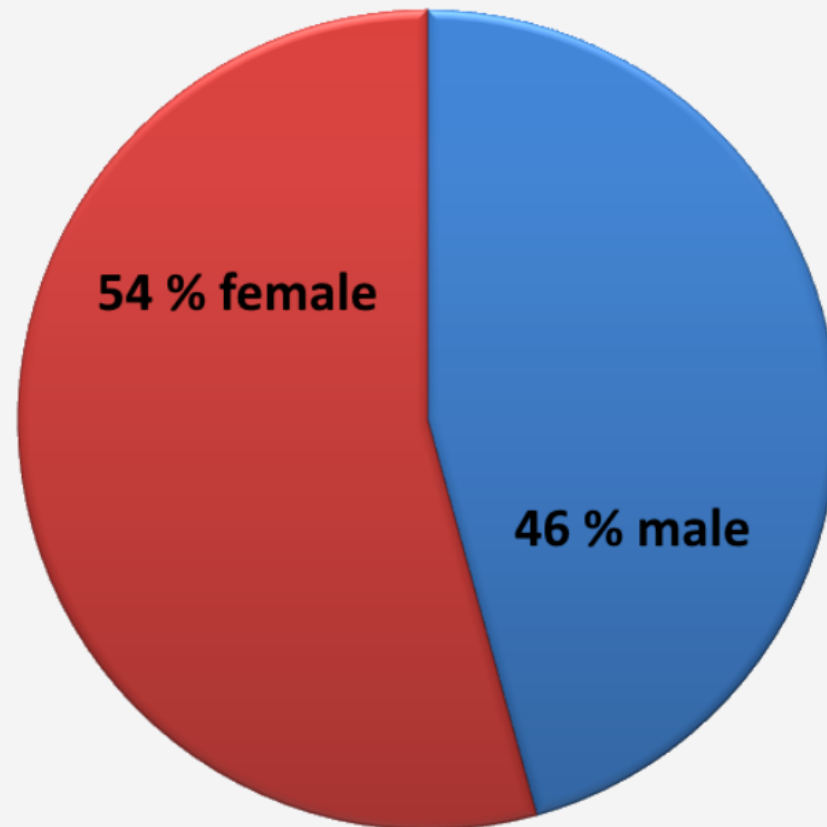
Aim Of The DLA Typing Project

Find out:

- Proportion of homozygous and heterozygous RR
- Number of present DLA variants (alleles) in the RR population
- Number of present haplotypes in the RR population
- Inheritance of haplotypes within Kennels
- Predicting haplotypes in litters based on parents

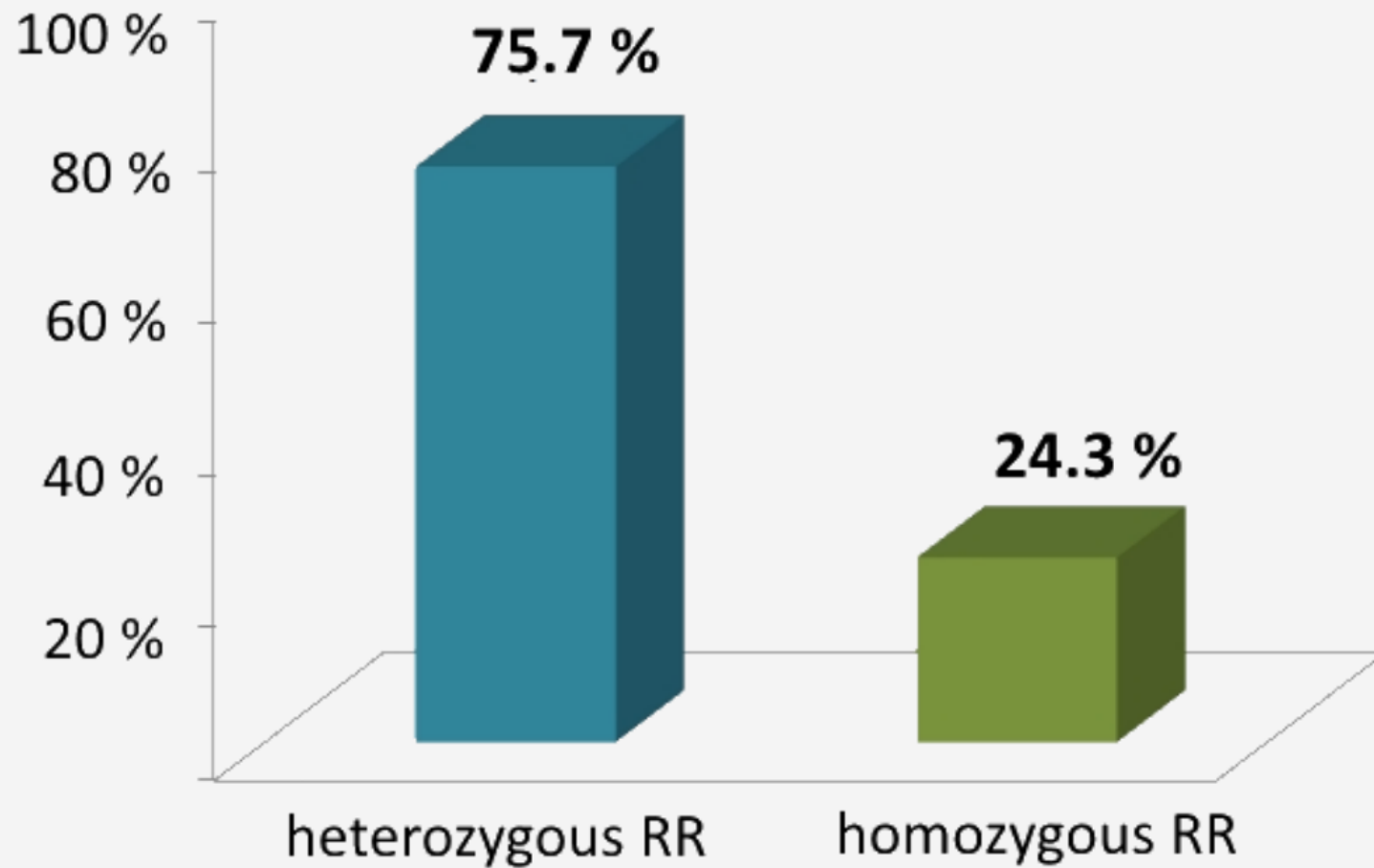


DLA typing
Proportion of female and male participants



70 tested dogs from
Austria/Germany/Suiss/Russia

DLA typing
Percentage of heterozygous and homozygous RR



Number of DLA alleles found

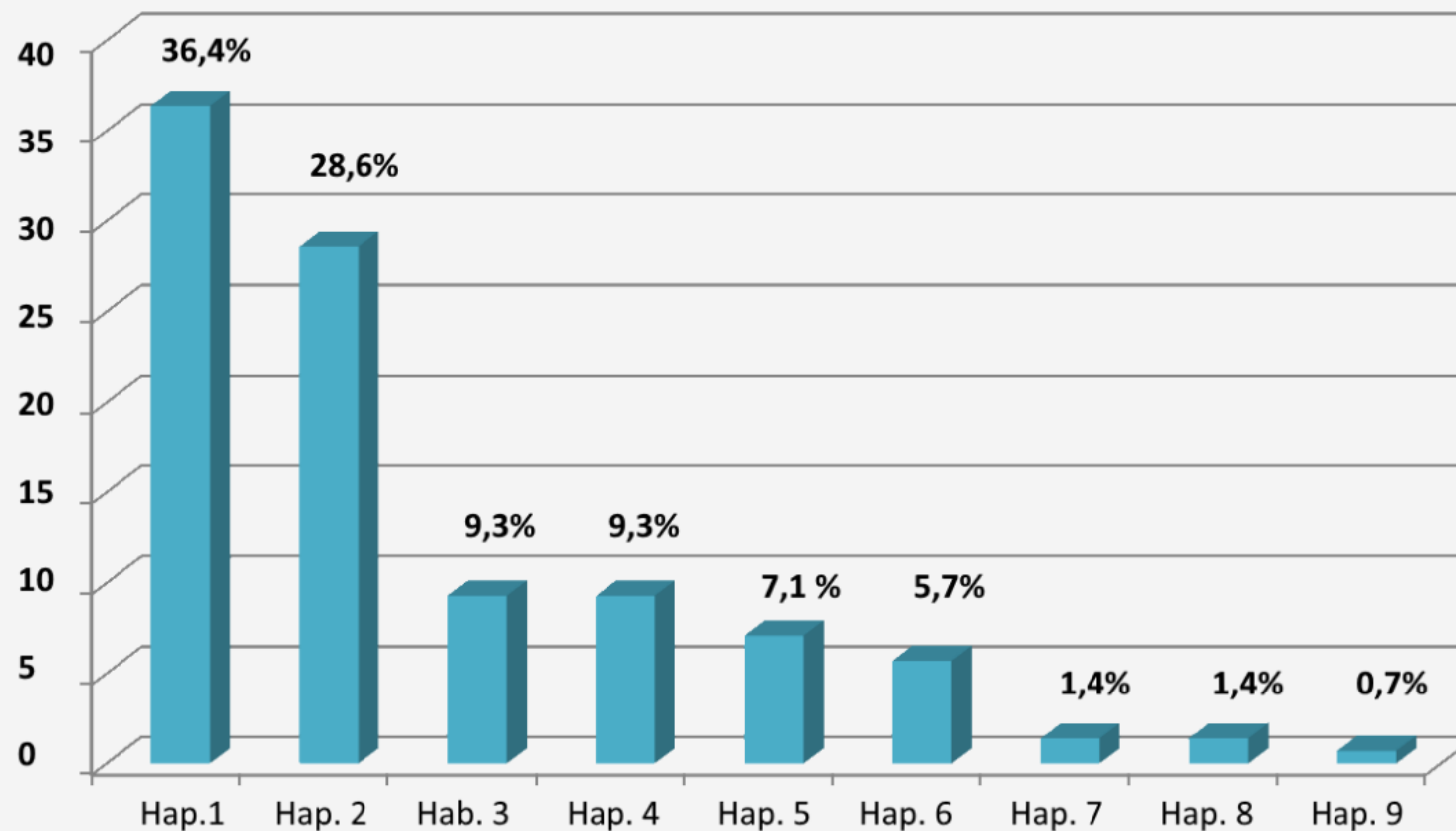
8 DLA-DRB1 Allele

6 DLA-DQA1 Allele

8 DLA-DQB1 Allele

**Combined to 9 different
haplotype**

Frequency of haplotypes found in the RR





Genomic Typing Project



University of Natural Resources
and Life Sciences, Vienna

eurofins



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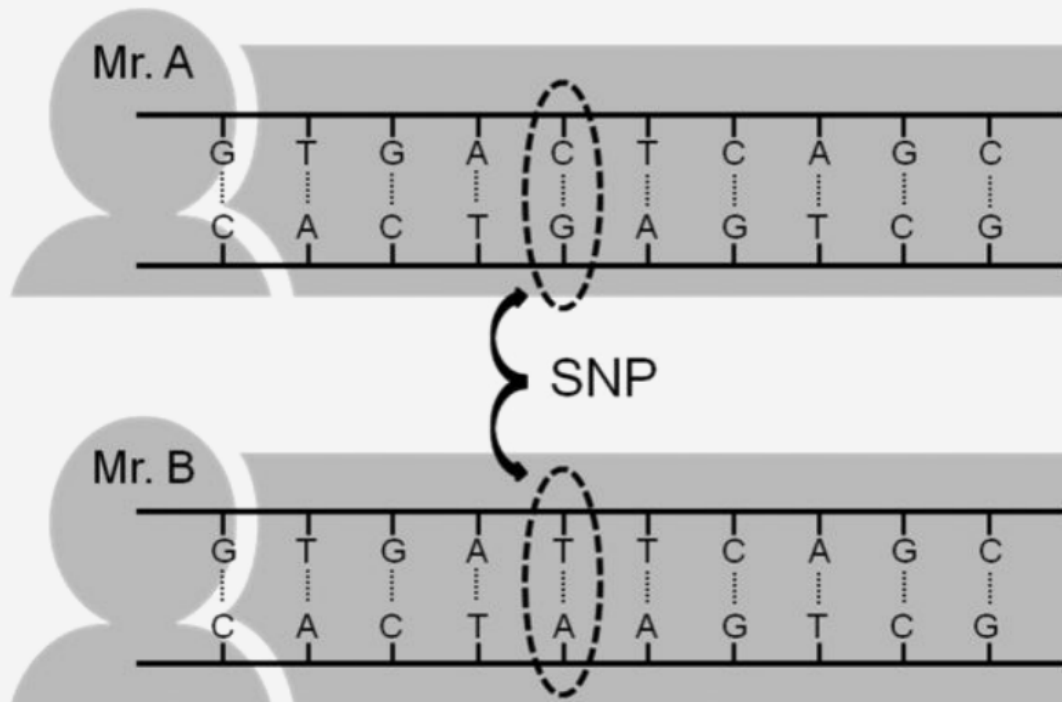
Primary aims

- Information of the whole genome diversity of selected RR
- Information of the whole genome diversity of the population
 - Assist breeders in mating decisions



SNP Genotyping

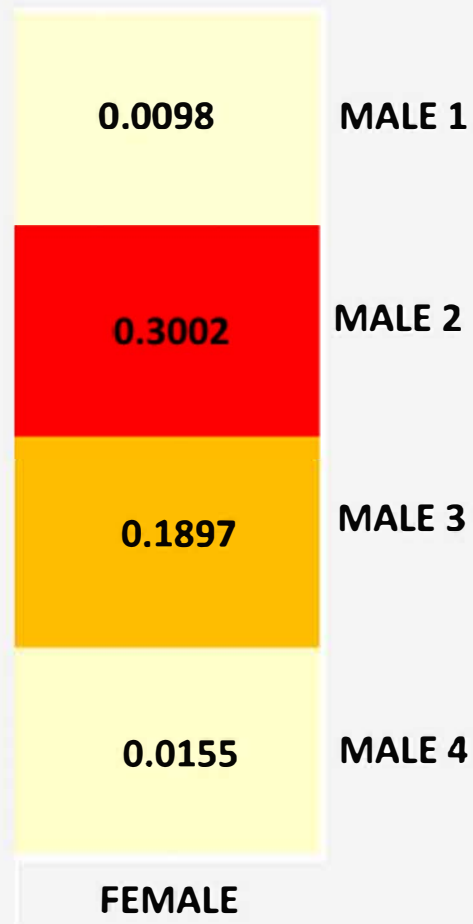
SNP = Single Nucleotide Polymorphisms



SNP data of 24 already
DLA typed RR

Analysis of 173,000
SNP markers

Mating suggestion



- Genomic data can identify relatedness of potential mate pairs
- Even if these are more distant relatives
- Reduction of potential inbreeding in offspring

Interpretation like relationship coefficient from 0 to 1
0.5 for parent- offspring or full siblings
0.25 for half-sibs or grandparent-grandchild
0.125 for first cousins and so on
pick up relatedness over all common ancestors
no pedigree needed

Follow up plans in the project and further steps

- Genomic inbreeding coefficients
 - State fo the art, no pedigrees needed
 - Individual values for each dog
- Relationship with other dog breeds
- Finding and identifying "selection marker"



Long-term genetic studies in dogs, cats, horses, and other domestic animals are still ongoing.



Solve The Genetic Puzzle

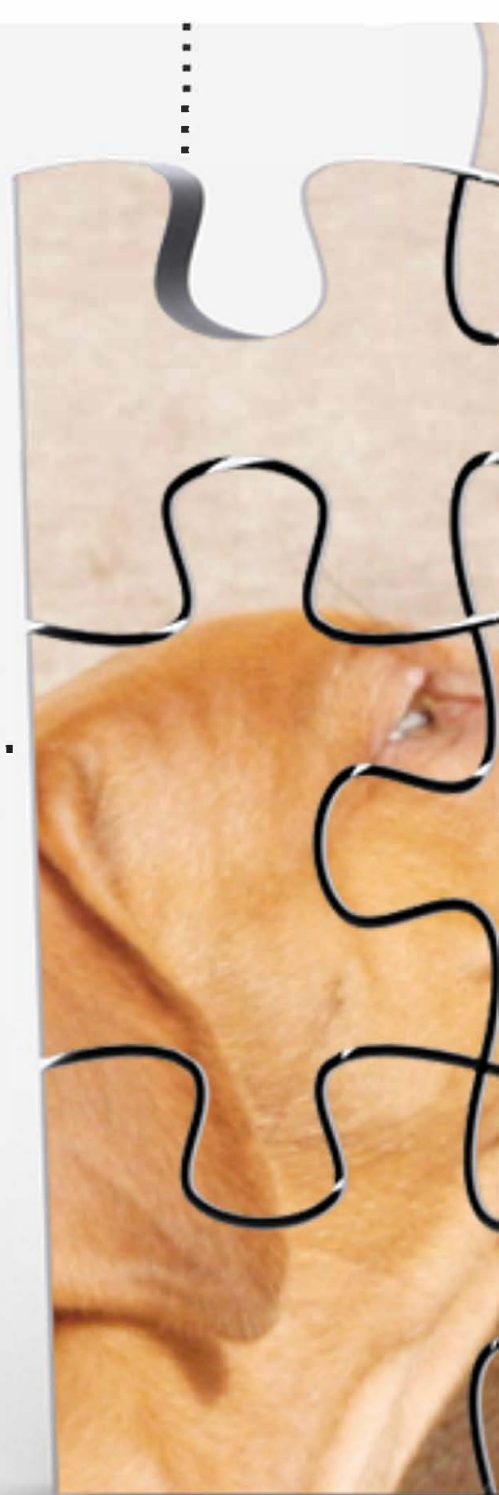
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Thanks for listening!



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