



## Coefficient of Inbreeding vs. Genetic Diversity Level in Greyhound

We introduced the MyDogDNA test last June<sup>1</sup>, which has been used on some German-bred Greyhounds in the meantime. In addition, we gave an overview of the levels of inbreeding (COI) in Greyhounds born in Germany<sup>2</sup>, which resulted in the recommendation to use tools to determine the real genetic diversity as well.

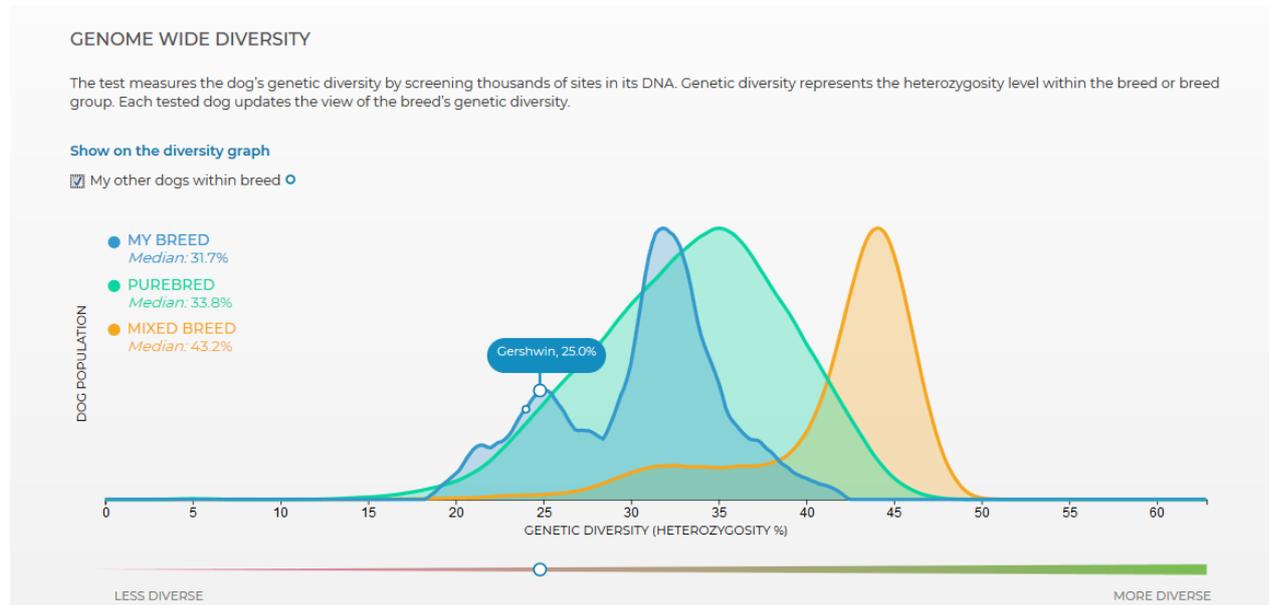
In this respect a comparison between the calculated COI and the measured genetic diversity would be interesting. So we will compare the following values:

- Coefficient of inbreeding for seven generations<sup>3</sup>
- Ancestor loss for seven generations<sup>4</sup>
- Genetic Diversity<sup>5</sup>: This is one aspect of the MyDogDNA test and is being analyzed by comparing more than 5000 SNP markers, which cover each of the 39 chromosome pairs in the dog genome with a defined intermarker distance. A particular emphasis was placed on marker selection in the chromosome 12, where genes of immunologic importance are located (DLA & MHC).

With a screening like this we can determine the level of heterozygosity, which means the proportion of inherited similar or different alleles (genetic information) for one trait the respective dog has gotten from his dam and sire. If a dog inherited many similar (homozygous) alleles and only a few different one, it will get a low score for “Genetic Diversity”. If it has inherited a lot of different genes, it will score much higher for “Genetic Diversity”.

A dog with a high share of homozygous genes does have a high congruence between outer appearance and inheritable traits, but may be less vital and adaptable. A (too) low level of genetic diversity is said to promote allergies and autoimmune diseases in dogs.

In the MyDogDNA database the data of more than 20000 dogs is saved, whose levels of “Genetic Diversity” range from 4 – 50 %. The results of more than 100 tested Greyhounds cluster around a median of 31,7 %.



Two of the tested dogs (blue circles) in comparison to all tested Greyhounds (blue line), to all purebred dogs in the database (green line, median of 33,8 %) and to all mixed-breed dogs in the database (orange line, median 43,2 %).

Listed below are the examined Greyhounds. These are ten dogs from Germany, two from Russia, Estonia, Ireland and France and one from Sweden. Seventeen dogs are show-bred, two are out of Irish racing-lines. According to their own statements, there should be data of more than 100 Greyhounds stored in the MyDogDNA database. Unfortunately they are not for public use.



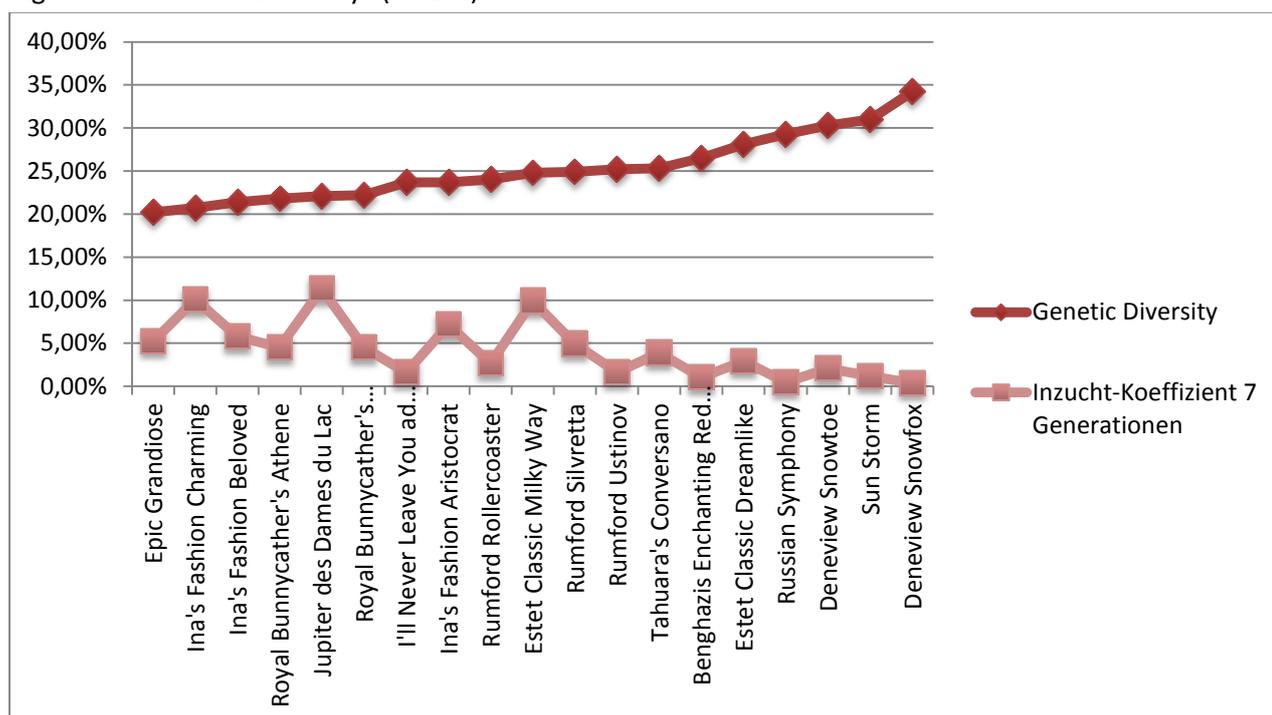
Dog's Name	Genetic Diversity	COI 7 Generations	Ancestor loss 7 Generations	Mutations	Genetic Health Index
Benghazis Enchanting Red Rose	26,50%	1,03%	30,30%		92
Deneview Snowfox	<b>34,20%</b>	<b>0,36%</b>	<b>25,60%</b>		<b>102</b>
Deneview Snowtoe	30,30%	2,08%	25,20%		95
Epic Grandiose	<b>20,20%</b>	5,20%	46,90%		<b>82</b>
Estet Classic Dreamlike	28,10%	2,93%	40,20%		92
Estet Classic Milky Way	24,80%	9,90%	54,70%		86
I'll Never Leave You ad Honores	23,70%	1,58%	30,70%		88
Ina's Fashion Aristocrat	23,70%	7,15%	44,10%		88
Ina's Fashion Beloved	21,40%	5,76%	47,20%		84
Ina's Fashion Charming	20,70%	10,09%	48,00%		83
Jupiter des Dames du Lac	22,10%	<b>11,33%</b>	51,20%		85
Royal Bunnycather's Aphrodite	22,20%	4,51%	39,80%		85
Royal Bunnycather's Athene	21,80%	4,51%	39,80%		85
Rumford Rollercoaster	24,00%	2,67%	36,60%		88
Rumford Silvretta	24,90%	4,92%	45,30%	-/del	80
Rumford Ustinov	25,20%	1,61%	46,50%		90
Russian Symphony	29,30%	0,46%	23,30%		94
Sun Storm	31,00%	1,17%	26,80%		97
Tahuara's Conversano	25,30%	3,88%	42,90%		90

### The relationship between Genetic Diversity and coefficient of inbreeding

If you compare the calculated COI with the measured levels of „Genetic Diversity“, you can – unsurprisingly – observe the following basic correlation:

The higher the COI is, the lower the level of „Genetic Diversity“ will be.

The dog of our group with the highest COI has also the 5<sup>th</sup> lowest „Genetic Diversity“ (Jupiter des Dames du Lac, COI 11.33 %, GD 22.10 %). On the other hand the dog with the lowest COI (Deneview Snowfox, 0.36 %) scores third highest for “Genetic Diversity” (34.2 %).





But we also see that there are some distinct deviations:

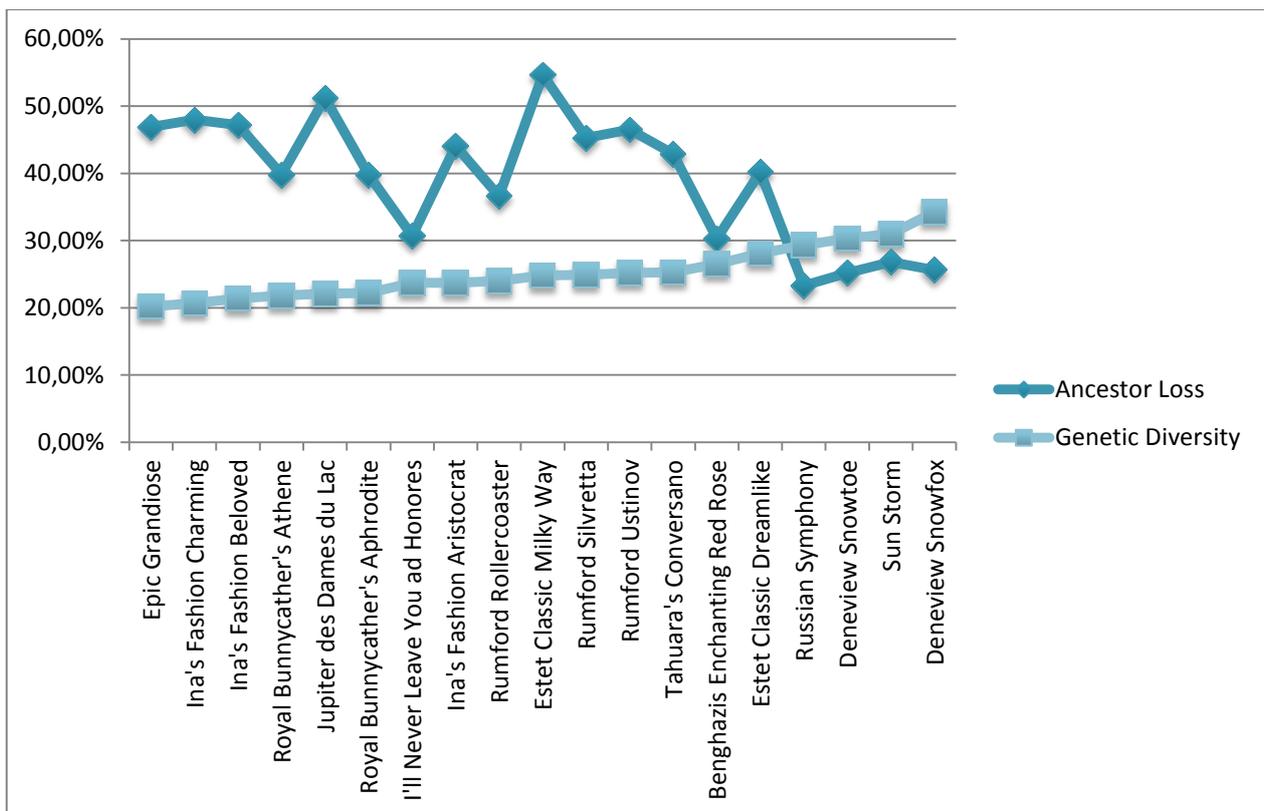
In one dog (Rumford Ustinov) we find a “Genetic Diversity” of only 25.2 %, but with 1.61 % also a comparatively low COI. In comparison, Tahuara’s Conversano shows almost the same “Genetic Diversity” (25.3 %), but his COI is more than twice as high at 3.88 %.

### Maybe the ancestor loss is more reliable in predicting the genetic diversity?

At first glance we find another relation:

The higher the ancestor loss is, the lower the genetic diversity.

But there are exceptions from that rule as well. The bitch „Estet Classic Milky Way“ shows a “Genetic Diversity” of 24.8 %, but also the highest ancestor loss of all nineteen dogs with 54.7 %. By contrast, the male Rumford Rollercoaster scores similarly at 24.0 % for “Genetic Diversity”, but has a much lower ancestor loss with only 36.6 %.



Eventually we are only able to deduce from a sample of a size this small that calculated data like COI and ancestor loss can give us only a hint of a particular dog’s actual genetic diversity. Two more examples:

The dog „Jupiter des Dames du Lac“ scores second highest for ancestor loss of this sample (51.2 %), the highest COI (11.33 %) and therefore shows up in the last quarter of the group for genetic diversity (22.10).

On the other hand the bitch „Estet Classic Dreamlike“ has an ancestor loss of 40.2 %, which corresponds with the mean value of this group (39.22 %), shows up in the upper half of the sample with a COI of 2.93 %, but boasts a surprisingly high score for “Genetic Diversity” of 28.10 – fifth highest result of the whole group.

In order to take this important factor into account when making the breeding decisions for your kennel or even for whole populations, a much larger amount of data should be compared. Until then, we can only recommend to collect information about the actual genetic diversity with a test like MyDogDNA of so much breeding stock as possible.





Footnotes:

- 1) „Deutsche Greyhounds bei MyDogDNA“: <http://katrin-und-joachim.de/2017/06/20/deutsche-greyhounds-bei-mydogdna/>
- 2) „Greyhound Breeding in Germany 2012 – 2016“: <http://katrin-und-joachim.de/2017/10/13/greyhound-breeding-in-germany-2012-2016/>
- 3) Calculated with the Tabular Method for seven generations. Source: <https://greyhound.breedarchive.com>
- 4) Calculated with formula  $2^{(\text{Anzahl der Generationen} + 1)} - 2$  for seven generations. Source: <https://greyhound.breedarchive.com>
- 5) „MyDogDNA® Technical Data Sheet“: <http://www.mydogdna.com/sites/default/files/mdd-os-technical-sheet-2017.pdf>
- 6) “Introducing MyDogDNA Pass and its reports - Part I: What is the Genetic Health Index (GHI) given by the MyDogDNA Pass?”: <http://www.mydogdna.com/blog/introducing-mydogdna-pass-and-its-reports-part-i-what-genetic-health-index-ghi-given-mydogdna>