



Coefficient of Inbreeding vs. Genetic Diversity Level in Greyhound

We introduced the MyDogDNA test in June¹, 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 Germany², 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 generations³
- Ancestor loss for seven generations⁴
- Genetic Diversity⁵: 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 %.



Gershwin
Greyhound
870024383875

Gershwin: 25.3%

[Show on the diversity graph](#)

My other dogs within breed

Select a view

Greyhound
(> 100 tested dogs)
Median: 31.7%

Short-haired Sighthounds
Median: 33.8%

- Azawakh
- Greyhound
- Hungarian Greyhound
- Italian Greyhound
- Polish Greyhound
- Sloughi
- Spanish Greyhound
- Whippet



One of the tested dogs (blue circle) in comparison to all tested Greyhounds (blue line), to all short-haired Sighthounds in the database (green line, median of 33,8 %) and to all dogs in the database (orange line, median 34,8 %).



Listed below are the examined Greyhounds. These are seven dogs from Germany, two from Russia, and one each from Estonia, Ireland and Sweden. Eleven dogs are show-bred, one is 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.

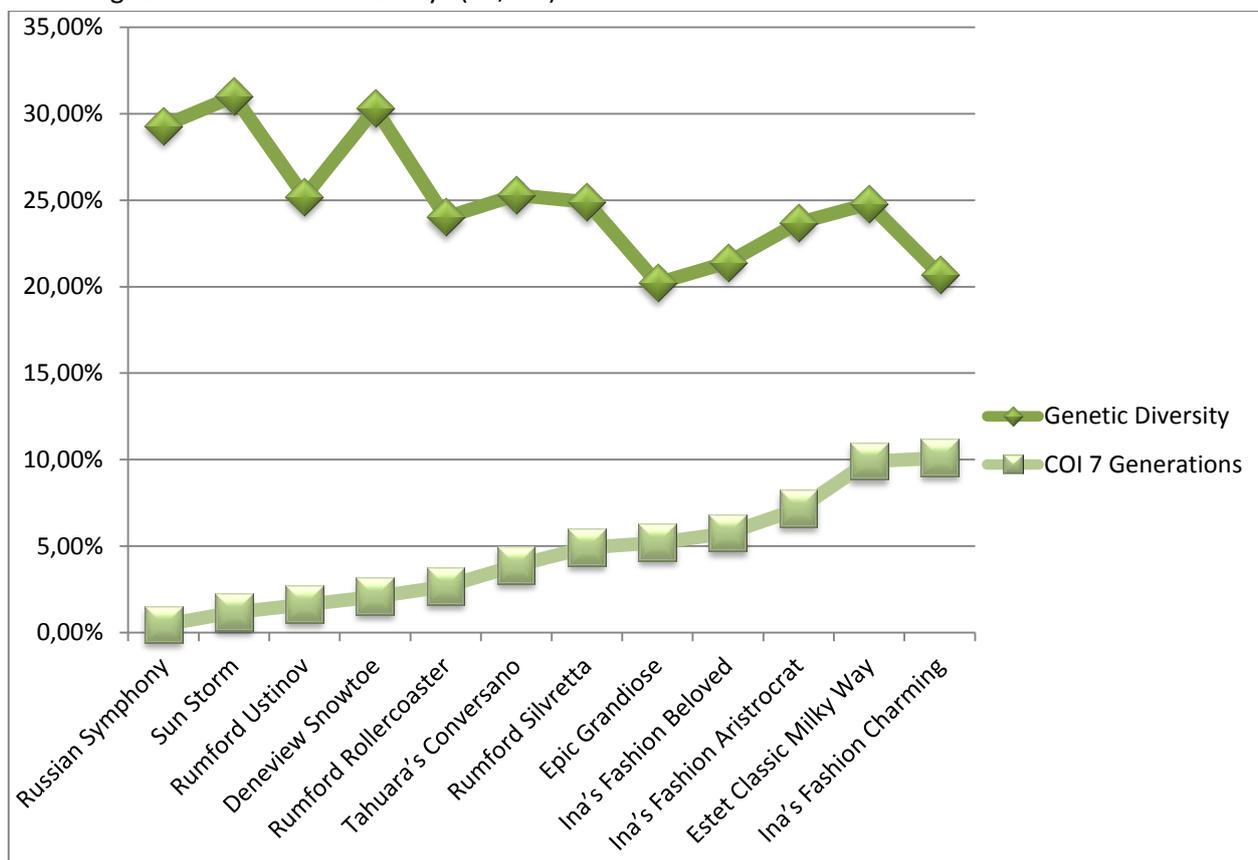
Dog's name	Genetic Diversity	COI 7 Generations	Ancestor loss 7 Generations	Found Mutations	Genetic Health Index
Deneview Snowtoe	30,3 %	2,08 %	25,2 %	-	95
Epic Grandiose	20,2 %	5,20 %	46,9 %	-	82
Estet Classic Milky Way	24,8 %	9,90 %	54,7 %	-	86
Ina's Fashion Aristocrat	23,7 %	7,15 %	44,1 %	-	88
Ina's Fashion Beloved	21,4 %	5,76 %	47,2 %	-	84
Ina's Fashion Charming	20,7 %	10,09 %	48,0 %	-	83
Rumford Rollercoaster	24,0 %	2,67 %	36,6 %	-	88
Rumford Silvretta	24,9 %	4,92 %	45,3 %	DEL / -	80
Rumford Ustinov	25,2 %	1,61 %	46,5 %	-	90
Russian Symphony	29,3 %	0,46 %	23,3 %	-	94
Sun Storm	31,0 %	1,17 %	26,8 %	-	97
Tahuara's Conversano	25,3 %	3,88 %	42,9 %	-	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 second-lowest „Genetic Diversity“ (Ina's Fashion Charming, COI 10,09 %, GD 20,07 %). On the other hand the dog with the lowest COI (Russian Symphony, 0,46 %) scores third highest for „Genetic Diversity“ (29,3 %).





But we also see that there are some distinct deviations:

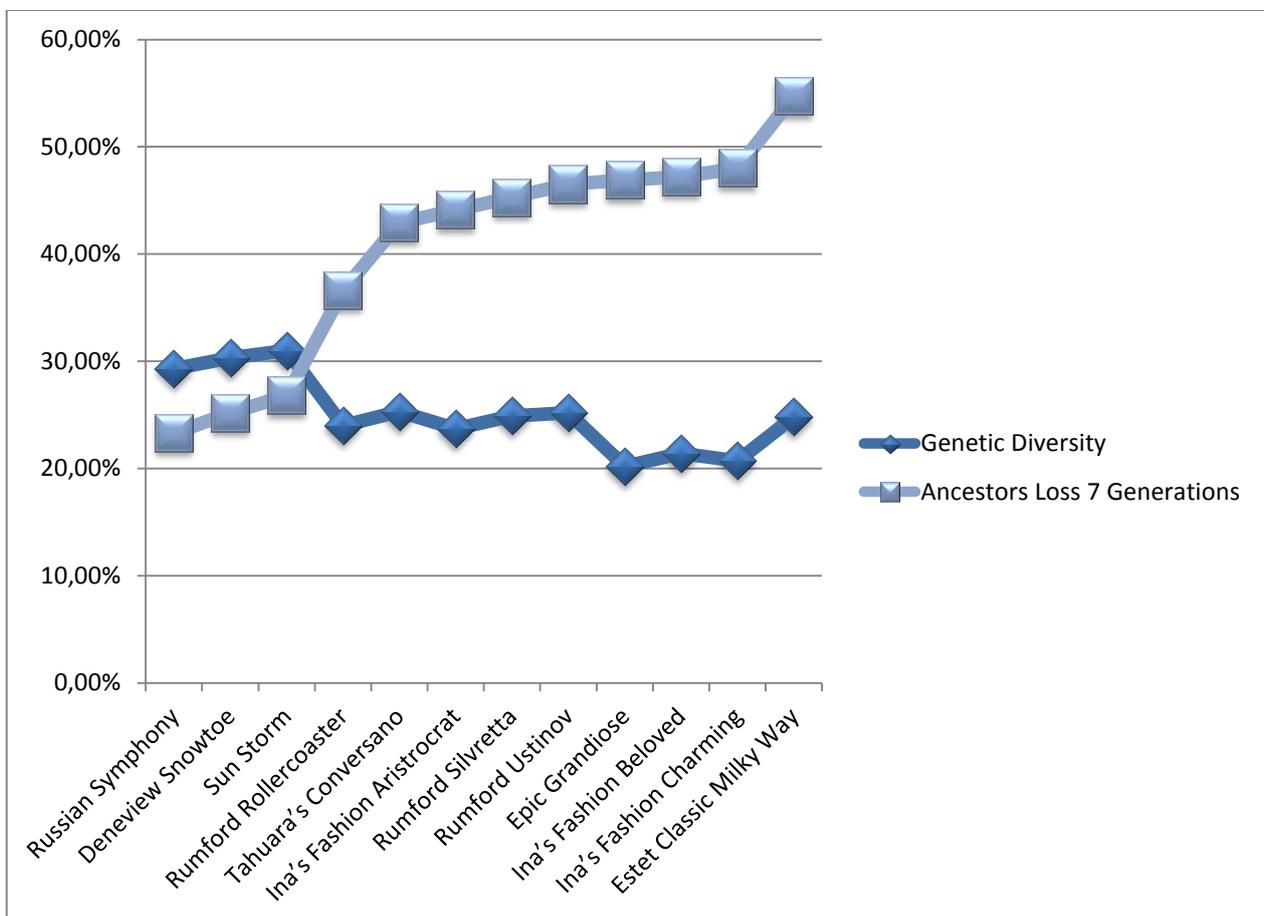
In one dog (Rumford Ustinov) we find a “Genetic Diversity” of only 25,2 %, but with 1,61 % also a comparatively low COI. In comparison, Tahuara’s Conversano shows almost the same “Genetic Diversity” (25,3 %), but his COI is more than twice as high at 3,88 %.

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 twelve 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.

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.



Genetic Health Index⁶

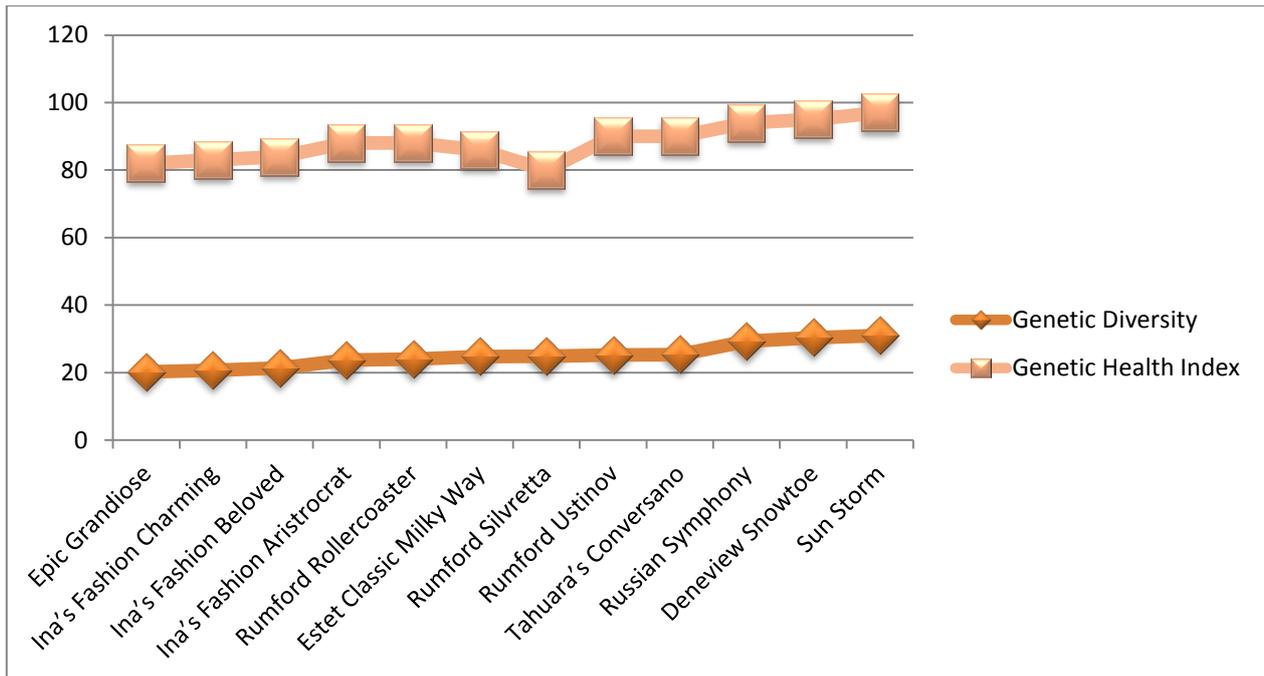
As a summarizing test result, MyDogDNA gives a „Genetic Health Index“ for every tested dog.

This is composed from the results from the tests of genetic diseases and the level of “Genetic Diversity”. This index can change with time, as it is continuously compared to the scores of all tested dogs in the database.

“100” is the average value of all dogs in the database. If a dogs scores lower than 100, its level of “genetic health” is assumed to be lower than average, if he scores higher than 100, it is better than average.

As only one of the twelve dogs of our group had been positively tested for a genetic disease, we can say that the „Genetic Health Index“ of the other eleven dogs solely depends on their (invariably quite low!) results for „Genetic Diversity“.

One of the twelve is a carrier for Neuropathy, you should be able to spot it by yourselves:



All in all we must face the fact that in all twelve tested Greyhounds we find such low levels of genetic diversity, that not even one reaches the average level of all tested dogs in database (score of 100 or more) – and this without carrying a bunch of nasty inherited disorders...

So it is high time to further investigate and to consider the factor “Genetic Diversity” when making future breeding decisions.

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>