

DNA Testing Is Changing Our Thinking About Belgian Shepherd Dog Coat Color Genetics

Through the research findings of Dr. Sheila Schmutz, at the University of Saskatchewan, Canada, we are learning a great deal about what color genes Belgian Shepherd Dogs carry. We also must discard long held beliefs and theories about their coat color genetics, as many are no longer accurate.

Using DNA swabs from various Belgians (Groenendaels, Laekenois, Malinois, and Tervuren), submitted from owners in Canada, U.S.A., and Holland, Dr. Schmutz and her team were able to pinpoint coat color genes carried by the individual specimens tested. Some were surprises, some not so much when their progeny were known.

We had long been told that the dominant black was the A^S gene. Through molecular testing this has been disproved. Dominant black is on a separate locus, referred to currently as the “ K ” locus (for black K), until that gene is identified. In order of dominance: K = dominant black, k^{br} = brindle, and k = nonblack.

Uniform black coat in a Groenendael can be inherited as a dominant or as a recessive. Since no living brindle Belgian Shepherds were found to test, we’ll ignore the k^{br} for now, although historically Belgians have carried this gene. A Groenendael, at the “ K ” locus, would have any of the following:

KK = two dominant black color genes
 Kk = one dominant black and one nonblack color gene
 kk = two nonblack color genes

A Groenendael is, by definition, black, and the above states that at the “ K ” locus a Groenendael could carry two nonblack color genes (kk). How could a Groenendael be black and not carry black coat color genes? The explanation for this is to be found on the “ A ” locus. DNA testing has firmly established that Belgians carry two of the following coat color genes that are found on the “ A ”:

a^Y = fawn
 a^t = black-and-tan
 a = recessive black

A Groenendael whose genetic makeup is kk , aa would be a recessive black. At the “ K ” locus, all Tervuren, Malinois, and Laekenois are kk , carrying two nonblack color genes. At the “ A ” locus they must carry at least one a^Y allele.

We have, in the last decade or so, seen an increase in Tervuren producing Groenendael puppies. The explanation for this is that besides carrying one a^Y gene, both parents had to carry the recessive black a gene. The genetic formula for a black puppy from Tervuren parents is the same as a recessive black Groenendael from Groenendael parents, kk, aa .

Only one Groenendael specimen, tested by Dr. Schmutz and her team, carried the a^t recessive black-and-tan gene, while the rest of the Groenendaels were either $a^Y a^Y$ or $a^Y a$. The coat color genetic formula for this single dog was $Kk, a^Y a^t$. Another Groenendael had a genetic formula of $KK, a^Y a^Y$. Another was $Kk, a^Y a$. Yet another was kk, aa .

The Malinois and Laekenois tested were $kk, a^Y a^Y$, although we know that both can also occasionally carry the a^t black-and-tan or a recessive black.

In summary, at the K locus:

KK – the Belgian is black.

Kk - the Belgian is black but also carries a non-black gene.

kk - the Belgian is not black, or could be a recessive black if carrying the aa recessive black genes at the A locus.

All Laekenois, Malinois, and Tervuren are kk at the K locus. Most are $kk, a^Y a^Y$. The litterbox “surprises” come when both parents also carry an a^t or an a gene instead of another a^Y .

What gene distinguishes a fawn Belgian Shepherd Dog from a lighter colored Belgian? The long-held belief was that it was the C and C^{ch} genes that were responsible. Dr. Schmutz and her team have ruled the Tyrosinase gene out, which is the gene called C in most other mammals. Currently they are conducting molecular testing to finally pinpoint just what gene is responsible

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