

Italian Greyhound Coat Color DNA Study

an update and information page for the owners of Italian Greyhounds who have contributed DNA brushes to the study

This pdf was prepared in November 2020 from a webpage mounted in spring 2006 and last updated on March 6, 2010 by Sheila Schmutz.

The Study

We are grateful to [Teri Dickinson, DVM](#) for coordinating the samples, photos, consent forms, etc. for this study conducted on behalf of the Health Committee of the Italian Greyhound Club of America (IGCA), who funded the study. We also thank the 25 dogs and their owners who contributed to the study. The dogs donated DNA via cheek brushes, hair clippings and posed for the photographs.

The 25 DNA brushes arrived in Saskatoon at our lab in March and April, 2006. The collection represents a wide variety of coat colors, but as we've discovered, probably not all the possible colors that occur.

Call names that were provided will be used, not the registered names of the dogs. Generic information will be posted on this site. Specific information will be emailed to the owner of a specific dog. We have completed DNA testing for A, B, and E. Although all dogs were tested for D also, not all dilute dogs had the common mutation and so testing continues for this locus. Furthermore we tried to determine which dilute dogs develop color dilution alopecia and if this is associated with a specific genotype, but we did not succeed in this.

Fawn, A Locus Genotypes

All IG were a^y/a^y at the agouti signal peptide (*ASIP*) gene. This allele is the dominant allele in this series. Fawn coat color, caused by this allele, is used to describe a variety of shades from yellow to red in many dog breeds. Fawn dogs have primarily phaeomelanin pigmentation. In the presence of an *E* or E^M allele, phaeomelanin is caused by the presence of at least one a^y at the agouti signal peptide (*ASIP*) gene.

IGs are called red, if they are dark. They are called fawn, if they are quite light, and red-fawn if they are in-between. Wizard, at the left, is an example of an IG that would be called red.



Both Dreamer, below at the left, and Honey, at the right fall in the general category of "fawn". Neither has noticeable black hairs intermingled with the reddish hairs on their body so they look as if they might be "clear red" dogs. However neither has the " e/e " genotype of a "clear red" dog. Although some of the dogs in this group had an " e " allele, although none were homozygous.



E Locus Genotypes

The melanocortin 1 receptor gene is encoded at the E Locus. There are 3 alleles in the dominance hierarchy: $E^M > E > e$. All these alleles exist in Italian Greyhounds.

Dogs with at least one E^M allele will have a melanistic mask. Lola, below left is an example of a fawn dog with a black mask. She has an E^M/E genotype. Ed, below right, is an example of a dog with a blue mask. He has an E^M/E^M genotype. Being homozygous for E^M does not make the mask bigger or darker. Ed's mask is blue because he has a d/d genotype (see more below about the D locus).



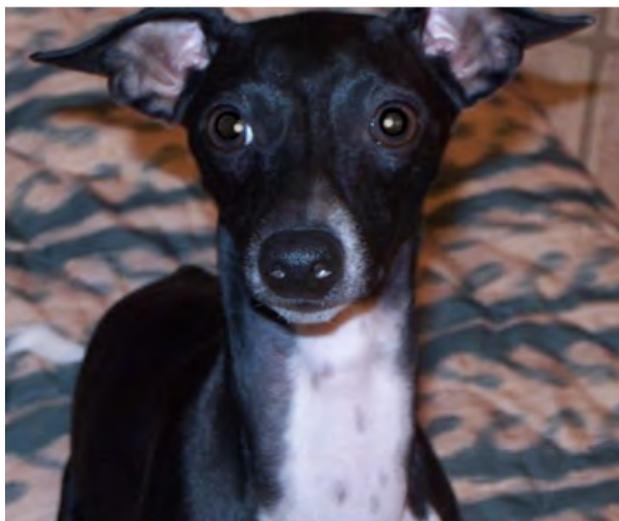
Miguel, below right, is a black dog who has a black mask but this can't be seen against his black body. Conversely, Wizard (page 1) has a black mask and it can't be seen because he has a white muzzle. White areas have no melanocytes so do not make any pigment in that area, no matter what their genotype at any other locus.

Neither Dreamer nor Honey, on the top of page 2, have a melanistic mask.

Although an "e" allele was found in some dogs in a heterozygous state, no dogs with an *e/e* genotype were found in this group. Such dogs would be "clear red".

K Genotypes

The K locus has been mapped to a specific chromosomal region by the Barsh Group, when they were at Stanford. DNA testing for the K^B and k^y alleles was not available at the time of this study. However, it is now available. All IGs that are black, blue or chocolate produce eumelanin pigment and therefore have at least one K^B allele. If such a dog has had fawn pups or parents then it is K^B/k^y .



Scandal, above left, shows her black coat color. Since she had a blue parent and a black parent, it was not possible to determine if she is K^B/K^B or K^B/k^y from that information. She has an *E/e* genotype.

Miguel, above right, is another black IG. He illustrates well how black nose pigment is on an IG that is neither dilute nor brown.

Seal = ???

Some IG are called "seal" in the United States. Sandy, left, and Vinnie, right, are examples of seal dogs. We have DNA tested a few seal IG and they had at least one K^B allele. It is therefore surprising they are not solid black.

At this time, the gene/s causing this coat color variation of black are not known. In some countries, such as Canada, this coat color might be what is called bronze.



Brown, B Locus Genotypes

Tyrosinase Related Protein 1 (*TYRP1*) is the gene responsible for brown coat colors in dogs (and mice and cattle and cats). Three different mutations in this gene all can produce brown. Any two brown alleles amongst these will cause a dog to be brown. In brown dogs in general, the two mutations in exon 5 symbolized by b^s and b^d are the "common" causes of brown.

Sadie, on the right, is an example of an IG that is brown and also dilute (dilute is explained on the next page). Brown dogs always have brown nose leather and pads.



Blue, D Locus Genotypes

"Blue" is used as the name for diluted black in Italian Greyhounds and many other dog breeds. The locus causing blue or "dilute" black is classically known as the D locus. The gene at this locus is melanophilin or *MLPH*. Duchess, below, looks grey and is a typical example of the shade seen in blue IG.



Ishe is an example of a dog with a coat color called Isabella in the U.S.. He has a d/d genotype but is also homozygous for brown (i.e. b/b). The term "Isabella" may be used more broadly in Europe than just for dilute brown IG.

Fawn IGs that are dilute may or may not have blue hairs mixed in their coats. Those that are noticeably blue are termed "blue-fawns". If you look closely at the nose leather on Ricky, next page left, you will see it is charcoal grey, not black. This is true of all dogs that have a d/d genotype with at least one B allele.

Gia, next page right, is a dilute fawn dog that has d/d and b/b and so her nose is a pale brown. Some people also consider the eye shade to be a bit paler but that is hard to capture reliably in a photograph.

All three of these "dilute" coat colored IGs are homozygous for the common mutation associated with blue in the *MLPH* gene.



White Spotting, S Locus Genotypes



del/del



ins/del



ins/ins

In some countries, such as the United States, white spotting is allowed in Italian Greyhounds. The three dogs above show that inherited white spotting does not include minimal white on the chest and toes. The dog at the extreme left does not have the insertion (ins) in the *MITF* gene that causes white marking in many breeds of dogs. The dog in the middle is heterozygous for this insertion mutation, and the dog at the right is homozygous for it. We would call this co-dominant inheritance in this case, because the heterozygous and homozygous spotted dogs have different phenotypes.

This photo above was included in a publication on white spotting in many breeds.

- Schmutz, Sheila M. ; Tom G. Berryere; Dayna L. Dreger (2009) [MITF and White Spotting in Dogs: A Population Study](#) Journal of Heredity 100:S66-S74.

For more general information, please see **Genetics of Coat Color in Dogs**
<http://munster.sasktelwebsite.net/DogColor/dogcolorgenetics.html>

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