An Overview of Canine Coat Colour

Genetic Pet Care

COAT SERIES

c-series:	**curl**	**on chromosome 27, gene KRT17**

The c-series affects the curliness of hair.

It encompasses the following alleles: **C** (curl, dominant), **c** (straight, recessive).

s-series:	**shorthair**	**on chromosome 32, gene FGF5**

The s-series has a major affect on the length of hair.

It encompasses the following alleles: **S** (shorthair, dominant), **s** (longhair, recessive).

w-series:	**wirehair**	**on chromosome 13, gene RSPO2**

The w-series affects "furnishings", hair texture, and possibly hair cycle.

It encompasses the following alleles: **W** (wirehair, dominant), **w** (non-wirehair, recessive).

Non-wire (ww) is required for a dog to have a regular shorthair coat or a regular longhair coat.

Curl doesn't show up on [most] shorthairs, but it is obvious when it occurs in non-wire/longs and in wire-longs.

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COLOR SERIES

(Notes: The b-series/d-series combination determines the dog's skin — nose, pads, etc. — pigment color.)

b-series:	black	on chromosome 11, gene TyrP1

black

chocolate

The b-series affects shape and organization of eumelanin.

It encompasses the following alleles: **B** (black, dominant), **b^{c}** (brown, recessive), **b^{d}** (chocolate, recessive), **b^{s}** (chocolate, recessive).

Chocolate is called brown, liver, or even red in some breeds.

The chocolate alleles, all independent mutations from the black allele, do not always interact with each other as expected. The exact nature of their interaction is still being confirmed.

c-series:	concentration	unknown

red

blush

cream

The c-series affects concentration/depth of pheomelanin. It does not affect eumelanin.

It encompasses the following alleles: **C** (full concentration of pheomelanin, dominant) and **c^{ch}** (chinchilla dilution, recessive) and might also include such postulated alleles as **c^{b}** (blue-eyed/cornaz dilution, recessive), **c^{d}** (dondo dilution, recessive), **c^{e}** (extreme dilution, recessive), and/or **c** (albino dilution, recessive).

The red and cream alleles are co-dominant so that one allele of each in one dog will generally give a color lighter than red but redder/darker than cream, hence the term blush here to describe a dog with one red allele and one cream allele.

Red in some breeds is called fawn, sable, mahogany, chestnut, tan, rust, brown, or liver.

Blush in some breeds is called: orange, apricot, red-fawn, gold, or yellow.

Cream in some breeds is called: fawn, fallow, wheaton, lemon, or yellow.

d-series:	dilution	on chromosome 25, gene MLPH

dilute black
(blue)

dilute chocolate
(isabella)

The d-series affects concentration/depth of eumelanin and pheomelanin. It affects eumelanin to a great extent and affects pheomelanin to a lesser extent.

It encompasses the following alleles: **D** (full concentration of pheomelanin/eumelanin, dominant), **d** (dilution of pheomelanin/eumelanin, recessive).

Blue is called grey, gray, or silver in some breeds.

Isabella is called fawn, lilac, silver, mouse, drapp, pearl, beaver, or café-au-lait in some breeds. The color is that of the weimaraner.

While many dilute dogs of varying breeds are fine, many other dilute dogs of varying breeds have color dilution alopecia. The condition requires the dog to be dilute, although it seems another gene maybe at play to cause the disorder.

D-series dilution has been called "blue dilution" by some in the past, but this is somewhat of a misnomer, as d-series dilution can dilute any coat color — red and its variants, black, and all variants of chocolate.

i-series:	intense	unknown

This is a postulated gene that would modify pheomelanin intensity.

Therefore, ALL dogs are either red, blush, or cream (or some as-yet not specifically determined, more-diluted c-series variation thereof), which is their pheomelanin color, AND are either black or chocolate, which is their eumelanin color (with or without subsequent d-series dilution).

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PATTERN SERIES

(Notes: Black & red are used as default eu/pheo colors in this chart. Chococlate & cream, etc., could have just as easily been used.)

a-series: **agouti** **on chromosome 24, gene ASiP**

ASPS

wildboar

points

ASES

The a-series affects the distribution of eumelanin.

It encompasses the following 4 alleles: **A** (ASPS; [mostly] solid pheomelanin, dominant), **a^w** (wildboar/sable/ wild-type banding), **a^t** (points), **a** (ASES; solid eumelanin, recessive).

A has been referred to as a^y in the past. However, it is the most dominant allele on the series so is due an uppercase letter. At this locus, the more dominant the pattern, the less eumelanin.

Points is also referred to as phantom in poodles.

Only one corresponding allele of two or more saddle determiners has been discovered (another allele that corresponds has not been), and it is located next to gene ASiP. Saddling interacts with points to restrict eumelanin even further than it would be on a pointed dog.

In cases where dogs do not carry the dominant black gene (K) and are not ee for the E locus the Agouti gene is expressed and will determine the dog's coat. Although the A locus does determine the base coat colour the colour can be modified by other genes – B and D Locus.

e-series: **extension** **on chromosome 5, gene Mc1R**

masking

grizzling

default

ESPS

The e-series affects production/restriction of eumelanin.

It encompasses the following alleles: **E^m** (masking, dominant), **E^g** (grizzle), **E** (default), **e** (ESPS; solid pheomelanin, recessive).

Masking, in addition to the mask, will allow whatever is on the a-series to show. Double masking looks the same as single masking.

Grizzle must be accompanied by points on the a-series in order to be expressed.

ESPS will suppress all eumelanin production in the hair so that only pheomelanin will be present. The lack of eumelanin in the hair is also why an ESPS cannot have eumelanistic shading, why a recessive dapple (Mm) will not show dappling (except in the eyes, if dappling occurs on them), and why a recessive double dapple (MM) will not show dappling except for the white areas (except in the eyes, if dappling occurs on them).

k-series: **black** **on chromosome 16, gene CBD103**

KSES

brindle

default

The k-series affects distribution/extension of eumelanin.

It encompasses the following alleles: **K** (KSES; [mostly] solid eumelanin, dominant), **k^{br}** (brindling), **k** (default, recessive).

K is also referred to as K^B, and k is also referred to as k^y, however the extra letters are not necessary and can be confusing.

Dominant K is epistatic to whatever is found at the a-locus, meaning that it suppresses expression of all a-series alleles.

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Pattern intra-hierarchy

E^mE^m, E^mE^g, E^mE, or E^me	=	masked
E^gE^g, E^gE, or E^ge [+ a^{t*}]	=	grizzle, *only when a^ta^t or a^ta is present on the a-series*
EE or Ee	=	*default to the pattern present on the k-series*
ee	=	ESPS

KK, Kk^{br}, or Kk	=	KSES
$k^{br}k^{br}$ or $k^{br}k$	=	brindle, + *defaulting to the pattern present on the a-series*
kk	=	*default to the pattern present on the a-series*

AA, Aa^w, Aa^t, or Aa	=	ASPS
a^wa^w, a^wa^t, or a^wa	=	wild boar
a^ta^t or a^ta	=	pointed (can instead be saddled if two other factors are involved)
aa	=	ASES

Pattern inter-hierarchy

Amongst the patterns, the e-series can be thought of as the most dominant, and the a-series can be thought of as the most recessive.

If the dog is ee, *all* other patterns (save for white-creating patterns) will be hidden.

If the dog is E^{m*}, E^{g*}, or E*, the k-series will be expressed [or, if kk, then the a-series will be expressed].

→ If the dog is K*, all other patterns on the k-series and all patterns on the a-series will be hidden.
If the dog is [non-ee and] kk, the a-series will be expressed.

→ If the dog is A*, all other patterns on the a-series will be hidden.
If the dog is a^{t*}, saddle may be expressed if present.
