



1 Learning Hub Colour Series

<https://nationalgroodleassociation.com>



Module 1

E Loci (extension locus)

Welcome to NGA Inc's Learning Hub, where we work with breeders and canine experts to develop resources that help improve the way Groodles are bred in Australia.



Let's talk about the E Locus

The E Loci or Locus consists of four alleles listed below in order of dominance.

Allele	Expression
Em	Melanistic Masking
Eg	Grizzle
E	Black
e	Yellow/ Red



What determines coat colour?

The colour of your dogs coat is determined by two major pigments

1. Eumelanin (black pigment)
2. Pheomelanin (yellow/red pigment)

This pigment is produced by cells called melanocytes that are located in your pup's skin and hair follicles.

The **MC1R** gene in your pups DNA makeup is also known as the **E loci**. It controls the production of eumelanin (black pigment) and determines if your pup will have a black coat or a yellow coat.

The **dominant form "E"** allows for normal production of eumelanin and the recessive form "e" shuts down that production.



Inheritance

The inheritance mode for the E locus is **Autosomal Recessive** which put simply means that each parent must pass down the recessive allele (e) to a pup for its coat to be expressed as yellow. By yellow, we also mean all the different shades of yellow from the cream coat Golden Retriever through to the red coat of the Irish setter. The reason for this is that the recessive "e" variant is responsible for inhibiting the production of Eumelanin (black pigment).

So why is my dog's nose black?

Interestingly a solid yellow dog will produce eumelanin in the areas of the nose leather, foot pads and eye rims so that these areas express as black if no other traits are hidden by the red coat.

- Other genetic factors will produce variations on the black and yellow coats such as the B locus and the D locus. We will go through those later in the Colour Series modules.



Interpreting your dogs E locus results



E/E – Dominant/Dominant

Both a light coloured or black coat is possible IF the K & A locus allow a sable, brindle or phantom coat pattern can express.

If the A locus is blocked by the K locus, then only solid black or brown (dependent on B locus) can be produced.

*Yellow coats will never be produced even when bred to an e/e partner.



E/e –Dominant/ Recessive

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*Can produce yellow pups when bred to a E/e or e/e partner.



e/e – Recessive/Recessive

Only a yellow coat is possible. This genotype can hide coat patterns determined by the K & A loci i.e hidden phantoms. It covers all coat patterns except parti (S locus) and will also cover brown (B locus).

*Can produce dark pups when bred to an E/E or E/e partner



Em - Melanistic Mask

Em results in the localized distribution of eumelanin (black pigment) on the muzzle of the dog which resembles a dark "mask" on dogs with lighter coloured coats.

Although the Em variant produces a black melanistic mask, the final color of a dog's mask is dependent on other DNA variants such as the B and D loci that modify the production or appearance of the eumelanin (black pigment) in the dog. For example, dogs that are b/b at the B locus will have brown masks due to the disruption of eumelanin synthesis that results in the conversion of black pigmented areas to brown.

(Reference: Pawprint Genetics)



Eg - Grizzle

The Eg produces a characteristic coat colour pattern consisting of a black pigmented widow's peak on the head of the dog with other black tipped hairs on the back of the dog similar to some sable or saddle tan colorations.

The grizzle coat colour pattern **has only been observed in the saluki, Afghan hound (referred to as "domino" in this breed) and the borzoi** (referred to as "sable" in this breed). Although the Eg variant of the MC1R gene is dominant to E and e, it is recessive to Em (melanistic mask).

Therefore, the grizzle coat colour pattern is only expressed if the dog does not have an Em variant (i.e., does not have a melanistic mask) and is also ky/ky for the K Locus and at/at for the A locus. (Reference: Pawprint Genetics)



Predicting breeding outcomes for E Locus

We've prepared a four examples using a Punnett Square to help you predict the theoretical outcomes of your planned breeding's with regard to the E locus.

There are other genes that can affect coat colour but for the purpose of introducing you to the E Locus, **we are making the assumption that there are no other factors and focusing only on the E locus.**



Example 1: Both parents are "ee"

	ee	ee
ee	ee	ee
ee	ee	ee

Outcome

All offspring will be "ee" and therefore have yellow coats in varying shades.



Example 2: One parent is ee and the other Ee

	e	e
E	Ee	Ee
e	ee	ee

Outcome

50% of offspring will be "ee" and have yellow coats

50% will be Ee and have black coats but can produce pups with yellow coats.



Example 3: Both parents are "Ee"

	E	e
E	EE	Ee
e	Ee	ee

Outcome

25% of offspring will be "EE" and have black coats and cannot produce yellow pups.

50% of offspring will be "Ee" and have black coats but able to produce yellow pups.

25% of offspring will be "ee" and have yellow coats.



Example 4: Both parents are "EE"

	E	E
E	EE	EE
E	EE	EE

Outcome

All offspring will be "EE" and therefore have black coats and cannot produce yellow pups.



Precautions

The recessive ee masks the expression of the Merle gene. For this reason Merle should always be tested for regardless of expression to reduce the risk of accidentally breeding Merle to Merle