

# Pointer Coat Color Genetics

This page is intended to be helpful to Pointer breeders or others that are curious about the genetic basis of their colors. I find coat color genetics to be quite fun to figure out. However, I absolutely do not suggest that any breeder make any decisions on whether or not to do a breeding based on color. The last factor a Pointer breeding should be done for is color. However, that being said, it will allow a breeder to predict to some degree what colors to expect; then the breeder can inform puppy buyers what to expect if they are hoping for a particular color.

## *The Coat Colors of Pointers*

First, let's discuss the possible coat colors of Pointers. The American Kennel Club (AKC) Pointer standard states that the allowed Pointer colors are, "Liver, lemon, black, orange; either in combination with white or solid-colored. A good Pointer cannot be a bad color. In the darker colors, the nose should be black or brown; in the lighter shades it may be lighter or flesh-colored." The last part of the standard is a bit confusing and is often a source of confusion. In reality, black and orange dogs should have black pigment (albeit sometimes the orange dogs have somewhat lighter pigment and it tends to turn pinker with age) on their nose and eye rims. Liver and lemon dogs should have self-colored pigment (meaning brown for liver dogs and pink for lemon dogs). It is not possible for a lemon dog to produce brown or black pigment, and thus obviously they should not be faulted for this in the conformation (show) ring. Look at the pictures below to see the difference between an orange and lemon dog.

Solid Pointers are still rare throughout the world, but we are lucky to have breeders out there that are continuing to breed solids.

Very rarely, a tricolor Pointer is born. The tricolor is not specifically covered in the AKC standard. Some consider the tricolor to be a hound trait, but this is actually not the case as there are several sporting breeds that come in tricolor including the American Cocker, English Cocker, English Setter, English Springer Spaniel, and Brittany (the Brittany standard states that tricolor is allowed but not preferred). The Kennel Club in England (the country of origin for the Pointer) states in the Pointer standard, "Usual colours are lemon and white, orange and white, liver and white and black and white. Self colours and tricolours are also correct."

## *Here are pictures of each color:*



From left to right black and white, liver and white, orange and white and lemon and white.



From left to right solid black, solid liver, solid orange, solid lemon and tricolor. Thank you to Solivia and Zeligren Pointers for the pictures.

### Some Basic Genetics

A genotype is the genetic makeup that results in a certain trait. For simple traits (like coat color) only one to a few genes are responsible. In the case of Pointer coat color, we are going to look at two genes.

Each gene has two alleles. A dog gets one allele from each parent. An allele can either be dominant or recessive. A dominant allele is typically shown using an uppercase letter and a recessive gene is shown with a lowercase letter. For the dominant trait to show up, the dog only needs one allele that is dominant; they must have one uppercase letter. For a recessive trait to show up, both alleles must be recessive; they must have two lowercase letters.

A phenotype is the expression of a gene. In other words, a phenotype is what we see (in this case the coat color).

### The Genetics Behind the Colors

The genetics behind Pointer colors are fairly simple. I still tend to diagram it out when I am trying to figure out what colors are possible with a breeding. Pointer color is determined by two genes, which are typically called the B and E genes. I think of the B gene as the "black pigment" gene. If a dog has at least one dominant B allele, they will have black pigment. Both black and orange dogs have black pigment. I think of the E as the "darker color gene". If a dog has at least one dominant E allele, they will be either black or liver in color.

The genotypes of the colors are listed below. A dash ( ) indicates that either gene can be present. Thus, a black dog could be BBEE, BbEE, BBee, or Bbee; an orange dog can be BBee or Bbee; a Liver dog can be bbEE or bbEe; a Lemon dog can only be bbee.

Black: B\_E\_

Orange: B\_ee

Liver: bbE\_

Lemon: bbee

To make things a bit more complicated, there are obviously some other factors. For example:

1) The amount of white a coat has versus the amount of color

2) The amount of ticking (freckling) a coat has

3) The shade of the color is quite variable. This is particularly true with orange and lemon dogs, although it can be seen in liver dogs as well. For example, Oz, our rescue dog, is lemon and white and his patches are almost as dark as a Brittany. Garrett is also a darker shade of orange, whereas his father, Boone, is a paler orange. I have seen orange and white dogs whose patches are extremely light cream colored and blend almost in with the white. Historically, before the understanding of genetics, there was some confusion about the lemon and orange dogs. The designation of these colors have nothing to do

with the shade of the color of the dog, but have to do with the color of the pigment on their nose and eye rims. If one is to ever see a historic pedigree where two lemon dogs produced any puppies that were a color other than lemon, it is likely that one of the parents was actually an orange dog.

For the purpose of this discussion, I am not going to cover the genetics of these details. But, remember that none of these details are considered important in the Pointer standard in any country. We are lucky to be part of a breed where color is considered to be of little importance.

Tricolor Pointers are very rarely produced, and the genetics behind these dogs is not well understood.

If a solid colored Pointer is bred to a typical "and white" Pointer, then 50% of the puppies will be solid and 50% will be "and white".

### Colors Results For A Breeding

Below are the potentials for each color. Note that these are only potentials, it depends on who the dog is bred to. Thus, a black bitch that can produce black and liver puppies bred to an orange stud dog that can produce black and orange puppies will only result in black puppies. There will not be any liver or orange pups in that litter.

There are four genotypes possible for a black dog:

BBEE – these dogs can only produce black puppies

BBEe – these dogs can produce black and orange puppies

BbEE – these dogs can produce black and liver puppies

BbEe – these dogs can produce all four colors

There are two genotypes possible for an orange dog:

BBee – these dogs can produce black or orange puppies

Bbee – these dogs can produce all four colors

There are two genotypes possible for a liver dog:

BbEE – these dogs can produce black and liver puppies

BbEe – these dogs can produce all four colors

There is only one genotype possible for a lemon dog:

bbee – these dogs can produce all four colors

The following charts are organized such that one parent (for example the bitch) is listed on the top, the potential mates are listed in the first column, and the potential puppy color percentages are listed in the second column. The first chart is just an example. You could easily switch the bitch and the stud dog; it makes no difference. Thus, in the category "For Breeding a Black Dog" the term dog is genderless and could be a bitch or a dog. A final important point to mention is that the percentages listed are statistically based. In reality, litters are too small to produce these percentages with any sort of accuracy. Point of fact, how often is a litter actually 50% male and 50% female puppies (as we would predict all of them should be statistically)...not very often!

Examples:

	The Bitch
Stud Dog 1	Puppy percentages by color if the Bitch is bred to Stud Dog 1
Stud Dog 2	Puppy percentages by color if the Bitch is bred to Stud Dog 2
Stud Dog 3	Puppy percentages by color if the Bitch is bred to Stud Dog 3

Stud Dog 4	Puppy percentages by color if the Bitch is bred to Stud Dog 4
Stud Dog 5	Puppy percentages by color if the Bitch is bred to Stud Dog 5
Stud Dog 6	Puppy percentages by color if the Bitch is bred to Stud Dog 6
Stud Dog 7	Puppy percentages by color if the Bitch is bred to Stud Dog 7
Stud Dog 8	Puppy percentages by color if the Bitch is bred to Stud Dog 8
Stud Dog 9	Puppy percentages by color if the Bitch is bred to Stud Dog 9
The Stud Dog	
Bitch 1	Puppy percentages by color if the Stud Dog is bred to Bitch 1
Bitch 2	Puppy percentages by color if the Stud Dog is bred to Bitch 2
Bitch 3	Puppy percentages by color if the Stud Dog is bred to Bitch 3
Bitch 4	Puppy percentages by color if the Stud Dog is bred to Bitch 4
Bitch 5	Puppy percentages by color if the Stud Dog is bred to Bitch 5
Bitch 6	Puppy percentages by color if the Stud Dog is bred to Bitch 6
Bitch 7	Puppy percentages by color if the Stud Dog is bred to Bitch 7
Bitch 8	Puppy percentages by color if the Stud Dog is bred to Bitch 8
Bitch 9	Puppy percentages by color if the Stud Dog is bred to Bitch 9

For Breeding a Black Dog:

	BBEE (Black)
BBEE (Black)	100% BBEE (Black)
BBEe (Black)	50% BBEE (Black), 50% BBEe (Black)
BbEE (Black)	50% BBEE (Black), 50% BbEE (Black)
BbEe (Black)	25% BBEE (Black), 25% BBEe (Black), 25% BbEE (Black), 25% BbEe (Black)
BBee (Orange)	100% BBEe (Black)
Bbee (Orange)	50% BBEe (Black), 50% BbEe (Black)
bbEE (Liver)	100% BbEE (Black)
bbEe (Liver)	50% BbEE (Black), 50% BbEe (Black)
bbee (Lemon)	100% BbEe (Black)
	BBEe (Black)
BBEE (Black)	50% BBEE (Black), 50% BBEe (Black)
BBEe (Black)	25% BBEE (Black), 50% BBEe (Black), 25% BBee (Orange)
BbEE (Black)	25% BBEE (Black), 25% BbEE (Black), 25% BBEe (Black), 25% BbEe (Black)
BbEe (Black)	25% BBEE (Black), 25% BBEe (Black), 25% BbEe (Black), 25% Bbee (Orange)
BBee (Orange)	50% BBEe (Black), 50% BBee (Orange)
Bbee (Orange)	25% BBEe (Black), 25% BbEe (Black), 25% BBee (Orange), 25% Bbee (Orange)
bbEE (Liver)	50% BbEE (Black), 50% BbEe (Black)
bbEe (Liver)	25% BbEE (Black), 50% BbEe (Black), 25% Bbee (Orange)
bbee (Lemon)	50% BbEe (Black), 50% Bbee (Orange)
	BbEE (Black)
BBEE (Black)	50% BBEE (Black), 50% BbEE (Black)
BBEe (Black)	25% BBEE (Black), 25% BbEE (Black), 25% BBEe (Black), 25% BbEe (Black)
BbEE (Black)	25% BBEE (Black), 50% BbEE (Black), 25% bbEE (Liver)

BbEe (Black)	12.5% BBEE (Black), 12.5% BBee (Black), 25% BbEE (Black), 25% BbEe (Black), 12.5% bbEE (Liver), 12.5% bbEe (Liver)
BBee (Orange)	50% BBee (Black), 50% BbEe (Black)
Bbee (Orange)	25% BBee (Black), 50% BbEe (Black), 25% bbEe (Liver)
bbEE (Liver)	50% BbEE (Black), 50% bbEE (Liver)
bbEe (Liver)	25% BbEE (Black), 25% BbEe (Black), 25% bbEE (Liver), 25% bbEe (Liver)
bbee (Lemon)	50% BbEe (Black), 50% bbEe (Liver)
	BbEe (Black)
BBEE (Black)	25% BBEE (Black), 25% BBee (Black), 25% BbEE (Black), 25% BbEe (Black)
BBee (Black)	25% BBEE (Black), 25% BBee (Black), 25% BbEe (Black), 25% Bbee (Orange)
BbEE (Black)	12.5% BBEE (Black), 12.5% BBee (Black), 25% BbEE (Black), 25% BbEe (Black), 12.5% bbEE (Liver), 12.5% bbEe (Liver)
	6.25% BBEE (Black), 12.5% BBee (Black), 12.5% BbEE (Black), 25% BbEe (Black), 6.25% BBee (Orange),
	12.5% Bbee (Orange), 6.25% bbEE (Liver), 12.5% bbEe (Liver), 6.25% bbee (Lemon)
BbEe (Black)	
BBee (Orange)	25% BBee (Black), 25% BbEe (Black), 25% BBee (Orange), 25% Bbee (Orange)
Bbee (Orange)	12.5% BBee (Black), 25% BbEe (Black), 12.5% bbEe (Liver), 12.5% BBee (Orange), 25% Bbee (Orange), 12.5% bbee (Lemon)
bbEE (Liver)	25% BbEE (Black), 25% BbEe (Black), 25% bbEE (Liver), 25% bbEe (Liver)
bbEe (Liver)	25% BbEE (Black), 25% BbEe (Black), 25% bbEe (Liver), 25% bbee (Lemon)
bbee (Lemon)	25% BbEe (Black), 25% Bbee (Orange), 25% bbEe (Liver), 25% bbee (Lemon)

For Breeding an Orange Dog:

	BBee (Orange)
BBEE (Black)	100% BBee (Black)
BBee (Black)	50% BBee (Black), 50% BBee (Orange)
BbEE (Black)	50% BBee (Black), 50% BbEe (Black)
BbEe (Black)	25% BBee (Black), 25% BbEe (Black), 25% BBee (Orange), 25% Bbee (Orange)
BBee (Orange)	100% BBee (Orange)
Bbee (Orange)	50% BBee (Orange), 50% Bbee (Orange)
bbEE (Liver)	100% BbEe (Black)
bbEe (Liver)	50% BbEe (Black), 50% Bbee (Orange)
bbee (Lemon)	100% Bbee (Orange)
	Bbee (Orange)
BBEE (Black)	50% BBee (Black), 50% BbEe (Black)
BBee (Black)	25% BBee (Black), 25% BbEe (Black), 25% BBee (Orange), 25% Bbee (Orange)
BbEE (Black)	25% BBee (Black), 50% BbEe (Black), 25% bbEe (Liver)
	12.5% BBee (Black), 25% BbEe (Black), 12.5% bbEe (Liver), 12.5% BBee (Orange), 25% Bbee (Orange), 12.5% bbee (Lemon)
BbEe (Black)	

BBee (Orange)	50% BBee (Orange), 50% Bbee (Orange)
Bbee (Orange)	25% BBee (Orange), 50% Bbee (Orange), 25% bbee (Lemon)
bbEE (Liver)	50% BbEe (Black), 50% bbEe (Liver)
bbEe (Liver)	25% BbEe (Black), 25% Bbee (Orange), 25% bbEe (Liver), 25% bbee (Lemon)
bbee (Lemon)	50% Bbee (Orange), 50% bbee (Lemon)

For Breeding a Liver Dog:

	bbEE (Liver)
BBEE (Black)	100% BbEE (Black)
BBEe (Black)	50% BbEE (Black), 50% BbEe (Black)
BbEE (Black)	50% BbEE (Black), 50% bbEE (Liver)
BbEe (Black)	25% BbEE (Black), 25% BbEe (Black), 25% bbEE (Liver), 25% bbEe (Liver)
BBee (Orange)	100% BbEe (Black)
Bbee (Orange)	50% BbEe (Black), 50% bbEe (Liver)
bbEE (Liver)	100% bbEE (Liver)
bbEe (Liver)	50% bbEE (Liver), 50% bbEe (Liver)
bbee (Lemon)	100% bbEe (Liver)
	bbEe (Liver)
BBEE (Black)	50% BbEE (Black), 50% BbEe (Black)
BBEe (Black)	25% BbEE (Black), 50% BbEe (Black), 25% Bbee (Orange)
BbEE (Black)	25% BbEE (Black), 25% BbEe (Black), 25% bbEE (Liver), 25% bbEe (Liver)
BbEe (Black)	25% BbEE (Black), 25% BbEe (Black), 25% bbEe (Liver), 25% bbee (Lemon)
BBee (Orange)	50% BbEe (Black), 50% Bbee (Orange)
Bbee (Orange)	25% BbEe (Black), 25% Bbee (Orange), 25% bbEe (Liver), 25% bbee (Lemon)
bbEE (Liver)	50% bbEE (Liver), 50% bbEe (Liver)
bbEe (Liver)	25% bbEE (Liver), 50% bbEe (Liver), 25% bbee (Lemon)
bbee (Lemon)	50% bbEe (Liver), 50% bbee (Lemon)

For Breeding a Lemon Dog:

	bbee (Lemon)
BBEE (Black)	100% BbEe (Black)
BBEe (Black)	50% BbEe (Black), 50% Bbee (Orange)
BbEE (Black)	50% BbEe (Black), 50% bbEe (Liver)
BbEe (Black)	25% BbEe (Black), 25% Bbee (Orange), 25% bbEe (Liver), 25% bbee (Lemon)
BBee (Orange)	100% Bbee (Orange)
Bbee (Orange)	50% Bbee (Orange), 50% bbee (Lemon)
bbEE (Liver)	100% bbEe (Liver)
bbEe (Liver)	50% bbEe (Liver), 50% bbee (Lemon)
bbee (Lemon)	100% bbee (Lemon)

### *Decoding Genotypes from Phenotypes*

Now that you are a genetic wizard when it comes to Pointer color coat genetics, you can use it to decipher genotypes from phenotypes (to some degree). As an example, I will use my own dogs. When I was planning the breeding between Maya (Black and White) and Boone (Orange and White), I was not sure what colors to expect. I knew that Maya, being a black and white bitch, had to be B\_E\_. Maya is out of two black and white parents, and was a singleton pup, so that gave me little insight into any further clues as to her genotype. I knew that Boone, being an orange and white dog, had to be B\_ee. Boone came from a black and white bitch and an orange and white dog. Thus, both of his parents had to have a lowercase e (since Boone's dad is orange and white it was already a given that he had two lowercase e's). Also, Boone had a liver and white brother. Thus I knew that both of his parents had a lowercase b (since liver and white is bbE\_). Using this information, Boone's mother was BbEe and his father was Bbee. Even with this knowledge, I knew that there was a 50% chance Boone was Bbee and a 50% chance he was BBee.

The breeding between Maya and Boone produced only two puppies. Garrett is orange and white and Gavin is liver and white. Knowing that they were able to produce these two colors, I figured out that Maya is BbEe and Boone is Bbee. Remember that a liver and white dog is bbE\_. Gavin, being liver and white from these parents has to be bbEe because he had to have gotten a lowercase e from Boone. Remember that an orange and white dog is B\_ee. Since Garrett could have gotten an uppercase B from either or both parents, he could be BBee or Bbee. It will be impossible to know, unless genetic testing is done, which one he is until he is bred (and even then only if he is bred to a certain genotype).

### *Genetic Color Testing*

There is genetic color testing available for Pointers through [Vet Gen](#) at a cost of \$85. Click on the link, then click on "Current Services" under the Canine section, then click on Pointer under the "Revolutionary ChromaGene™ – Coat Color Prediction" category.