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Genetics of Coat Color of Horses  
Michigan State University  
Cooperative Extension Service  
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NOTE: The author is Melvin Bradley, Department of Animal Husbandry, University of Missouri. This series of bulletins is reprinted for Michigan use through courtesy of the University of Missouri—Richard Dunn, Extension Specialist in Animal Husbandry, Michigan State University.

Loud-colored horses command high prices. Of course they must be acceptable in conformation. Questions often asked by horsemen are "How can I get a certain coat color?" or "Why did I get so much difference in the foal's color compared to its parents?"

Some colors are easy to get because only one pair of genes is involved. Generally speaking, the louder the coat color, the more complex the inheritance and the more difficult it is to produce.

An understanding of a few principles of cellular division is helpful in predicting coat color.

The bodies of all animals are made up of microscopic building blocks called cells. A cell consists of a cell wall and a nucleus, which is more or less in the center of the cell. Between the nucleus and the cell wall is the cytoplasm.

The genetic material is carried within the nucleus of the cell in the form of chromosomes.

Chromosomes are threadlike structures that occur in pairs or as twins in body cells. For each pair of chromosomes in the nucleus, one came from the father and one from the mother. Each cell possesses 32 pairs of chromosomes. The possible combinations of these are in the millions.

Of the pairs of chromosomes in each cell, only one of

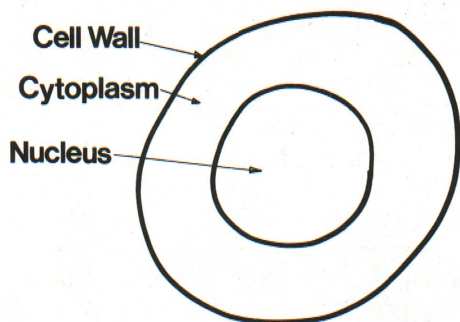
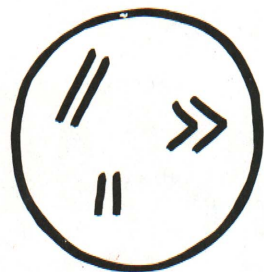
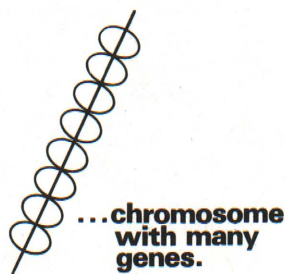


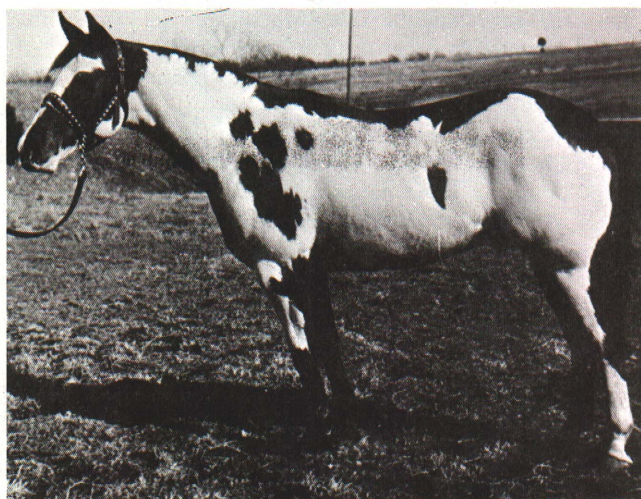
Diagram of a cell



Chromosomes



Genes



Overo Paint Stallion.

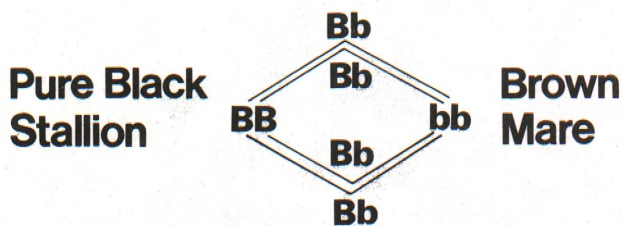
the individuals in each pair will be transmitted to any one off-spring. Which one of a pair is transmitted depends on chance.

Many different genes are carried on each chromosome. The genes may be compared to a number of beads on a string.

Genes also occur in pairs in body cells, and each gene is identified by giving it one of the letters of the alphabet. For example, with two genes, such as large *A* and small *a*, three different pairings can occur. They are large *A*, large *A*; large *A*, small *a*; and small *a*, small *a*.

Let's take an example. We assume that the gene for black, large *B*, is dominant to the gene for brown, small *b*. These two genes can also pair in three different ways—*BB* for pure black, *Bb* for impure black, and *bb* for brown.

Black and brown are the two basic colors of horses. Let's designate pure black with two capital *B*'s; impure black with capital *B*, small *b*; and brown with two small *b*'s.



**All Bb or Impure Blacks**



Because the gene for black, capital *B*, is dominant to the gene for brown, small *b*, the horse will appear black in color even though he carries a brown or small *b* gene.

One kind of black is *dominant* black. The foal is jet black at birth, with black skin, eyes, and hooves. It will remain this color throughout its life and will not fade in sunlight.

Another kind of black is called *recessive* black. A foal is black at birth but fades to a light brown color in sunlight. Each spring its new hair coat will be black. When kept out of the sun, these horses are difficult to distinguish. Sometimes brown hairs may be found on their lips and flanks.

Brown, chestnut, and sorrel horses must have two recessive or small *b* genes to avoid being black. Therefore, their genetic makeup or *genotype* is known since it can only be expressed when both genes are the same. Brown is produced mainly by crossing brown-colored horses together or crossing browns with Palominos.

What coat colors do you expect when you breed a pure black stallion to a brown or chestnut mare? The only genes the stallion has to transmit are dominant black genes. Therefore, he is *homozygous dominant* and all of the foals from this mating will be black. However, they are genetically "impure" or *heterozygous* individuals.

What color combinations would you expect from breeding a herd of chestnut mares to an impure or heterozygous black stallion?

The stallion has one dominant black gene and one recessive gene for brown. On an average these would be transmitted with equal frequency—that is, half of his foals from chestnut or brown mares would be impure black and half chestnut or brown.

Finally, what colors would you expect from the mating together of impure black horses?

Since they are impure, each has a dominant and a recessive gene. On an average, random segregation of genes will produce three blacks to one brown. Two of the blacks, however, will be impure and one pure.

Some stallion owners will guarantee a black foal from such a mating. This is because their horse has never sired a brown foal. If a stallion or mare has ever produced a brown offspring, it is proof without fail they are impure or heterozygous for this color. This genetic principle applies to many traits in animals and humans.

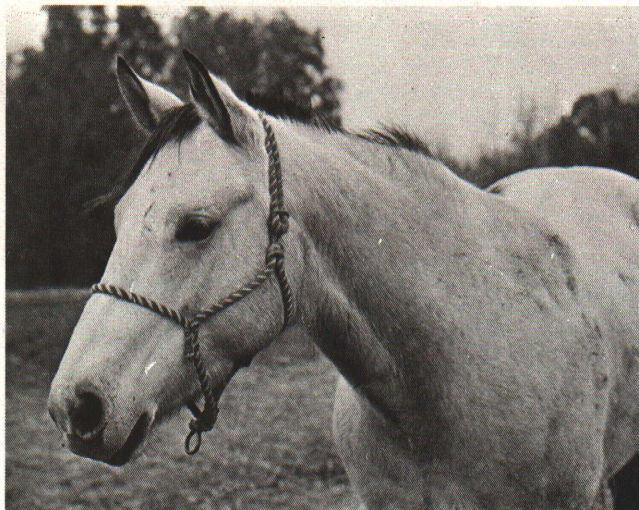
We may have oversimplified the genetics of coat color. Some horses are intermediate between colors and may be difficult to classify into a color group. A sorrel horse might be called light chestnut by some people when he is actually sorrel in color.

## Chestnut

Chestnut horses range in color from reddish brown to liver-colored with brown manes and tails. If they had black manes and tails, they would be bays.

## Bay

Bay horses have black manes and tails. This distinguishes them from chestnuts and sorrels. In addition, they usually have black stockings. However, a bay horse with typical black mane and tail may have one or more white stockings



"Genetically speaking," Buckskin Horses are basically black.

along with black ones. Bay horses may also have white facial markings.

Bay colors range from light to dark or red bay. Many bays are solid-colored with the exception of black stockings.

## Buckskin

Buckskins are basically black. They have black points or legs and may come in many shades. Their name comes from tanned leather and they resemble real buckskin in color.

Duns are buckskins with dorsal stripes. These stripes extend from the withers to the tail head. The withers are often black.

A grulla is a dun with roan characteristics. Yellow hairs mixed with brown or black produce a grayish-blue mouse color. Most grullas have black points and dorsal stripes.

Buckskin and Dun come from matings such as:

- Buckskin x buckskin
- Palomino x black, or
- Palomino x bay.

## Grey

Greys have a mixture of white and black hairs. This is because of a "greying" gene. Many horses born dark will lighten with age, but few get completely light.

With a dapple grey horse, the dappling usually appears between two and five years of age and remains throughout life. It is a very popular color. When the coat has a great deal of black in it, the horse is said to be iron grey or steel grey.

Grey coat color is most often obtained by crossing:

- Grey x grey,
- Grey x black, and
- Grey x buckskin.

## White

Dominant white color is given this name because it causes horses of any color to be white, with colored eyes. It should not be confused with greys which are almost white or with pseudo-albino, Type A, which comes from the mating of palomino with palomino.

Horses with dominant white coloring are always impure





Golden Palomino coloring is desired.

—large  $W$ , small  $w$ —because the pure form—large  $W$ , large  $w$ —kills the foal early in pregnancy. The mating of dominant white individuals with colored individuals will give approximately 50 percent white and 50 percent colored offspring.

### Palomino

Basically, Palominos are brown, but also possess one dilution gene. Palominos should be the color of a “newly-minted gold coin.” However, they vary from almost white to very dark. They must have “flaxen” or white manes and tails.

A medium or golden Palomino is very desirable. When well-groomed and fitted they present a striking appearance. Because of the genetic complexity of Palomino color inheritance, a desirable color is hard to get. A good way is to mate sorrels with pseudo-albinos, Type A, but these horses can't be registered as Palominos. Palominos crossed together produce about half Palomino colors.

### Roan

Roan is a mixture of white hairs with colored hair over the entire body. Mixtures of white and brown hair give a red roan. Coloring is due to the roaning gene, capital  $R$ . As with black, a horse may be pure for roaning or may be roan-colored with a recessive gene.

Blue roan is a mixture of white and black hair. For horses to produce roan offspring, one parent should be roan. Because of their dominance, roans should not be used when trying to get Appaloosa or Paint coloring.

### Paint

Paints or Pintos are white, spotted with color in varying proportions over the body. The gene for spotting is dominant to nonspotting. Black and white spotting is known as “piebald.” Most spotted horses are piebald or skewbald. A skewbald is a Paint or Pinto with white spots and any other color than black. Most common are bays, chestnuts, and sometimes buckskins.

Paints and Pintos can further be divided into color patterns called “tobiano” and “overo.” Tobianos are usually white on the legs below the hocks. They often have white across the back.



Blanket pattern is common for Appaloosas.

Overos seldom have white across the back. Their faces are often bald or with a bonnet pattern. When overos are bred together, they sometimes have a white foal that dies shortly after birth.

### Appaloosa

Appaloosas are of several kinds. The mode of inheritance of Appaloosa coloring is not well understood. Many Appaloosas have blanket patterns. When these types are mated, the frequency of getting desirable coloring is good.

Leopard coloring is white with dark spots. Some are striking in color and uniformity of spotting. Such types command high prices. A “frost” or “roan” Appaloosa is not a true roan, but has a frosted appearance. Usually the forehead or front is darker.

Snowflake coloring is tiny white spots on a darker body, producing a salt-and-pepper appearance.

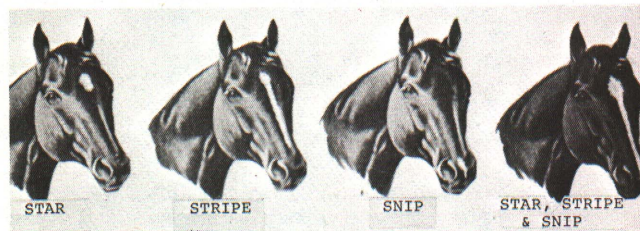
Colors that have the least probabilities of success in crosses for Appaloosa color are duns, Palominos, greys, and all light colors.

Appaloosas crossed together and with blacks, browns, bays, dark chestnuts, and sorrels have the best chance of getting desirable color.

### Common Markings

A star is a clearly-defined spot on the forehead. A stripe is a narrow path of white from forehead to muzzle. A snip is a patch of white on the nose or muzzle. There can be many combinations of star, stripe, and snip.

Blazes are wide stripes extending from between the eyes down over the nose. When the white stripe extends onto



Common facial markings of horses.



the flat side of the face, the horse is said to have a bald face.

Common leg color markings are equally variable. They range from very little to full stockings. When combined with face markings they add significantly to the color patterns of most horses.

Horses come in all combinations of colors. Solid colors are easier to breed, with loud colors and mixtures being more difficult to obtain. We must select good individuals with color and not sacrifice utility, as any good athletic horse wears his color well.