

Coat Color Genetics

Overview

- * Genes
 - * Hold all the inheritable information
 - * Made up of two halves called alleles
 - * One half, or one allele, comes from each parent
- * Alleles
 - * Either “dominant”, shown with an uppercase letter
 - * or “recessive”, shown with a lowercase letter
- * Coat Color
 - * Comes from 16 genes

Extension

- * All coat colors come from two “base” colors
 - * Extension gene
 - * Black (EE) or red (ee)
- * Eumelanin - dominant allele causes the horse to form black pigment
- * Pheomelanin - recessive allele causes the horse to form red pigment

Extension - EE & Ee/eE

- * Eumelanin
- * EE (homozygous dominant)
 - * Black coat (True black)
 - * Unusual color, but not rare
 - * Must be completely black to be considered, except for white markings
- * Ea / aE (heterozygous dominant)
 - * Black coat
 - * Not enough e to overpower the E

Extension - ee

- * Pheomelanin
- * ee (homozygous recessive)
 - * Chestnut coat
 - * Red or brownish coat, with mane and tail the same or lighter in color
 - * One of the most common coat colors, as it is seen in almost every breed of horse
- * For the horse to show up as red, it must have both recessive alleles
- * Pheomelanin can cause a wide range of different shades, but they all will have a reddish cast
 - * Sorrel and Chestnut - genetically identical

Extension



THE BASE COLORS



Agouti Bay

- * The Agouti gene is responsible for one of the most common horse colorations (bay)
- * Modifier gene which restricts black eumelanin pigment to a horse's lower legs, mane, and tail
- * Both chestnut's and black's can carry the dominant Agouti gene
 - * The bay coloration will only be visible on a black horse
 - * Chestnut horse does not have any black pigment for the Agouti gene to restrict
- * Different than most genes, the Agouti has more than two possible alleles...

Agouti Bay

- * Four total in order from most recessive to most dominant

- * aa

- * Does nothing and is easily overwritten

- * Ata or aAt

- * restricts black pigment from the soft areas of a horse's body

- * Results in seal brown

- * Aa or aA

- * Most common and results in regular bay coloring

- * Body will be brown, legs may have black shading up to the knees, mane and tail will be black

- * A+a or aA+

- * Wild Bay

- * All the characteristics of regular bay except black shading does not pass fetlocks

- * Brown/red body color is typically lighter as well

Agouti Bay



AGOUTI
(BAY)



wild
bay



bay



brown
("seal brown")

White or Grey

- * Don't be confused by these two very similar colors
- * White
 - * Pink skin
 - * Born white, stay white
 - * If both parents carry the gene responsible for white color, Lethal White Syndrome develops and is fatal to the offspring.
- * Grey
 - * Black skin
 - * Born chestnut, bay, black before "greying out"
 - * "Greying out" speed varies from horse to horse

White or Grey



Grey

- More accurately Grey is a modifier
- Ongoing process of depigmentation of the colored hairs
- Grey slowly removes the pigment from the base color
- Black base coat with white diluting hairs throughout the body

Grey

- Grey has the unique ability to mask *everything* including any Pinto or Appaloosa patterns.
- No color is safe when Grey is present, as all horses that carry the Graying gene will end up a shade of grey or white.
 - For this reason some breeders do not like to have mares or stallions in their breeding herd.
- Gray is dominant
 - GG = Gray
 - Gg = physically grey
 - gg = no dilution (base coat appears)

Lethal White

Lethal – a genetic factor that causes death of an animal during prenatal life, at birth, or later in life

- WW = not born
- Ww = white horse
- ww = color expressed



Cream Dilution

- * The cream gene is an incomplete dominant
 - * A single dominant allele will have a different effect than two dominant alleles
 - * Single dilute or double dilute
- * Single Dilute – cream gene that causes gold horses
- * Double Dilute – cream gene that will lighten a horse's coat to ivory or nearly white

Cream Dilute

Single Dilute



Double Dilute



Cream Dilution

Palomino

1. Golden yellow
 - Ideal
 - New United States gold coin
 - Shades light to dark
 - Born very light to white
 - Pink skin at time but will darken
 - Brown to light amber eyes
 - It may take several years for a horse to turn golden
2. White mane and tail

▪ Cream dilution

- * Appears in conjunction with Agouti
- * Recessive gene--somewhat
- * CC = Base coat will appear
 - * Chestnut
- * Cc^{cr} = Cream dilution
 - * Palomino
 - * Base coat = chestnut with dilution



Cream Dilution

Buckskin

- Light bay
- Gold to yellow coat
- Black points
- No dorsal stripe



■ Cream dilution

Appears in conjunction with Agouti

Recessive gene--somewhat

CC = Base coat will appear

Black, Chestnut, or Bay

Cc^{cr} = Cream dilution

Buckskin

Base coat = bay with dilution

Cream Dilution

Perlino

- Light or pink skin
- White or cream colored hair coat
- Mane, tail and legs slightly darker than the body
- Blue eyes



■ Cream dilution

Appears in conjunction with Agouti

Recessive gene--somewhat

CC = Base coat will appear

Black, Chestnut, or Bay

Cc^{cr} = Cream dilution

Palomino or Buckskin

c^{cr}c^{cr} = Highest dilution

Bay base coat and dilution = Perlino

Cream Dilution

Cremello

- Light or pink skin
- White or cream colored hair coat
- Mane, tail and legs crème
- Blue eyes



■ Cream dilution

Appears in conjunction with Agouti

Recessive gene--somewhat
CC = Base coat will appear
Black, Chestnut, or Bay

Cc^{cr} = Cream dilution

Palomino or Buckskin

$c^{cr}c^{cr}$ = Highest dilution

Chestnut base coat and
dilution = Cremello

Dun Dilution

- Bay base color
- Dun dilutes
 - * Bay base color
 - * Dun dilution
 - * Black
 - * Red pigment
 - * Dun dilution causes different types of Dun
- Primitive markings
 - * Dorsal stripe
 - * It may or may not have
 - * Zebra stripes on legs
 - * Transverse stripe over wither
- Dilution Gene
 - Dominant dilution
 - Affects Black, Chestnut, and Bay
 - DD, Dd = Dun
 - dd = no dilution



Dun Dilution

- * Different Combinations of the Dun Dilution

- * Classic Dun EeAaDd

- * Grulla EeaaDd

- * Red Dun eeaaDd

- * Brown Dun EeAtaDd

- * Dunalino eeaaCrcrDd

- * Dunskin EeAaCrcrDd

- * Smokey Grulla EeaaCrcrDd

- * Dun Pearl EeaaprlprlDd

- * Apricot Dun eeaprlprlDD

Champagne

- * Rare Dilution affecting the red gene
 - * Red horse turns golden
 - * Hazel eyes is a unique characteristics
- * Classic, Sable, Amber, Gold Champagne



Gold Champagne



Classic Champagne



Amber Champagne



Sable Champagne

Silver Dapple & Flaxen

- * Gene that affects the mane and tail
 - * Silver Dapple affects black pigment
 - * Disproportionate shading of the mane and tail
 - * Flaxen affects red pigment
 - * Mane and tail is lighter than the body color
 - * Blonde

Silver Dapple & Flaxen



Roan, Rabicano, Sooty

- ROAN

- Pattern caused

- * White hairs mixing with colored hairs
 - * Legs and face typically remain solid

- Non-progressive color

- * Visible by a few months of age
 - * May become darker
 - * Seasonal change



- RABICANO

- Pattern caused

- * White hairs mixing with colored hairs on the belly

- Non-progressive color

- * Visible by a few months of age
 - * May become darker
 - * Seasonal change



Roan, Rabicano, Sooty

- SOOTY
 - Pattern caused
 - * Black hairs mixing with colored hairs
 - * Prevalent on the back of the horse
 - Non-progressive color
 - * Visible by a few months of age
 - * May become darker
 - * Seasonal change

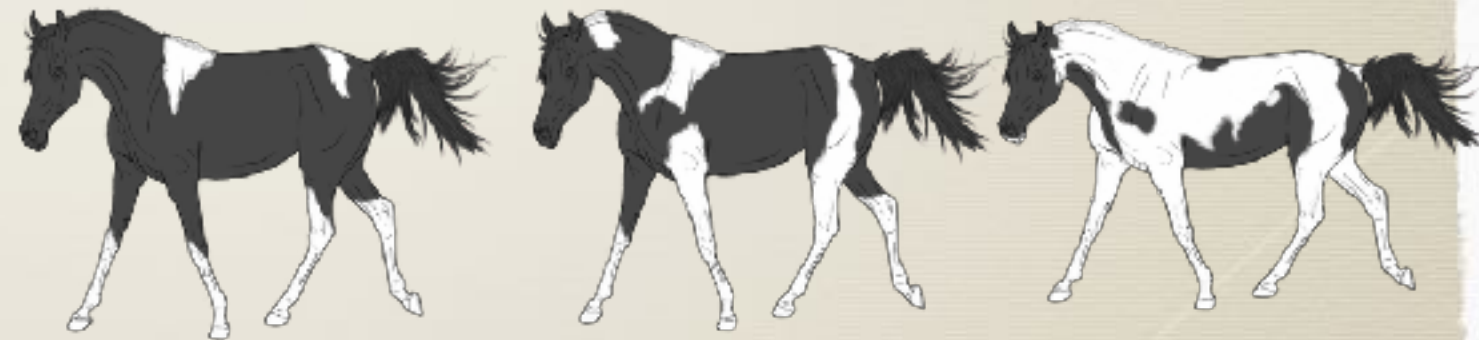


Pintos & Paints

- * Pinto – Can be any breed and is a coat color generally characterized by flashy, asymmetrical white markings
- * Paint – of Quarter Horse or Thoroughbred lineage with pinto markings
- * White markings will have pink skin underneath the hair, although the margins of the markings may have dark skin.

Pintos & Paints

- * Tobiano - often characterized by vertical white markings that are ovalish in shape, white legs, brown eyes, and face markings.
- * Legs are typically white
- * White patches cross the center line of the back



Tobiano Markings Ref



Pintos & Paints

- * Frame Overo - irregular white patches arranged in a horizontal fashion over its base color. They are usually jagged rather than rounded and typically have a sharp edge
- * Legs are typically colored
- * White on face is common
- * A foal with both dominant Fr genes will develop Lethal White Syndrome



Overo Marking Ref.



Pintos & Paints

- * Sabino - causes a distinctive white spotting pattern with irregular rough edged white patches on 2 or more legs and the face
- * Caused by an incomplete dominant allele of the KIT gene
- * frequently have spots or roaning on the belly and flanks



Pintos & Paints

- * Splashed White - often characterized by crisp margins on the white markings, bottom-heavy wide blazes, tall socks, belly spots, and blue eyes (even if the white doesn't touch the eyes)
- * Looks as though the horse was dunked in or ran through white paint



The KIT Gene

- * Responsible for many different white patterns
 - * Roan, Tobiano, Sabino, and Dominant White

Appaloosa

- Pattern
 - * Leopard
 - * Blanket
 - * Snowcap
 - * Snowflake
 - * Varnish roan
 - * Frost
- Mottled skin
 - * Grey, pink patterned skin
- Striped hooves
- White sclera around the eye



