

Let's Review Some Cowboy Genetics

Adapted from the North American Limousin Foundation (NALF) Members Manual

Like all mammals, many different types of cells shape beef cattle. To geneticists, the most important part of the cell is the nucleus, which contains chromosomes. The chromosomes contain genes, which determine the animal's heredity. Chromosomes occur in pairs, and cattle have 30 pairs of chromosomes. Therefore, each cell contains 60 chromosomes.

Sperm and ovum (eggs) are different, however. Those cells contain only one chromosome from each pair (30 single chromosomes). When a bull's sperm fertilizes a cow's egg, the resulting embryo will contain the 30 pairs of chromosomes. One chromosome in each pair will come from the bull, and one will come from the cow.

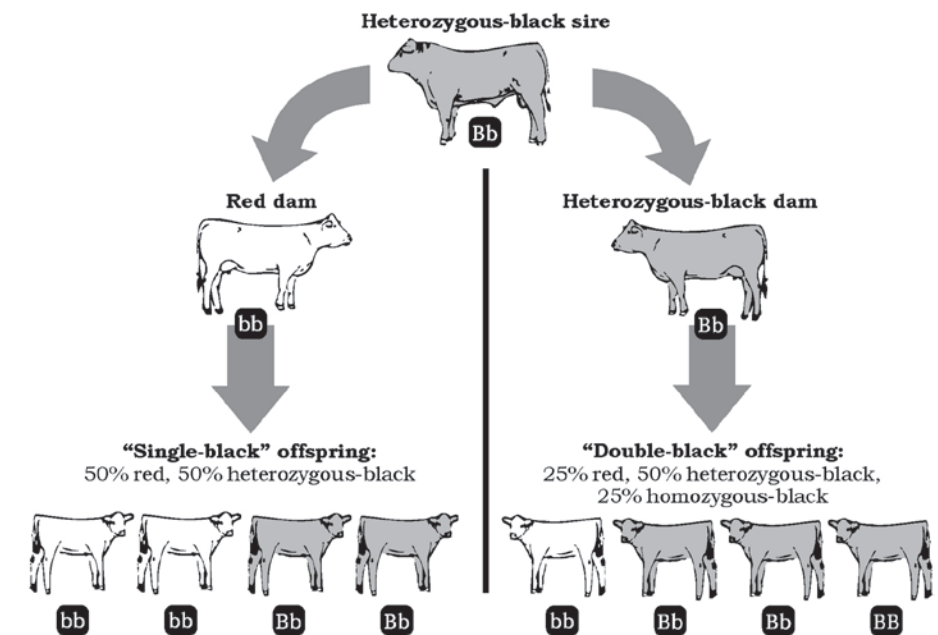
There are possibly several hundred or several thousand genes on each chromosome. Genes, like chromosomes, occur in pairs. The place where a gene is located on a chromosome is a "locus." At any locus, there are two genes—one on each chromosome.

Genes control (to a greater or lesser degree) growth rate, feed efficiency, disposition, conformation and about all of the animal's other characteristics. Many genes combine to influence such traits as birth and weaning weights, while a single pair of genes determines such traits as coat color and polled status.

Coat Color

Due to upgrading programs within the Limousin breed, both black and red purebred Limousin cattle exist today. A single gene pair influences that difference in color.

We will call the gene responsible for black color "B" and the gene for red color (or the absence of black) "b." When both of an animal's genes are for black ("BB") or for red ("bb") at the



same locus, we say it is "homozygous." When an animal has a black gene and a red gene at the same locus ("Bb"), we say it is "heterozygous."

The black gene is dominant to the red gene so an animal will be black whenever the black gene appears on its chromosome. Therefore, both a homozygous-black and a heterozygous animal will be black. Only a homozygous-red animal will be red. In fact, because there is no such thing as a "heterozygous-red" animal, we do not need to refer to red animals as homozygous.

The animals will pass one of the genes for color to their offspring. A homozygous-black animal always will pass on the black gene. Likewise, a red animal always will pass on the red gene. A heterozygous animal, however, could pass either the black or the red gene to its offspring. If two black parents both are heterozygous-black, they each have a 50 percent chance of passing on the red gene. Therefore, their offspring have a 25 percent chance of being red.

The figure illustrates two scenarios of how an animal might inherit the color gene.

Polled Status, Scurs

Like coat color, a single gene pair controls polled status. The polled condition is dominant to the horned condition. We will call the polled gene "P" and the horned gene "p." The only time an animal will exhibit horns is when it is homozygous-recessive (homozygous-horned or "pp"). Homozygous-dominant ("PP") and heterozygous ("Pp") animals will be phenotypically polled.

Scurs and smooth polls (lacking scurs) are separate from horned or polled status. Scurs are incompletely developed horns that generally are loose and moveable beneath the skin. They can attach to the skull in older animals.

The inheritance of scurs is a separate process from the inheritance of horns, and it involves different genes. We will call the genes controlling the presence of scurs "Sc" and the absence of the scur gene "Sn." The presence or absence of the gene for scurs has

no effect on the polled genes. Many horned cattle have the gene for scurs, but the horn growth hides its presence.

The inheritance of the scur gene is more complicated than that for polled status or coat color. More than one pair of genes might affect the scurred condition. In addition, males and females express the gene differently. In males, the scur gene is dominant so the presence of a single scur gene (“Sc”) will cause a bull to be scurred. In females, the scur gene is recessive so

Animal's genotype	Female phenotype	Male phenotype
ScSc	Scurred	Scurred
ScSn	Smooth-polled	Scurred
SnSn	Smooth-polled	Smooth-polled

a cow must possess two “Sc” genes to be scurred. If a cow is heterozygous (“ScSn”), she will not be scurred; but she may pass the scur gene to some of her calves. You can detect a heterozygous cow if she produces a scurred bull calf

from a smooth-polled bull. Additionally, a phenotypically scurred cow always is expected to produce bull calves with scurs.

The above table explains the inheritance of scurs. **LW**