Background & Example 1: Color Genetics Probability

In order to calculate the probabilities for offspring from a cross, you must first figure out what kind of sperm the bull can produce with respect to the trait or traits you're working on. The same thing is true for the eggs from the cow. Remember that all of this is a matter of probabilities, not guaranteed results.

I'll use a red bull who is E^+/e and a black cow who is E^D/e for my first example. Notice that I am talking only about the E genes- not any other color or trait.

This bull produces 2 different kinds of sperm: ½ of his sperm will have the E^+ gene, and ½ of his sperm will have the e gene. I'll use blue for the genes from the bull.

This cow produces 2 different kinds of eggs: ½ of her eggs will have the E^D gene, and ½ of her eggs will have the e gene. I'll use red for the genes from the cow.

Multiply the number of kinds of sperm (2) times the number of kinds of eggs (2) to find out how many squares you need in your diagram and how they are arranged in rows and columns. 2 x 2 = 4, so you need four squares that are arranged in 2 rows and 2 columns. For the sake of consistency, I'll put the bull's genes on the top of every diagram and the cow's genes on the left side of every diagram. After you've put the sperm and egg genes where they belong in the diagram, fill in the boxes to combine the genes from the bull and cow. Notice that I put the gene symbols in the same order (E^D,E^+,e) no matter which parent they come from. The reason for doing this is to keep the analysis of the results as simple as possible. I put the color analysis of the calf in each box in green.

	E^+	e
E^D	E^D/E^+ black	E^D/e black
e	E^+/e red	e/e red

You can see from this diagram that 2/4 = ½ = 50% of the calves are black, and 2/4 = ½ = 50% are red. Notice that the black calves carry red.

Example 2: Color Genetics Probability

dun bull (b/b) x black cow that carries dun (B/b)

All (100%) of this bull's sperm have a dun gene (b)

½ of this cow's eggs have a black gene (B), and ½ of her eggs have a dun gene (b)

1 x 2 = 2, so we need two boxes: 1 column with 2 rows

	b
B	B/b black
b	b/b dun

You can see from this diagram that ½ = 50% of the calves are black, and ½ = 50% are dun. Notice that the black calf carries dun.

Example 3: Color Genetics Probability

black bull that carries dun (B/b) x black cow that carries dun (B/b)

½ of this bull's sperm have a black gene (B), and ½ of his sperm have a dun gene (b)

½ of this cow's eggs have a black gene (B), and ½ of her eggs have a dun gene (b)

2 x 2 = 4, so we need four boxes: 2 column and 2 rows

	B	b
B	B/B black	B/b black
b	B/b black	b/b dun

You can see from this diagram that 3/4 = 75% of the calves are black, and 1/4 = 25% are dun. Notice that the 1/3 of the black calves do not carry dun, and 2/3 of the black calves do carry dun.

The cross of a black bull that carries red with a black cow that carries red works just like Example 3.

Example 4: Color Genetics Probability

black bull that carries red and dun (E^D/e B/b) x dun cow that carries red (E^D/e b/b)

This bull produces 4 different kinds of sperm: E^D B, E^D b, e B, e b
(each kind of E with each kind of B)

This cow produces 2 different kinds of eggs: E^D b, e b
(each kind of E with b)

4 x 2 = 8, so we need eight boxes: 4 columns with 2 rows

	E^D B	E^D b	e B	e b
E^D b	E^D/E^D B/b black	E^D/E^D b/b dun	E^D/e B/b black	E^D/e b/b dun
e b	E^D/e B/b black	E^D/e b/b dun	e/e B/b red	e/e b/b red*

*See #5 of "Basic Concepts of Dexter Color Genetics"

You can see from this diagram that 3/8 of the calves are black, 3/8 are dun, and 2/8 are red. Remember that a Dexter that contains two red genes and two dun genes is red in appearance.

Example 5: Color Genetics Probability

black bull that carries red and dun (E^D/e B/b) x black cow that carries red and dun (E^D/e B/b)

This bull produces 4 different kinds of sperm: E^D B, E^D b, e B, e b
(each kind of E with each kind of B)

This cow produces 4 different kinds of eggs: E^D B, E^D b, e B, e b
(each kind of E with each kind of B)

4 x 4 = 16, so we need sixteen boxes: 4 columns with 4 rows

	E^D B	E^D b	e B	e b
E^D B	E^D/E^D B/B black	E^D/E^D B/b black	E^D/e B/B black	E^D/e B/b black
E^D b	E^D/E^D B/b black	E^D/E^D b/b dun	E^D/e B/b black	E^D/e b/b dun
e B	E^D/e B/B black	E^D/e B/b black	e/e B/B red	e/e B/b red
e b	E^D/e B/b black	E^D/e b/b dun	e/e B/b red	e/e b/b red*

*See #5 of "Basic Concepts of Dexter Color Genetics"

You can see from this diagram that 9/16 of the calves are black, 4/16 are red, and 3/16 are dun. Remember that a Dexter that contains two red genes and two dun genes is red in appearance.

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