6 SB

Academic Biology Chapter 10 Incomplete and Codominance Worksheet

In many ways Gregor Mendel was quite lucky in discovering his genetic laws. He happened to use pea plants, which happened to have a number of easily observable traits that were determined by just two alleles. And for the traits he studied in his peas, one allele happened to be dominant for the trait & the other was a recessive form. Things aren't always so clear-cut & "simple" in the world of genetics, but luckily for Mendel (& the science world) he happened to work with an organism whose genetic make-up was fairly clear-cut & simple.

If Mendel were given a mommy black mouse & a daddy white mouse & asked what their offspring would look like, he would've said that a certain percent would be black & the others would be white. He would never have even considered that a white mouse & a black mouse could produce a *GREY* mouse! For Mendel, the phenotype of the offspring from parents with different phenotypes always resembled the phenotype of at least one of the parents. In other words, Mendel was unaware of the phenomenon of

INCOMPLETE DOMINANCE.

I remember Incomplete Dominance in the form of an example like so:

RED Flower x **WHITE** Flower ---> **PINK** Flower

With incomplete dominance, a cross between organisms with two different phenotypes produces offspring with a **third** phenotype that is a **blending** of the parental traits.

It's like mixing paints, red + white will make pink. Red doesn't totally block (dominate) the white, instead there is *incomplete* dominance, and we end up with something in-between.

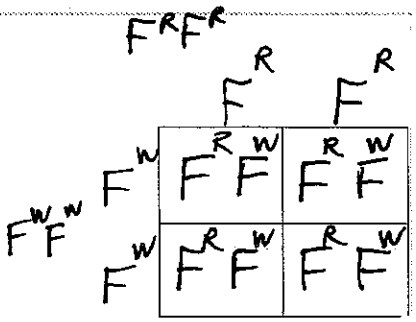
We can still use the Punnett Square to solve problems involving incomplete dominance. The only difference is that instead of using a capital letter for the dominant trait & a lowercase letter for the recessive trait, the letters we use are both going to be capital (because neither trait dominates the other). So the cross above would look like this:

F^R = allele for red flowers

F^W = allele for white flowers

red x white ---> pink

$F^RF^R \times F^WF^W$ ---> 100% F^RF^W



We'll use "F" for the flower color allele.
F^R = allele for red flowers
F^W = allele for white flowers

The trick is to *recognize* when you are dealing with a question involving incomplete dominance. There are two steps to this:
1) Notice that the offspring is showing a **3rd phenotype**. The parents each have one, and the offspring are **different from the parents.**
2) Notice that the trait in the offspring is a **blend** (mixing) of the parental traits.

Sample Questions

1. A cross between a blue blahblah bird & a white blahblah bird produces offspring that are silver. The color of blahblah birds is determined by just two alleles.
a) What are the genotypes of the parent blahblah birds in the original cross?
b) What is/are the genotype(s) of the silver offspring?
c) What would be the phenotypic ratios of offspring produced by two silver blahblah birds?

2. The color of fruit for plant "X" is determined by two alleles. When two plants with orange fruits are crossed the following phenotypic ratios are present in the offspring: 25% red fruit, 50% orange fruit, 25% yellow fruit. What are the genotypes of the parent orange-fruited plants?

CO-DOMINANCE

First let me point out that the meaning of the prefix "co-" is "together".
Cooperate = work together. Coexist = exist together. Cohabitat = habitat together.

The genetic gist to codominance is pretty much the same as incomplete dominance. A **hybrid** organism shows a **third phenotype** --- not the usual "dominant" one & not the "recessive" one ... but a third, *different* phenotype. With incomplete dominance we get a blending of the dominant & recessive traits so that the third phenotype is something in the middle (red x white = pink).

In **COdominance,** the "recessive" & "dominant" traits appear **together** in the phenotype of hybrid organisms.

I remember codominance in the form of an example like so:
red x ---> r d & h t s o t d

With codominance, a cross between organisms with two different phenotypes produces offspring with a third phenotype in which both of the parental traits appear together.

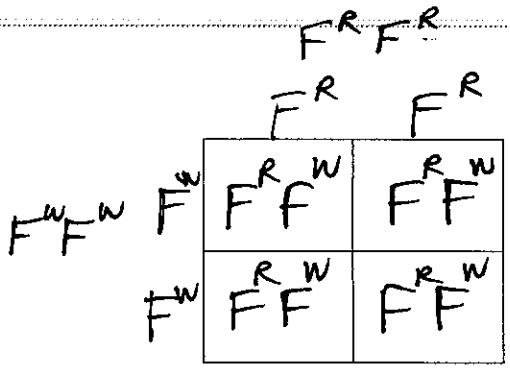
When it comes to punnett squares & symbols, it's the same as incomplete dominance. Use capital letters for the allele symbols. My example cross from above would look like so:

F = allele for red flowers

F = allele for white flowers

red x white ---> red & white spotted

$F^R F^R \times F^W F^W$ ---> 100% $F^R F^W$



We'll use "F" for the flower color allele.
F^R = allele for red flowers
F^W = allele for white flowers

red x white --------> red & white spotted flowers
$F^R F^R \times F^W F^W$ ----> 100% $F^R F^W$

The symbols you choose to use don't matter, in the end you end up with hybrid organisms, and rather than one trait (allele) dominating the other, both traits appear together in the phenotype. Wa-la, codominance.

A very very very very very common phenotype used in questions about codominance is roan fur in cattle. Cattle can be red (RR = all red hairs), white (WW = all white hairs), or roan (RW = red & white hairs together). A good example of codominance.
Another example of codominance is human blood type AB, in which two types of protein ("A" & "B") appear together on the surface of blood cells.

Sample Questions

1. Predict the phenotypic ratios of offspring when a homozygous white cow is crossed with a roan bull.

2. What should the genotypes & phenotypes for parent cattle be if a farmer wanted only cattle with red fur?

3. A cross between a black cat & a tan cat produces a tabby pattern (black & tan fur together).
   a) What pattern of inheritence does this illustrate?
   b) What percent of kittens would have tan fur if a tabby cat is crossed with a black cat?

The concepts on this page don't make Mendel dumb in any way. They are simply information that has been discovered & added to his ingenious work, making this snowball we call science just a wee bit bigger, & bigger, & bigger ....

So, good work! Hope your brain got a little bigger.