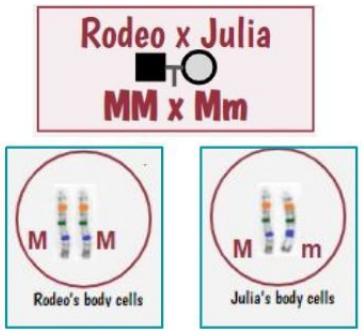
Student Support for Probability Work

This document will support your thinking while you work with these thinking tools to make predictions about the likelihood of offspring inheriting certain genotypes from parents. There are two methods to try (plus some alternate options for once you have a good understanding for how this works). While you may choose to use whichever method you are most comfortable working with, you may find that this document will help you see the similarities in the methods; so you may see them as interchangeable. There is plenty of space for notes in this packet so please annotate this and record any questions you have to help make sense of these tools.

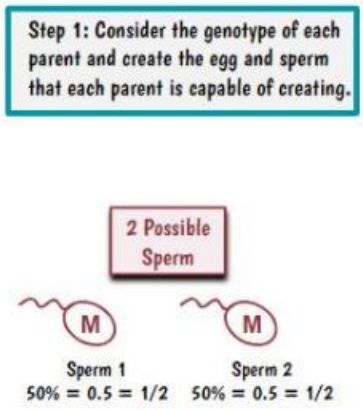
Making Predictions Using the Probability Rules

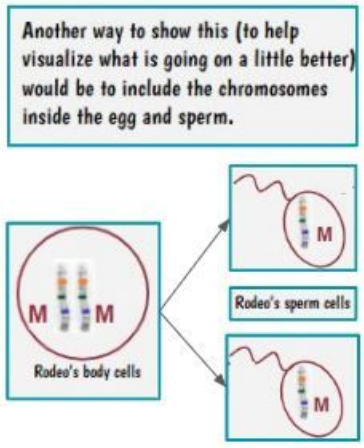
Remember - it is important to always remember what is happening during the process of making eggs and sperm, and what is happening when a sperm fertilizes an egg.

Whenever you are thinking about alleles, picture where they exist on a chromosome.

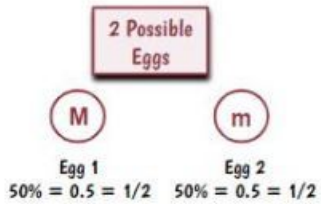


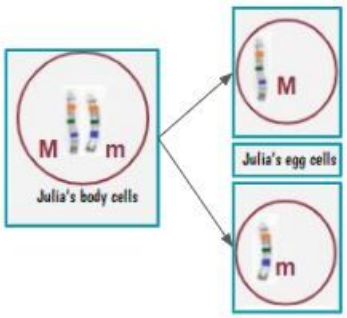
The body cells of organisms have 2 of each kind of chromosome. That means the body cells will have two alleles for each trait. An individual may be homozygous or heterozygous for any given trait.

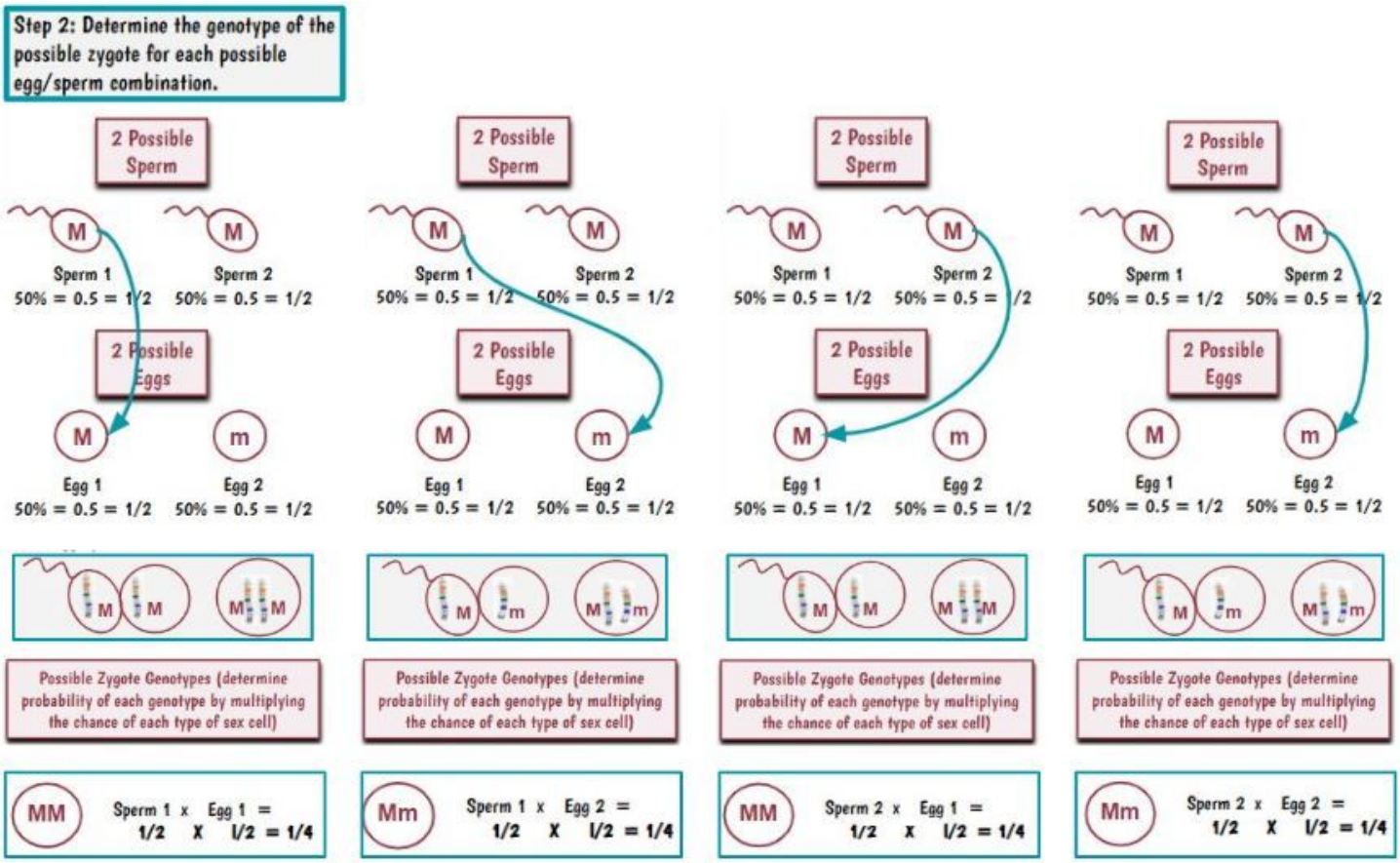




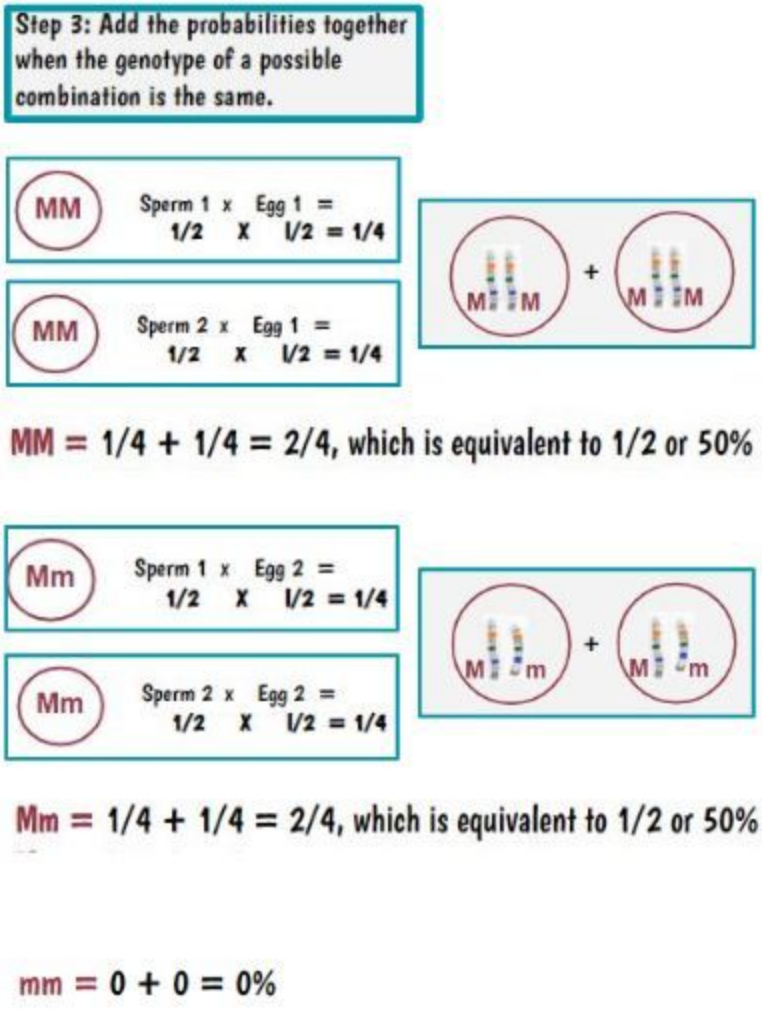
When egg and sperm are made they only get 1 chromosome from each pair, therefore they also only have 1 allele for each trait.



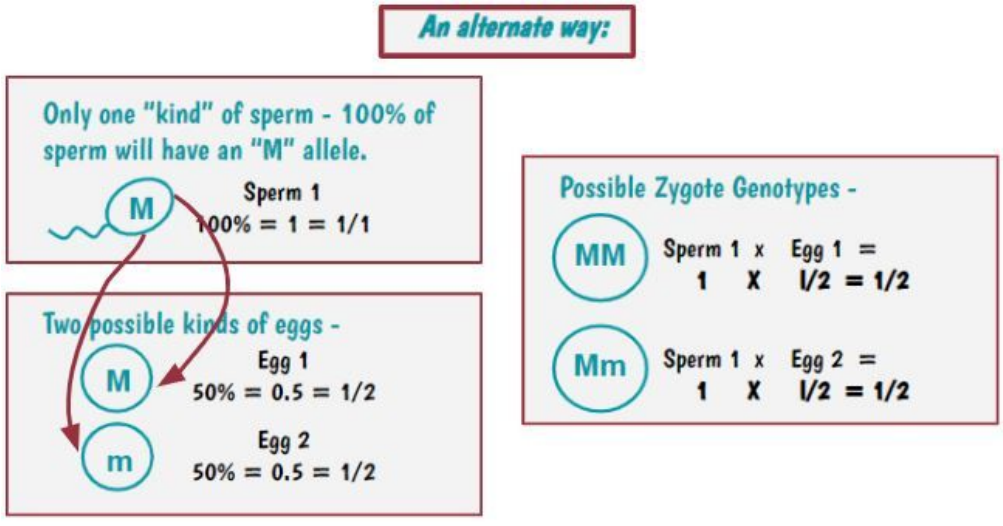




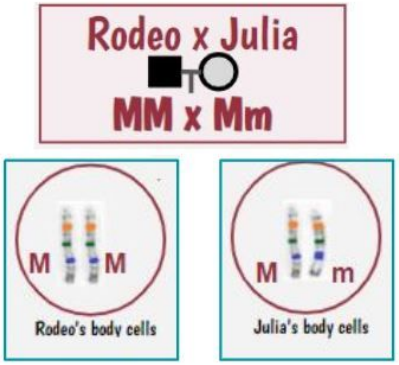
When an egg and sperm combine to form a zygote, the chromosomes combine to give that cell 2 of each kind of chromosome. One chromosome was provided by the female parent through the egg cell and the other by the male parent through the sperm cell.



Here is an alternate way to think about these predictions using the Probability Rules:

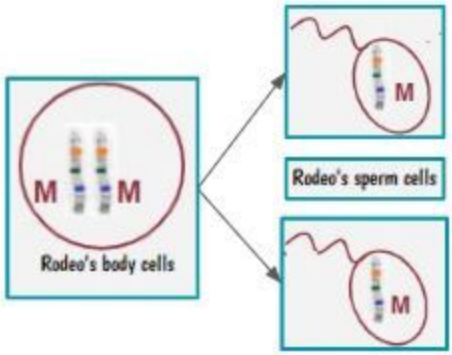


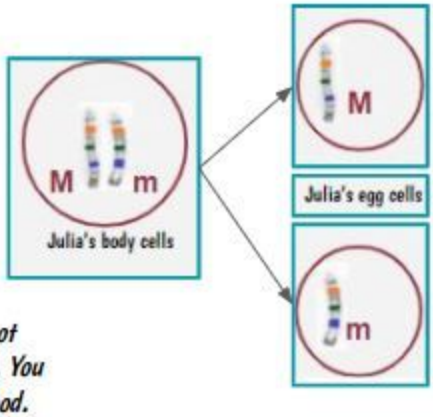
Making Predictions Using Punnett Squares



Step 1: Consider the genotype of each parent and create the egg and sperm that each parent is capable of creating.

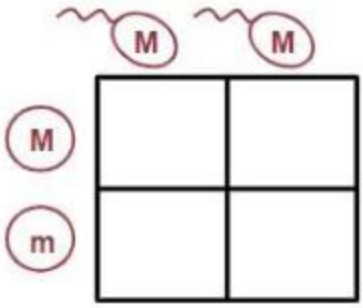
Another way to show this (to help visualize what is going on a little better) would be to include the chromosomes inside the egg and sperm.



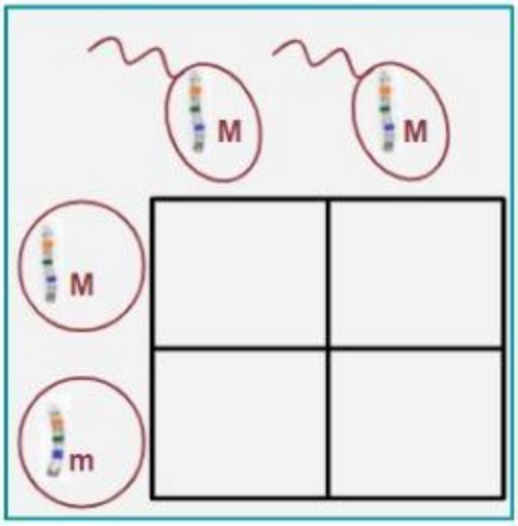


Notice the only difference in Step 1 - we are not designating a probability for each egg and sperm. You may do this, but it isn't necessary for this method.

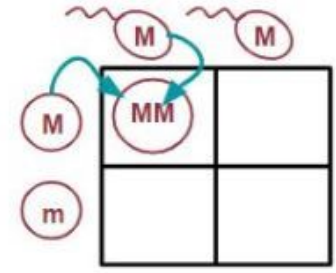
Step 2: Create a grid and arrange the possible sperm cells along the top of the grid and the possible egg cells down the side of the grid.

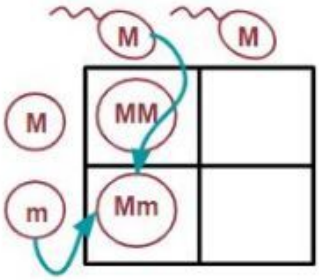


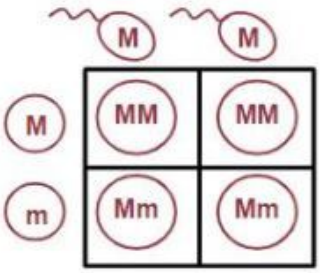
The grid that helps visualize these probabilities is called a "Punnett square"

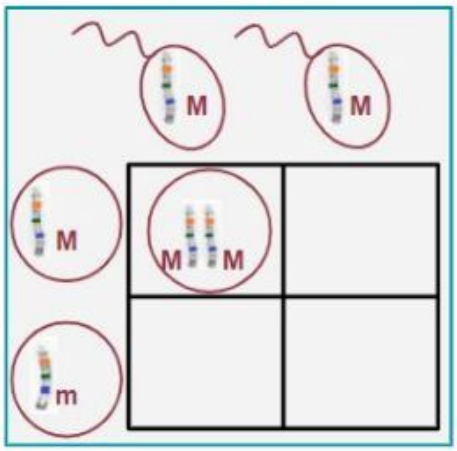


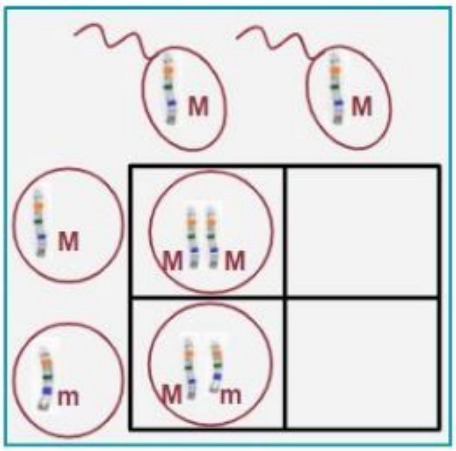
Step 3: Use the grid to determine the genotype of the zygote for each possible egg/sperm combination.

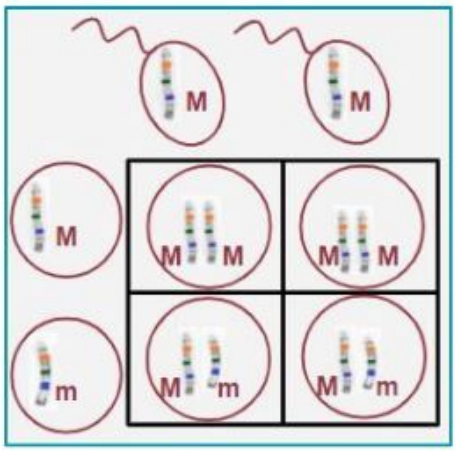




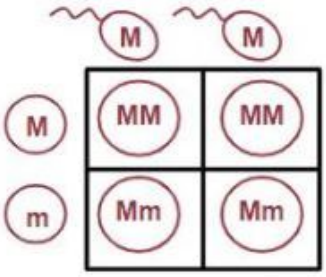






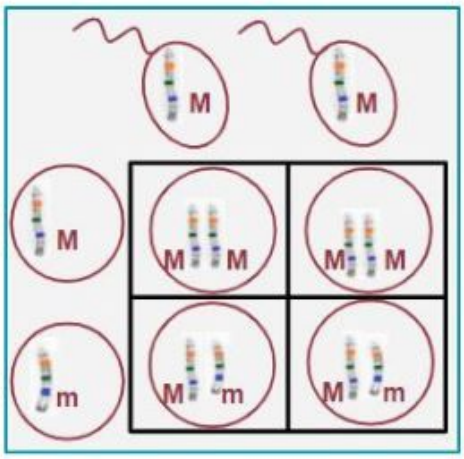


Step 4: Count the zygotes that have the same genotype and then divide by the number of total zygotes to get the probability for each genotype



Determine the probability of each genotype by counting the zygotes of that type and dividing by the total

MM = 2/4 = 2/4, which is equivalent to **1/2 or 50%**
Mm = 2/4 = 2/4, which is equivalent to **1/2 or 50%**
mm = 0/4 = 0%



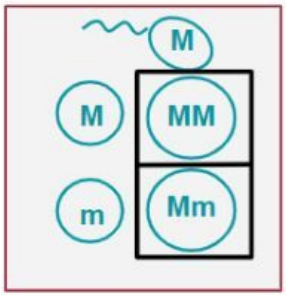
Here is an alternate way to think about these predictions using a Punnett square:

An alternate way:

Only one "kind" of sperm - 100% of sperm will have an "M" allele.

Two possible kinds of eggs -

Find the possible Zygotes by setting up a (not square) Punnett square -



Count the number of zygotes for for each genotype and divide by the total number of possible zygotes.

MM = 1/2
Mm = 1/2
mm = 0/2

MM = **1/2 = 50%**
Mm = **1/2 = 50%**
mm = 0/2 = 0%