TUTORIAL: Dihybrid Crosses: Crosses that involve 2 traits.

Name: _____

These types of crosses can be challenging to set up, and the square you create will be 4x4. This simple guide will walk you through the steps of solving a typical dihybrid cross common in genetics. The method can also work for any cross that involves two traits.

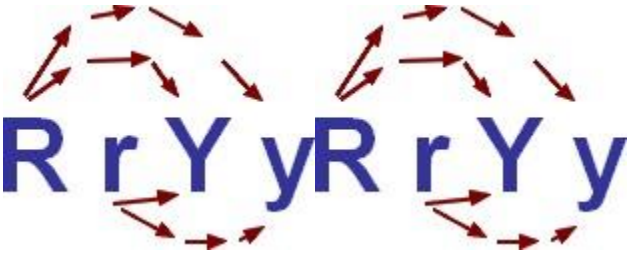
Consider this cross

A pea plant that is heterozygous for round, yellow seeds are self-fertilized, what are the phenotypic ratios of the resulting offspring?

Step 1: Determine the parental genotypes from the text above, the word "heterozygous" is the most important clue, and you would also need to understand that self-fertilized means you just cross it with itself.

R r Y y x R r Y y

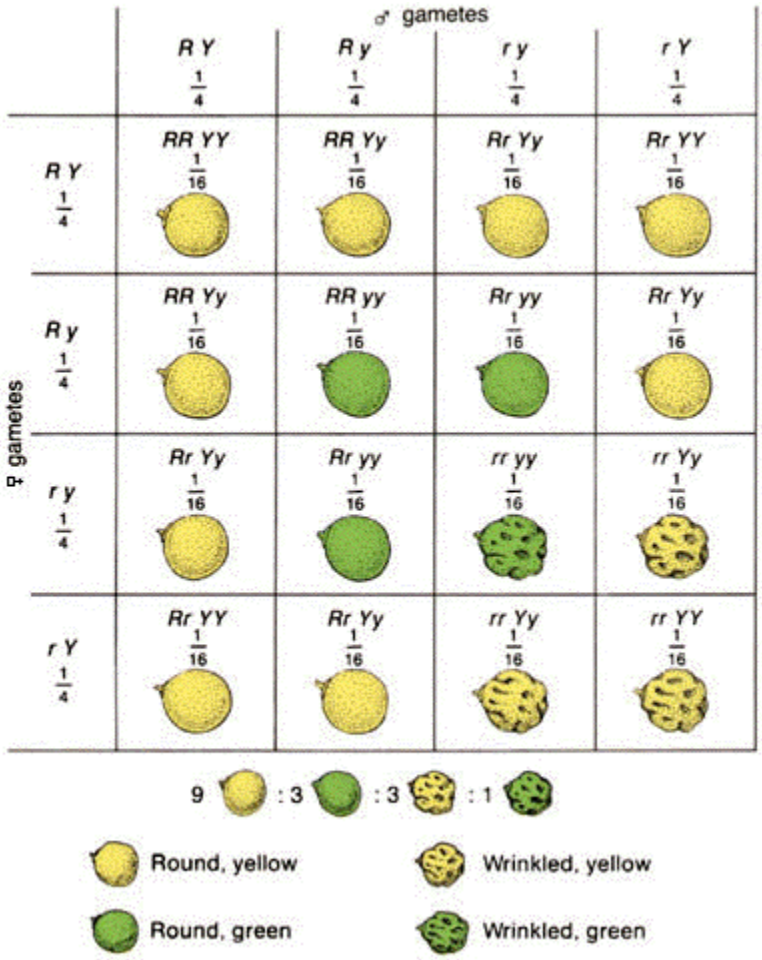
Step 2: Determine the gametes. This might feel a little like the FOIL method you learned in math class. Combine the R's and Ys of each parent to represent sperm and egg. Do this for both parents



Gametes after "FOIL"

RY, Ry, rY, ry (parent 1) and **RY, Ry, rY, ry** (parent 2)

Step 3: Set up a large 4x4 Punnett square, place one gamete set from the parent on the top, and the other on the side



Step 4: Write the genotypes of the offspring in each box and determine how many of each phenotype you have. In this case, you will have 9 round, yellow; 3 round, green; 3 wrinkled, yellow; and 1 wrinkled green

Some Shortcuts

In any case where the parents are heterozygous for both traits (AaBb x AaBb) you will always get a 9:3:3:1 ratio.

9 is the number for the two dominant traits, 3 is the number for a dominant/recessive combination, and only 1 individual will display both recessive traits.

Another way to determine the ratios is to do it mathematically

3/4 of all the offspring will have round seeds
3/4 of all the offspring will have yellow seeds

3/4 x 3/4 = 9/16 will have round, yellow seeds.

Crosses that Involve 2 Traits

Consider: R r Y y x r r y y

The square is set up as shown

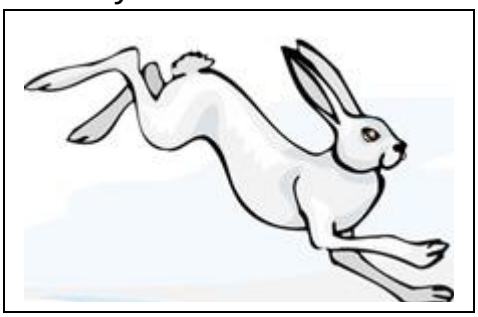
	RY	Ry	rY	ry
ry	RrYy round, yellow	Rryy round, green	rrYy wrinkled, yellow	rryy wrinkled, green
ry	RrYy	Rryy	rrYy	rryy
ry	RrYy	Rryy	rrYy	rryy
ry	RrYy	Rryy	rrYy	rryy

1/4 round, yellow
1/4 round, green
1/4 wrinkled, yellow
1/4 wrinkled, green

You might notice that all four rows have the same genotype. In this case, you really only need to fill out the top row, because 1/4 is the same thing as 4/16

Genetic Crosses that Involve 2 Traits – Assignment

In rabbits, grey hair is dominant to white hair. Also in rabbits, black eyes are dominant to red eyes.



GG = gray hair	BB = black eyes
Gg = gray hair	Bb = black eyes
gg = white hair	bb = red eyes

1. What are the phenotypes (descriptions) of rabbits that have the following genotypes:

Ggbb _____ ggBB _____
ggbb _____ GgBb _____

2. A male rabbit with the genotype GGbb is crossed with a female rabbit with the genotype ggBb The square is set up below. Fill it out and determine the phenotypes and proportions in the offspring.

How many out of 16 have grey fur and black eyes? ____

How many out of 16 have grey fur and red eyes? _____

How many out of 16 have white fur and black eyes? ____

How many out of 16 have white fur and red eyes? _____

	Gb	Gb	Gb	Gb
gB				
gB				
gb				
gb				

3. A male rabbit with the genotype GgBb is crossed with a female rabbit with the genotype GgBb The square is set up below. Fill it out and determine the phenotypes and proportions in the offspring.

How many out of 16 have grey fur and black eyes? ____

How many out of 16 have grey fur and red eyes? _____

How many out of 16 have white fur and black eyes? ____

How many out of 16 have white fur and red eyes? _____

	GB	Gb	gB	gb
GB				
Gb				
gB				
gb				

4. Show the cross between a ggBb and a GGBb. You'll have to set the square up yourself!

Genetic Crosses that Involve 2 Traits

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gb				

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How many out of 16 have white fur and black eyes? _____

How many out of 16 have white fur and red eyes? _____

3. A male rabbit with the genotype GgBb . Determine the gametes produced by this rabbit (the sperm would have these combinations of alleles) Hint there are 4 combinations.

4. Use the gametes from #3 to set up the Punnett square below. Put the male's gametes on the top and the female's gametes down the side. Then fill out the square and determine what kind of offspring would be produced from this cross and in what proportion. Use the back of this page for more room.

6. An aquatic arthropod called a Cyclops has antennae that are either smooth or barbed. The allele for barbs is dominant. In the same organism, resistance to pesticides is a recessive trait. Make a "key" to show all the possible genotypes (and phenotypes) of this organism. Use the rabbit key to help you if you're lost.

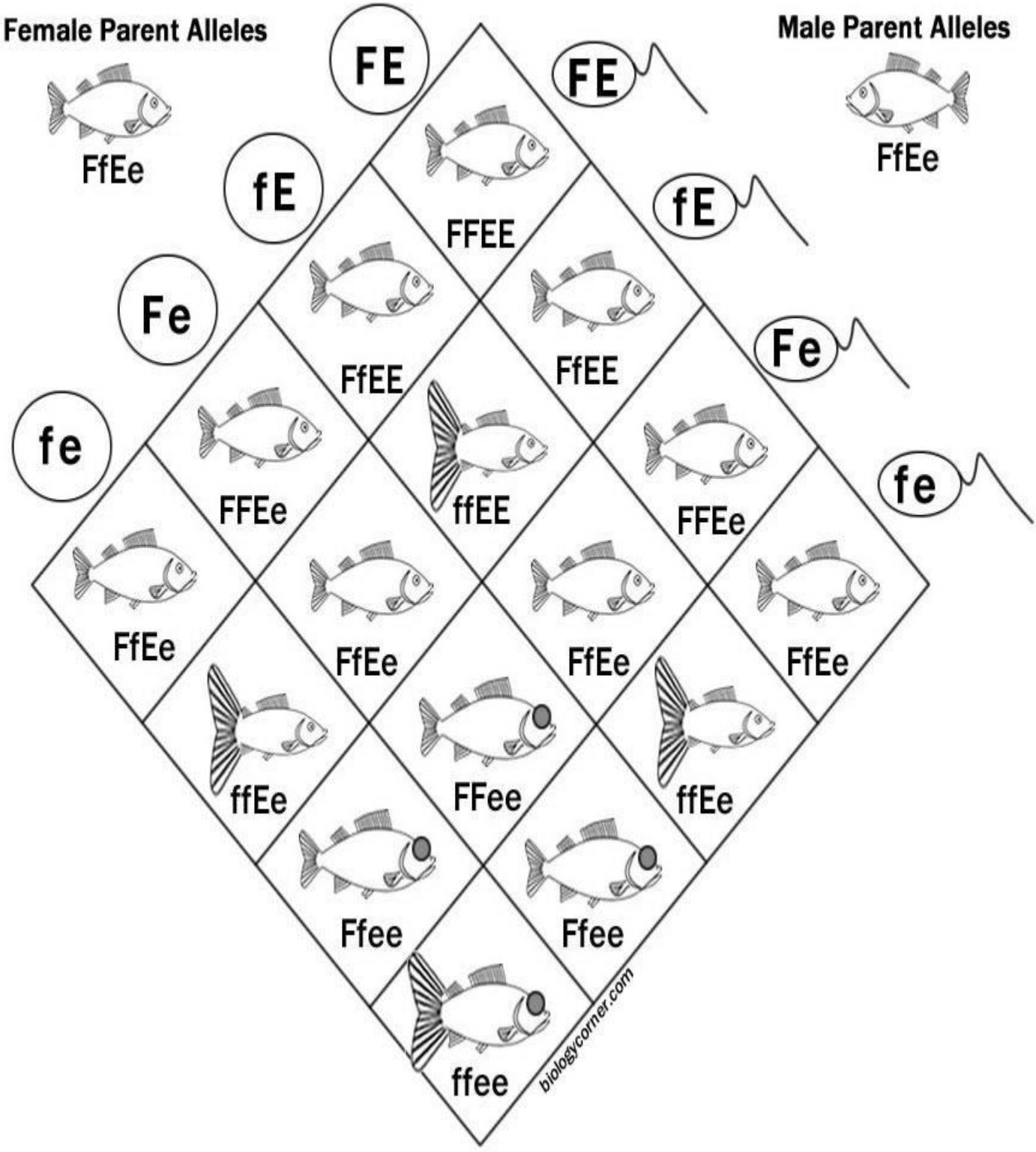
7. A Cyclops that is resistant to pesticides and has smooth antennae

is crossed with one that is heterozygous for both traits. Show the genotypes of the parents. _____ x _____

8. Set up a Punnett square for the cross and show the phenotypic ratios.

Dihybrid Cross: Fish with Fancy Tails and Funny Eyes

Determine the ratio of the cross shown below of two fish. The genes being studied are (f) (fancy tail) and (e) funny eye.



1. How many of the offspring are:

Normal Tails with Normal Eyes? _____
Normal Tails with Funny Eyes? _____
Fancy Tails with Normal Eyes? _____
Fancy Tails with Funny Eyes? _____

2. Set up the following cross using a Punnett Square:

Fancy Tailed, Funny Eyed Fish (ffee) x Normal Tail, Funny Eyed Fish (Ffee)