Genetics Worksheet - Punnett Squares **Name: _____**

Part 1 Introduction:

1. Describe the genotypes given (use your book). The first two are already done.

A. DD *homozygous, dominant*
B. Dd *heterozygous*
C. dd _____
D. ss _____
E. Yy _____
F. WW _____

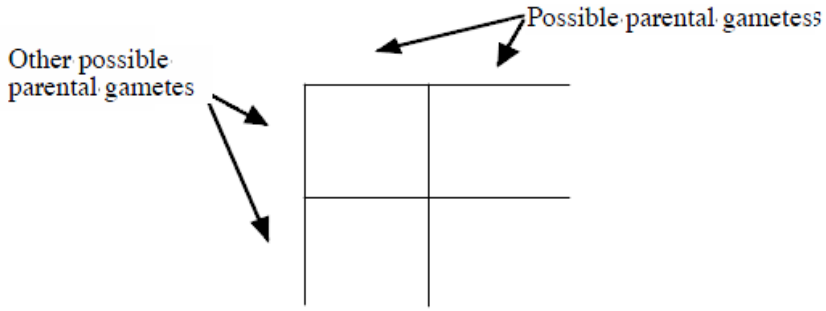
2. In humans, brown eye color (B), is dominant over blue eye color (b). What are the **phenotypes** of the following genotypes? In other words, what color eyes will they have?

A. BB _____
B. bb _____
C. Bb _____

The Five (5) Steps Associated With Solving a Genetics Problem:

If you take the time to follow the directions below, you will be able to solve most genetics problems.

1. **Determine** the **genotypes** of the parents or whatever is given in problem.
2. Set up your **Punnett square** as follows: *# sq. based on possible gametes that can be formed.



3. **Fill in** the squares. This represents the possible combinations that could occur during fertilization.
4. **Write out** the possible **genotypic ratio** of the offspring.
5. **Using** the **genotypic** ratio determine the phenotypic ratio for the offspring.

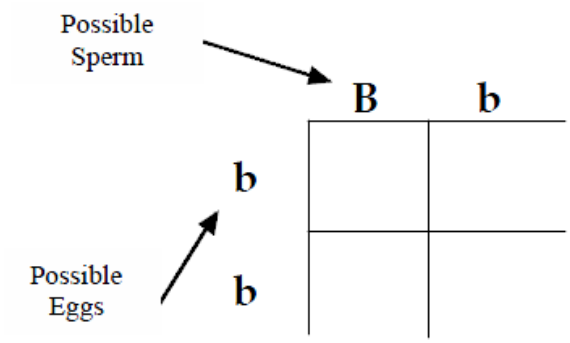
Part 2: Sample Problem (Just read this over, it is a practice problem)

A heterozygous male, black eyed mouse is crossed with a red eyed, female mouse. Predict the possible offspring!

Step 1: **Determine the genotype of the parents**. The male parent is **heterozygous** which means he has one allele for black eyes and one allele for red eyes. Since his eyes are black, this means that black allele must be dominant over the red allele. So the male parents genotype is "**Bb"** (B = allele for black eye, b = allele for red eye).

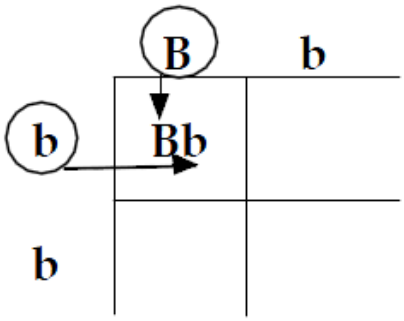
The female parent has red eyes, there is only one way to have this recessive phenotype, so she must to be homozygous recessive. Homozygous recessive means that her genotype must be "**bb**". Therefore, genotype of the parents is **Bb x bb.**

Step 2:
During meiosis (the formation of sex cells) one member (allele) of each gene pair separate. The male mouse (Bb) produces some sperm containing "B" (the allele for black eye) and some sperm containing "b" (the allele for red eyes).
On one axis of the Punnett square you put the two possible gametes for the male.



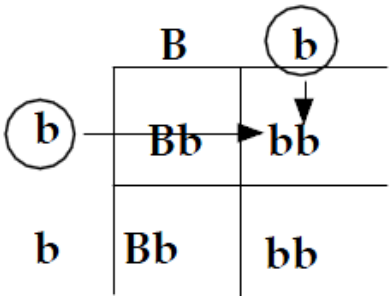
Repeat this for the other axis for the possible female gametes. Since she is "bb" you must put "b" and "b".

Step 3:
During fertilization sperm meets the egg. The Punnett square show us the various **possibilities** during fertilization. The offspring must be one of these genotypes listed in the squares.



If the sperm contains a "B" and it fertilizes an egg containing the "b" allele, the resultant offspring will have the genotype "Bb".

Repeating the process we can see all of the possible genotypes.



Step 4:
The genotypic ratio is determined by counting each possible genotype. You'll note there are two "Bb" for every two "bb". Therefore, we write the ratio as **2 Bb : 2 bb**

Normally we reduce to the lowest terms: **1 Bb : 1 bb**

Step 5:
The Bb will produce a black eyed mouse (phenotype) and the bb will produce a red eyed mouse (phenotype). The phenotypic ratio is written as **1 black eye : 1 red eye**

*Ratios tell you there is an **even chance** of having offspring with black eyes as there is for having offspring with red eyes. That would be the same as a 50% probability of having red eyes, or a 50% probability of having black eyes.*

. **On the following pages are several problems. With each new problem, one sample is illustrated, make sure you look over the sample.

Part 3 Monohybrid Cross

When we study the inheritance of a single gene it is called a monohybrid cross. **On the following pages are several problems.**

1. A heterozygous, smooth pea pod, plant is crossed with a wrinkled pea pod plant. *There are two alleles for pea pod, smooth and wrinkled.* **Predict the offspring from this cross.**

a. What is the the genotype of the parents? _____

b. Set up a Punnett square with possible gametes.

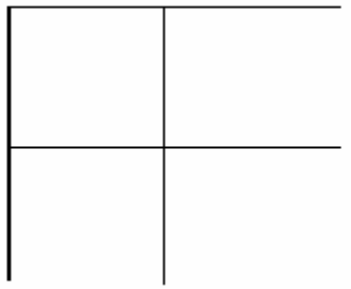
c. Fill in the Punnett square for the resultant offspring.

d. What is the predicted genotypic ratio for the offspring ?_____

e. What is the predicted phenotypic ratio for the offspring ?_____

f. If this cross produced 50 seeds how many would you predict to have a wrinkled pod?

2. In humans, acondroplasia "dwarfism" (D) is dominant over normal (d). A homozygous dominant (DD) person dies before the age of one. A heterozygous (Dd) person is dwarfed. A homozygous recessive individual is normal. A heterozygous dwarf man marries a dwarf heterozygous woman…….



a. What is the probability of having a normal child? _____
b. What is the probability that the next child will **also** be normal? _____
c. What is the probability of having a child that is a dwarf? _____
d. What is the probability of having a child that dies at one from this disorder? _____

3. In humans, free earlobes (F) is dominant over attached earlobes (f). If one parent is homozygous dominant for free earlobes, while the other has attached earlobes can they produce any children with attached earlobes?

Part 4: Working Backwards
Sometimes we only know about the offspring and we want to learn about the parents. You should have started to notice a pattern. For example, when bothparents are heterozygous the phenotypic ratio always comes out 3 to 1. If one parent ishomozygous recessive and the other is heterozygous, the phenotypic ratio always comes out 1 to1. Keeping this in mind see if you can solve the next two problems.

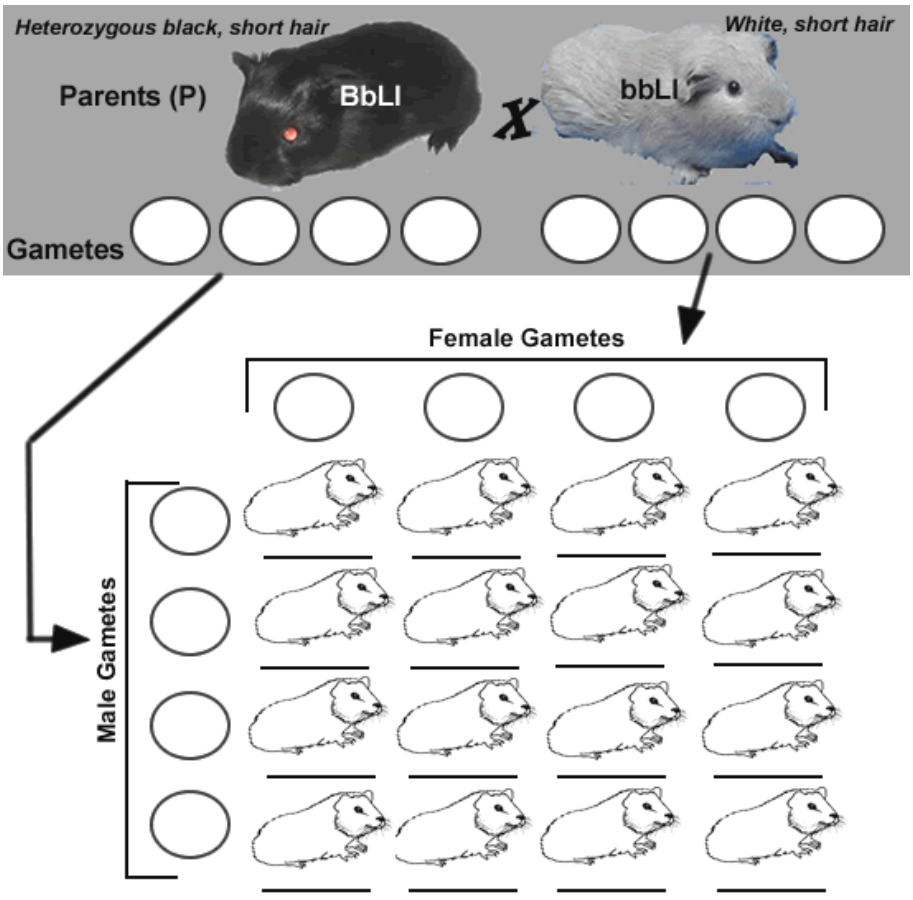
1. In pea plants, yellow seeds (Y) are dominant and green seeds (y) are recessive. A pea plant with yellow seeds is crossed with a pea plant with green seeds. The resulting offspring have about equal numbers of yellow and green seeded plants. What are the genotypes of the parents?

2. In another cross, a yellow seeded plant was crossed with another yellow seeded plant and it produced offspring of which about 25% were green seeded plants.
What are the genotypes of both parents?

Part 5: Dihybrid Cross

When we study two traits on different chromosomes, at one time, we call this a dihybrid cross. You still follow the same five step process for Monohybrid crosses but now there will be four times as many possibilities because we are studying two traits. Remember that the offspring must have the same number of chromosomes as their parents or they will be mutants!

E.g. A female guinea pig is heterozygous for both fur color and coat length is crossed with a male that has light fur color and is heterozygous for coat length. What possible offspring can they produce? Dark fur color is dominant (B) and light fur (b) is recessive. Short coat (L) is dominant, while long coat (l) is recessive.



How many of the offspring are:
Black, Short _____
Black, Long _____
White, Short _____
White, Long _____

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

GG = gray hair Gg = gray hair gg = white hair	BB = black eyes Bb = black eyes 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.

	Gb	Gb	Gb	Gb
gB				
gB				
gb				
gb				

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? _____

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. A female rabbit has the genotype ggBb. Determine the gamets (eggs) produced by this rabbit.

5. Use the gametes from #3 and #4 to set up a punnet 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.