Making Babies

So far we have been talking about your phenotype – your observable traits. For every characteristic (like eye color) there are different forms or varieties of that characteristic that you could actually have (blue, green, hazel or brown eyes).

All of these traits are caused by variations in your genes. Every gene comes in one of two different forms. We represent those forms by a letter, either as a capital letter or a lower case letter. For example, eye color has a gene that can come in the B form (brown) or the b form (non-brown). These different forms are called alleles.

Every individual has 2 copies of each gene, one from mom, the other from dad. Thus, for eye color, you could be:
BB – two brown alleles
Bb – one brown allele, one non-brown allele
bb – two non-brown alleles

One allele is dominant. The other allele is recessive. The dominant allele masks or covers up the other gene. Brown eyes are dominant over blue eyes. If you have a brown allele, your eyes will be brown no matter whether the other allele is. Thus, if a person is Bb with one brown allele and one non-brown allele, then they will have brown eyes, not a mixture of brown and blue.

If you are BB, your eyes will be _____.
If you are Bb, your eyes will be _____.
If you are bb, your eyes will be _____.

Every gene has two alleles or forms, one that is dominant and one that is recessive. For each of the traits we looked at, there is a dominant and a recessive form.

Trait	Dominant	Recessive
Brown eyes	Brown (BB or Bb)	Non brown (bb)
Freckles	Freckles (FF or Ff)	No freckles (ff)
Tongue rolling	Can roll (RR or Rr)	Can't roll (rr)
Dimples	Dimples (DD or Dd)	No dimples (dd)
Earlobe attachment	Unattached (EE or Ee)	Attached (ee)
Widow's peak	Widow's peak (WW or Ww)	Straight hairline (ww)
Cleft chin	Cleft chin (CC or Cc)	Smooth chin (cc)
Hair color	Dark (HH or Hh)	Light (hh)

Hair texture is a little more complicated because curly textured hair (T) is not completely dominant over straight hair (t). If you have one curly allele and one straight allele (Tt) then you end up with wavy hair. This is called incomplete dominance.

<u>Step 1 – Figure out your genotype</u>
So… what's your genotype? Remember, you have two copies of every gene! One gene comes from each parent.

If your phenotype (your observable traits like eye color) is recessive (b), then your genotype (which forms of the gene you have) has to be two recessive alleles (bb).

If your phenotype is dominant (B), then your genotype could be *EITHER* two dominant alleles (BB) or one dominant and one recessive allele (Bb). In this exercise, if you have the dominant phenotype, assume that you have one dominant and one recessive allele (Bb) unless you know for SURE that NO relative (grandparent, aunt, uncle, parent or sibling) has the recessive trait. Only if NO relative is recessive should you put down two dominant alleles (BB)

Trait	Dominant	Recessive		Phenotype	Genotype
Brown eyes	Brown (BB or Bb)	Non brown (bb)			
Freckles	Freckles (FF or Ff)	No freckles (ff)			
Tongue rolling	Can roll (RR or Rr)	Can't roll (rr)			
Dimples	Dimples (DD or Dd)	No dimples (dd)			
Earlobes	Unattached (EE or Ee)	Attached (ee)			
Widow's peak	Widow's peak (WW or Ww)	Straight hairline (ww)			
Cleft chin	Cleft chin (CC or Cc)	Smooth chin (cc)			
Hair color	Dark (HH or Hh)	Light (hh)			
Hair texture	Curly (TT)	Wavy (Tt)	Straight (tt)		

<u>Step 2 – Make eggs and sperm</u>
You are going to make babies with a partner (don't worry, no sex required). To begin, each person will need to make two <u>gametes</u> (sperm and/or eggs). Sperm and eggs are special because while every other cell in our bodies has two copies of our genes (one from mom and one from dad), sperm and eggs have only one copy of each gene.

Sperm and eggs are created through a process called <u>meiosis</u>. Meiosis is a special form of cell division in which you start with a parent cell with 2 copies of every gene and end up with a daughter cell that has only one copy of every gene. The two alleles for any given gene are randomly divided into our gametes. Thus, if your genotype is Bb, some gametes will have the dominant B allele and some gametes will have the recessive b allele.

In this lab, you will flip a coin for each trait to determine which allele is in each gamete.

With your partner, decide which person will make sperm and which person will make eggs. Each person will make 2 gametes.

Look closely at your genotype. Toss the coin for each gene (each trait).
Heads → the gamete will have the first allele
Tails → the gamete will have the second allele

For example, let's say your genotype is Bb for eye color. If you flip heads, then give sperm #1 the B allele. Flip again for the second gamete. If you flip tails, then give sperm #2 the b allele.

Fill in the sperm and eggs below for you and your partner.

_____'s Egg #1

Trait	Allele
Brown eyes	
Freckles	
Tongue rolling	
Dimples	
Earlobe attachment	
Widow's peak	
Cleft chin	
Hair color	
Hair texture	

_____'s Egg #2

Trait	Allele
Brown eyes	
Freckles	
Tongue rolling	
Dimples	
Earlobe attachment	
Widow's peak	
Cleft chin	
Hair color	
Hair texture	

_____'s Sperm #1

Trait	Allele
Brown eyes	
Freckles	
Tongue rolling	
Dimples	
Earlobe attachment	
Widow's peak	
Cleft chin	
Hair color	
Hair texture	
Gender	

_____'s Sperm #2

Trait	Allele
Brown eyes	
Freckles	
Tongue rolling	
Dimples	
Earlobe attachment	
Widow's peak	
Cleft chin	
Hair color	
Hair texture	
Gender	

Notice, there is an extra line for gender under the sperm. That is because sperm pass on the information that determines whether the child will be a boy or a girl. The sperm providing partner should flip their coin one extra time.
Head → girl
Tails → boy

Step 3 – Making Babies

You and your partner are now ready to have kids! You will make two kids. Sperm #1 will fertilize egg #1 to create baby #1. They combine their genes to make a baby. That baby now has two copies of each gene – one copy from mom, and one from dad.

In the chart below, fill in each baby's genotype and phenotype. Then, draw a picture in color of what that child will look like in middle school.

Baby #1 - Name _____   Draw a picture here:

Trait	Genotype	Phenotype
Brown eyes		
Freckles		
Tongue rolling		
Dimples		
Earlobe attachment		
Widow's peak		
Cleft chin		
Hair color		
Hair texture		
Gender		

Baby #2 - Name _____   Draw a picture here:

Trait	Genotype	Phenotype
Brown eyes		
Freckles		
Tongue rolling		
Dimples		
Earlobe attachment		
Widow's peak		
Cleft chin		
Hair color		
Hair texture		
Gender		

Conclusion Questions

1. How many copies of each gene do you have? _____
   Where do they come from?

2. What's the difference between your <u>phenotype</u> and your <u>genotype</u>?

3. What does it mean for an allele to be <u>dominant</u>?

4. For the freckles trait, having freckles (F) is dominant while no freckles (f) is recessive. What will someone that is Ff look like? _____

5. If someone does not have freckles, what do you know about their genotype? Explain how you know.

6. What are gametes? _____

7. How many copies of each gene do gametes have? _____

8. Look at the gametes you made. Are they exactly the same? _____
   Explain why or why not.

9. Did either of your children look exactly like you? _____
   How likely is it for you to have kids that look exactly like you? _____
   Explain why.

10. What does a single side of a double-sided coin or disk represent?

11. Why is a coin toss a good way to represent allele combinations that occur in nature?

12. Can you accurately determine an organism's genotype by observing its phenotype? Explain your answer.