New Paltz High School
Science Department

Name:……..…….……**Due Date**:…….....

Lab Title: *Human Inheritance & Pedigree Analysis* **Lab #**……

Lab Partners:……

Your Lab Score will be based on the following:

Neatness: All labs must be **well-written and done in pencil** unless directed otherwise. There are to be no cross-outs or misspelled words. Questions should be answered in complete sentences.

Accuracy: Certain **questions will be checked** for accuracy.

Completeness: All questions are to be answered completely. There are to be **NO BLANKS** or incomplete sections.

Lab Class Procedure: You are to **follow directions** and use lab equipment properly, work for the entire period, and follow proper clean-up procedures

Rubric:

Lab Score Category	Points Earned
Neatness	0 1
Accuracy	0 1 2 3 4
Completeness	0 1 2 3
Lab Class Procedure	0 1 2
Total Lab Score	0 1 2 3 4 5 6 7 8 9 10

You are to submit all lab material with this lab report:

Comments:

Mr. Ulrich
Regents Biology

Human Inheritance

Background: With an understanding of heredity and probability, biologists have learned about the genetics of many human traits. In many of these traits, several pairs of genes are involved and the pattern of inheritance is complex. For this activity we will assume that the traits we are studying are regulated by the alleles of only one gene, with one allele coming from the father and the other allele from the mother, as described in Mendel's Law of Segregation.

Objectives: In this activity you will:

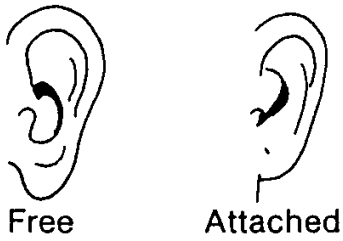
a) Determine your phenotype for several traits.
b) Determine (as far as possible) your genotype for the same traits.
c) Interpret the genotypes of individuals in a pedigree.

Procedures and Observations:

--- Part One: Phenotype and Genotypes of Common Traits ----

You will determine your phenotype and try to determine your genotype for the traits listed in Table 1. Remember, if you show a dominant trait you may be homozygous or heterozygous for that trait. Suppose, however, that one of your parents shows the recessive trait. In that case, the parent would have passed on a gene for that recessive trait and you would be heterozygous. If neither of your parents shows the recessive trait, you may not know if you are heterozygous or homozygous for that trait. In that case, put a blank (_) for the unknown allele. If you show the recessive trait, record the genotype and the phenotype, with two recessive alleles.

1. Free earlobes, *L*, are dominant. People whose earlobes are attached directly to the head have the recessive genotype *ll*.



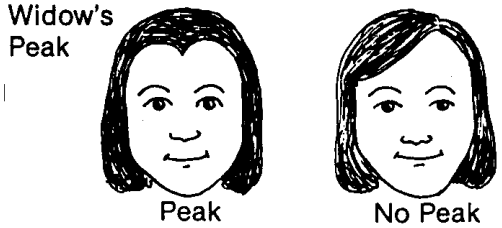
Have your partner check your earlobes.

➔ *Record Your phenotype and genotype in Table 1. on the next page. (If you cannot determine whether your genotype is homozygous or heterozygous, record* L_ *in the table.)*

2. As we have discussed in class, multiple genes control inheritance of eye color but people having the homozygous recessive genotype *bb* have blue (or green) eyes. People who have the dominant allele, *B*, may have different shades of brown or hazel eyes.

Check your eye color.

➔ *Record your phenotype and genotype in Table 1.*

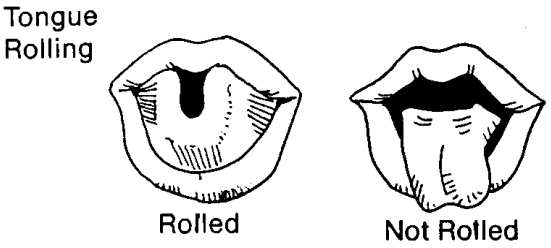


3. A widow's peak is a hairline that forms a downward point in the middle of the forehead. This is caused by the dominant allele, *E*. A smooth hairline is caused by the recessive genotype *ee.*

Have your partner check your hairline.

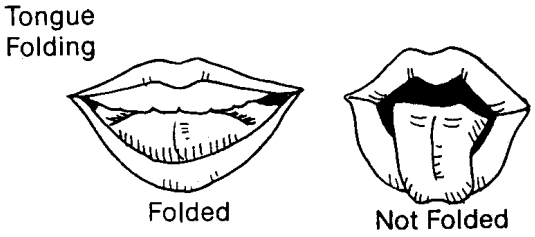
➔ *Record your phenotype and genotype in Table 1*

4. A dominant allele, *R*, gives some people the ability to roll their tongues into a "U" shape when it is extended. People with the recessive alleles, *rr*, cannot roll their tongues.



Check to see if you can roll your tongue.

➔ *Record your phenotype and genotype in Table 1.*



5. A dominant allele, *T*, gives some people the ability to fold their tongues over without using their teeth. People with the recessive genotype, *tt*, cannot.

Check to see if you can fold your tongue.

➔ *Record your phenotype and genotype in Table 1.*

6. A dominant allele, *F*, results I the end joint of the little finger bending inward. Straight little fingers are a result of recessive genotype *ff*.

Place your hands on a flat surface, palms down, and relax. Check to see if the first joints on your little fingers are bent or straight.

➔ *Record your phenotype and genotype in Table 1.*

7. People who can taste the bitter chemical phenylthiocarbamide, PTC, have at least one dominant allele, *A*. Those with the recessive genotype, *aa*, cannot taste it.

Taste the PTC paper to find out if it tastes bitter to you.

➔ *Record your phenotype and genotype in Table 1.*

8. Individuals who have hair on the middle joints of their fingers have at least one dominant allele, *H*. Those with two recessive alleles, *hh*, do not have hair on that joint.

Check to see if you have hair on the middle joints of you r fingers.

➔ *Record your phenotype and genotype in Table 1.*

9. Individuals with red hair have the recessive genotype *nn*. Those with any other hair have at least one dominant allele, *N*.

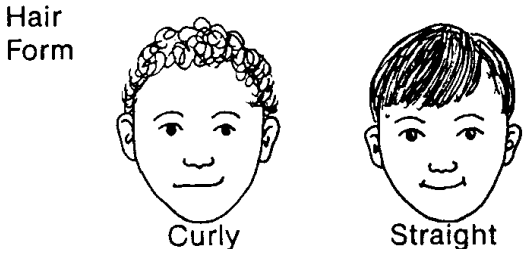
Check your hair color.

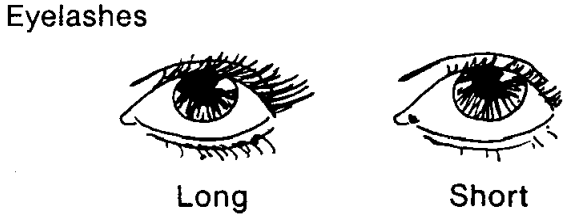
➔ *Record your phenotype and genotype in Table 1.*

10. Individuals with curly hair have at least one dominant allele, *Q*. Those with straight or wavy hair have the recessive genotype *qq*.

Check your Hair form.

➔ *Record your phenotype and genotype in Table 1.*





11. Long eyelashes are the result of the dominant allele *G*. Short eyelashes are the result of the recessive genotype *gg*.

Check the length of your eyelashes.

➔ *Record your phenotype and genotype in Table 1.*

Table 1. Phenotypes and Genotypes of Some Human Traits

Trait and Symbols for Genes	**Phenotype**	**Genotype**
Shape of ear lobe *L,l*		
Eye color *B,b*		
Shape of hairline *E,e*		
Ability to roll tongue *R,r*		
Ability to fold tongue *T,t*		
Shape of little finger *F,f*		
Ability to taste PTC *A,a*		
Hair on middle joint of finger *H,h*		
Hair color *N,n*		
Hair curliness Q,*q*		
Eyelash length *G,g*		

Analysis and conclusions

1. Do you think it is possible for someone in class to have all of the same characteristics on the list as you? Explain.

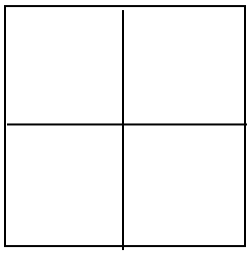
2. Do you make gametes that bear a recessive allele for short eyelashes? Yes? No? Maybe? How do you know?

3. Think very far in the future. Would you be able to have a blue eyed? Baby? What would your mate's genotype be for that to happen? Draw the Punnet square.

Complete the following Punnet squares. **Be sure to include the probability of each genotype and phenotype.:**

4. B= Brown eyes b= blue eyes Mom= Bb Dad= BB What are the eye color possibilities if they chose to have children? Be sure to include the probability of each genotype and phenotype.

Genotypes

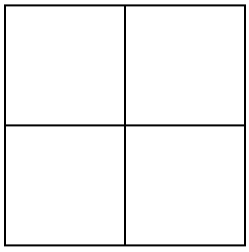


Phenotypes

5. Curly hair is dominant, and straight hair is recessive. A woman with straight hair marries a man who is homozygous dominant for hair curliness. Predict the outcomes for their children.

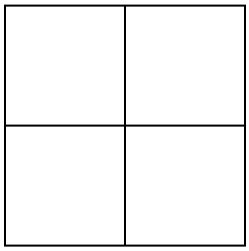
Genotypes

Phenotypes



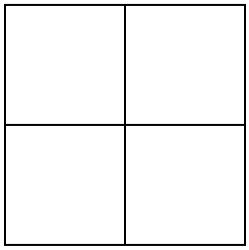
6. Free earlobes are dominant over attached earlobes. Complete the Punnett Square for the following individuals: Mom=LL and Dad=ll

Genotypes Phenotypes



7. Freckles are recessive. Lacking freckles is dominant.
Mom= heterozygous Dad=homozygous recessive Possible outcomes for kids?

Genotypes Phenotypes

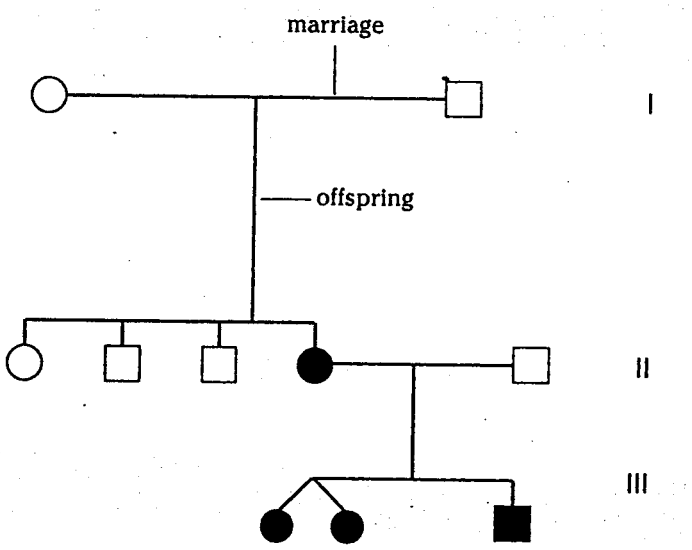


On to Part Two!

--- Part Two: Human Pedigree Analysis ----

A diagram showing the transmission of a trait through several generations of a family is called a pedigree. In Figure 1, generation I is made up of grandparents, generation II is their children, and generation III is their children.

1. Study the pedigree diagram and the key n figure 1 to learn the symbols.



Key

Symbol	Meaning
○	Female without trait
□	Male without trait
●	Female with trait
■	Male with trait
•	Female, died in infancy
▪	Male, died in infancy
○○	Identical twins

Figure 1

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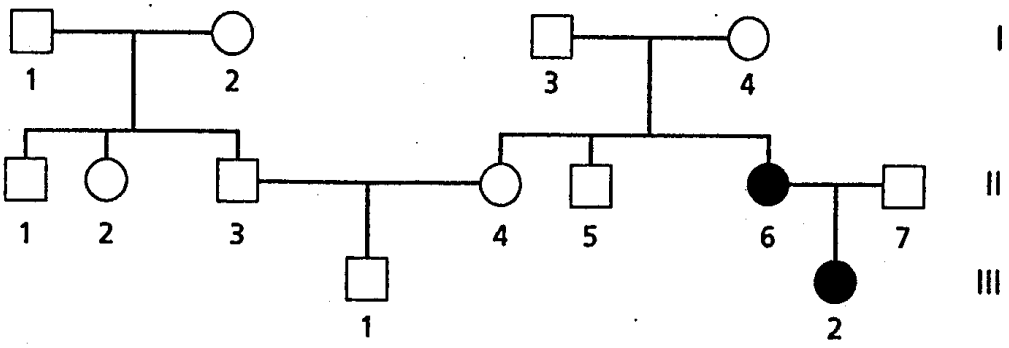
Case one: Albinism Individuals that lack an enzyme needed to form the skin pigment melanin are called albinos. Normal skin pigmentation is dominant.

2. Use *D* to represent the allele for normal skin and *dd* to represent the genotype for albinism. Where you cannot be sure whether an individual with the dominant trait is homozygous or heterozygous, show the genotype as *D_*.

➔ *What does the Law of Segregation say about where each individual gets each one of their alleles*

➔ ***Use the data table to list the genotype of each individual in figure 2 on the next page.*** *Keep Mendel's laws in mind.*

Albinism Pedigree



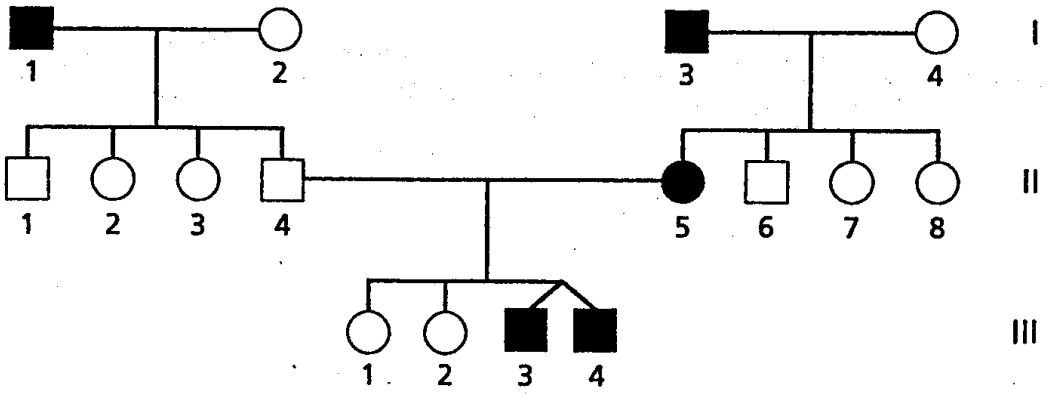
Individual		Genotype
I	1	
	2	
	3	
	4	
II	1	
	2	
	3	
	4	
	5	
	6	
	7	
III	1	
	2	

Figure 2

Case Two: PTC Non-Taster We already discussed these individuals in Part One.

3. Use *A* to represent the allele for the ability to taste PTC, a dominant allele. Use *aa* for the PTC non-taster, who exhibits the recessive trait. Use *A*_ where the genotype is uncertain. **Individuals that are filled in are the recessive PTC non-tasters**
   - ***Use the data table to list the genotypes of each individual in figure 3 below***. *Remember to keep Mendel's laws in mind (especially the Law of Segregation).*

PTC Taster Pedigree



Individual		Genotype
I	1	
	2	
	3	
	4	
II	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
III	1	
	2	
	3	
	4	

Figure 3

Yes, There ARE questions on the back!!!!!!

Analysis and Conclusions:

1. In the pedigree in Figure 2, if the individuals 6 and 7 have another child, what is the chance that it will be albino. Show the Punnet square.

2. In Figure 2, can you determine the genotypes of individuals 1 and 2 in generation I? Explain your answer.

3. In the pedigree in Figure 3, if individuals 4 and 5 have another child, what is the probability that it will be a taster?

4. In Figure 3, if individual 8 in generation II married a man with genotype *AA*, what is the probability that she will have a non-taster child? Illustrate your reasoning with a Punnet square.