Genetics Lab

By preparing for this lab, completing it, and taking the post-lab quiz, you should be able to:

- Demonstrate inheritance of a simple dominant and a simple recessive trait.
- Write the definition of an allele.
- Differentiate chromosomes and genes.
- Describe how genotype affects phenotype.
- List the reasons why predicting the genotype and phenotype of future offspring is a statistical probability not a certainty.
- Give examples of codominant, incomplete dominance, and polygenic traits.
- Give examples of how genotype affects the expression of traits.
- Explain why the dominant trait is not always the most common.

Before you do this lab:
⇒ Review your text, lab manual, and notes.

This lab is done with a **partner**!

My partner is _____

This Genetics Lab consists of **two components**:

- This **Lab Packet** with paper-and-pencil exercises.
- The **Computer Module**, with a pre-lab quiz, Offspring Sequence, and post-lab quiz.

To complete this lab, you must do each item on this list. Do them in the order they are listed; check them off as you complete them.

☐ 1. Here's Lookin' at You Exercise (*Lab Packet*)

☐ 2. Pre-Lab Quiz (*Computer Module; no printout*)

☐ 3. Offspring Sequence (*Computer Module*: **print the results & complete the phenotype column**)

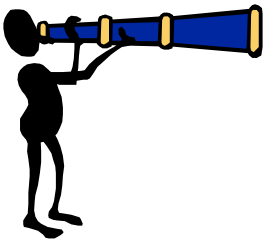
and

☐ 4. Offspring Sequence Questions (*Lab Packet*)

☐ 5. Post-Lab Quiz (*Computer Module*: **print the results**)

Turn all the paper exercises and the computer printouts in to your instructor (there will be no printed results for the Pre-Lab Quiz).

This Lab Packet and the computer portion work together! Keep track of where you are!



Here's Lookin' at You, Kid!

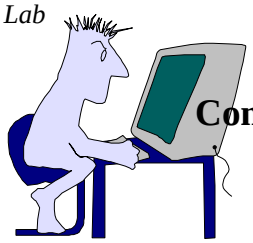
Look at yourself. Record your phenotype and circle possible genotypes on the table below.

Trait	**Record your phenotype and indicate if it is dominant or recessive.**	**Possible Genotypes**
Widow's Peak Present=Dominnat		WW Ww ww
Finger Hair Present =Dominant		HH Hh hh
Freckles Present=Dominat		FF Ff ff
Thumb Joint Hitch-hiker= Dominat		TT Tt tt
Hair Type Incomplete Dominance	Curly Wavy Straight	CC CC' C'C'
Ear Lobes Attached = Recessive		EE Ee ee

These are all examples of simple dominant/recessive traits.

For which of these traits do you know your exact genotype?

Why don't you know your exact genotype for your dominant traits?



Computer Module

Now we are ready to start the Computer Module! This is a fun way to see how genetics works. You and your lab partner are about to have a child!! Surprised? What do you think your offspring will look like? The computer module will show you, as you tell it what genes you are contributing to your offspring. But first . . .

Pre-Lab Quiz

When the computer module begins, it will ask you to take a pre-lab quiz. Your score on this quiz must be 80% or more, or you will not be allowed to proceed to the Offspring Sequence!

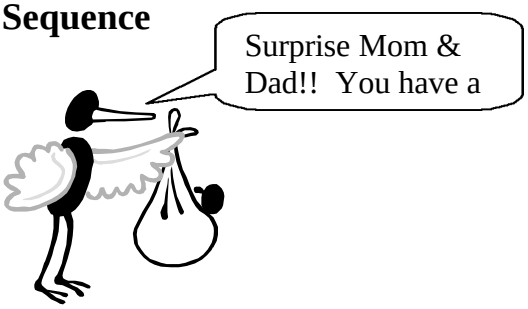
Review your text and notes. Be prepared to show that you can:

- Define phenotype and genotype
- State the number of alleles needed to express dominant and recessive traits
- Define polygenic, co-dominant, and incomplete dominant traits
- Provide examples of homozygotes and heterozygotes

Ready? **Start the Computer Module.**

Directions

Offspring Sequence



You must have **two coins** for this exercise. "Mom" gets one coin. "Dad" gets the other coin.

Genetics is random. If you carry two different genes for a trait, which gene is passed to your offspring is as random as whether or not a coin turns up heads or tails when you toss it. So, to determine which genes you will contribute to your offspring, you will toss a coin!

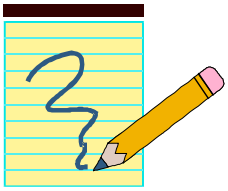
As parents each of you will contribute one member of each pair of your genes. But which member will you contribute? The coin toss determines whether you contribute the dominant or recessive gene (we are going to assume *both* parents are *hetero*zygous for all gene pairs. This way, we don't need any two-headed coins).

- Heads = Dominant Trait (use a capital letter, such as B)
- Tails = Recessive Trait (use a lower case letter, such as b)

Note

We are also assuming that both parents are *heterozygous* for all traits. In real life, that is not true. This does mean that you may see some unusual combinations in your offspring here!!

<u>Be sure you do this:</u>



1. As the Computer Module builds a picture of your offspring, you must also **answer the questions** about the genetic traits in this Lab Packet.
2. At the *end* of the Computer Module you will be required to complete a data sheet, printed with your offspring's picture.

Your gene contributions and genotype will be recorded; **you must record the phenotype**.

Begin the Offspring Sequence & continue to questions on next page.

Offspring Sequence Trait Questions:

1. **Sex**, boy or girl: only dad flips here. Heads = an X chromosome, tails = a Y. Why doesn't mom have to flip? (Multiple choice)

   A. She *contributes* only one kind of chromosome that influences the sex of her offspring but *has* two different sex chromosomes that influence the sex of her off spring.
   B. Both of her sex chromosomes are the same so she has only one type of sex chromosome to contribute to her offspring, whereas the father contributes one of two different sex chromosomes.
   C. Only the father contributes genes that influence the sexual phenotype

2. **Face shape**: RR and Rr = Round face rr = Square face
   Is the square face shape a simple dominant or simple recessive trait?

3. **Chin shape:** RR and Rr = round chin rr = a square chin.
   Is a round chin simple dominant or simple recessive?

4. **Chin Cleft:** AA and Aa = no cleft aa = cleft chin

5. For this exercise, we will say **skin color** is controlled by 2 pairs of genes, as well as the environment. Between the two parents there are *4 alleles* contributed to the child.

   - Both parents **flip 2 times**. The first flip is A (heads) or a (tails), the second B or b. If all 4 are dominant (AA and BB) the skin is very dark black. If all genes are recessive (aabb) the skin is very fair white. The more dominant genes, the darker the skin gets, light tan to brown to dark brown to black.

     Keep track of the alleles you contribute: you will have to **enter** them in the program.

     Select the one *or* two terms below that describe this trait.

simple dominant	simple recessive
co-dominant	polygenic
incomplete dominance	multiple allele

6. **Hair type**

CC-Curly CC'-Wavy C'C'-Straight

Select the one *or* two terms below that describe this trait.

simple dominant	simple recessive
co-dominant	polygenic
incomplete dominance	multiple allele

7. Widow's peak
Present- WW or Ww Absent (straight hairline)-ww

Select the one *or* two terms below that describe a straight hair line trait.

simple dominant	simple recessive
co-dominant	polygenic
incomplete dominance	multiple allele

8. Hair color is first controlled by a pair of genes that decides if it is red or not red. Homozygous recessive (rr) is red, RR or Rr is not red. This (red/not red) trait is a **simple dominant/recessive trait**.

If your first flips result in rr, the kid is a carrot top. If you flip RR or Rr, you will have to flip one more time. Then select the number of dominant alleles in response to the question on the screen. Four recessives result in blond hair, four dominants result in black, two or three dominants give varying shades of brown hair.

Keep track of the alleles you contribute: you will have to **enter** them in the program
Select the one *or* two terms below that describe the the blond to black hair color trait.

simple dominant	simple recessive
co-dominant	polygenic
incomplete dominance	multiple allele

9. Eyebrow Color
HH = darker than hair HH' = same as hair H'H' = Lighter than hair

Select the one *or* two terms below that describe this trait.

simple dominant	simple recessive
co-dominant	Polygenic
incomplete dominance	multiple allele

10. Eyebrow
BB or Bb = bushy bb = fine

Select the **one *or* two** terms below that describe the *fine* eyebrow trait.

Simple dominant	simple recessive
Co-dominant	polygenic
Incomplete dominance	multiple allele

11. Eyes-Distance Apart
EE = close together EE' = average distance apart E'E' = far apart

Select the **one *or* two** terms below that describe this trait.

simple dominant	simple recessive
co-dominant	polygenic
incomplete dominance	multiple allele

12. Eyes-Size
EE = large EE' = medium E'E' = small

Select the **one *or* two** terms below that describe this trait.

simple dominant	Simple recessive
co-dominant	Polygenic
incomplete dominance	Multiple allele

13. Eyelashes
LL or Ll = long ll = short-

Before flipping (e.g. before fertilization) what is the probability the child will have *long* lashes?

A. 0
B. ¼
C. ½
D. ¾
E. 1

Before flipping, what is the probability the child will be heterozygous?

A. 0
B. ¼
C. ½
D. ¾
E. 1

14. Eye color: in this computer module, we are only going to use two pairs of gene combinations for eye color; in real life this is much more complex: eye color is controlled by at least three pairs of genes.

So flip twice (a or A and b or B from each parent). Four dominants (AABB) will result in dark brown eyes, 3 dominants will result in brown eyes, 2 dominants = hazel (yellow-brown), 1 dominant = green, all recessive= blue.

Keep track of the alleles you contribute: you will have to **enter** them in the program

Select the **one *or* two** terms below that describe this trait.

simple dominant	simple recessive
co-dominant	Polygenic
incomplete dominance	multiple allele

15. Mouth size
MM = wide MM' = average M'M' = narrow

Select the **one *or* two** terms below that describe this trait.

simple dominant	simple recessive
co-dominant	Polygenic
incomplete dominance	multiple allele

16. Lips
LL or Ll = Thick ll = Thin

Select the **one *or* two** terms below that describe the *thin lip* trait.

simple dominant	simple recessive
co-dominant	Polygenic
incomplete dominance	multiple allele

17. Dimples
DD, Dd = present dd = absent

Before flipping (e.g. before fertilization) what is the probability the child will have *dimples*?

A. 0
B. ¼
C. ½
D. ¾
E. 1

18. Nose size
NN = Big NN' = Average N'N' = small

Select the **one *or* two** terms below that describe this trait.

simple dominant	simple recessive
co-dominant	polygenic
incomplete dominance	multiple allele

19. Nose Shape
RR, Rr = rounded rr = pointed

Select the **one *or* two** terms below that describe the pointed trait.

simple dominant	simple recessive
co-dominant	polygenic
incomplete dominance	multiple allele

20. Earlobe attachment
EE or Ee = free ee = attached

Select the **one *or* two** terms below that describe the *free* earlobe trait.

simple dominant	simple recessive
co-dominant	polygenic
incomplete dominance	multiple allele

21. Freckles on cheeks
FF or Ff = present ff = absent

Select the **one *or* two** terms below that describe this trait.

simple dominant	simple recessive
co-dominant	polygenic
incomplete dominance	multiple allele

22. Blood type: We won't be able to see the blood type in your offspring's picture, but you need to know that it is as randomly determined as other genetic traits. So let's see what your offspring's blood type turns out to be . . .

Let's say Mom is type A (but heterozygous, remember, so the genotype is AO) and Dad is a heterozygous B.

Heads = the dominant gene (A from mom and B from dad)
Tails = the recessive gene (O).

What was dad's genotype?

A. BB
B. Bb
C. BO
D. AB

Select the **one *or* two** terms below that describe the ABO blood type trait.

simple dominant	simple recessive
co-dominant	polygenic
incomplete dominance	multiple allele

23. Rh factor: Again, you won't see this in your offspring's picture, but it is determined like other genetic traits. The only way to be Rh negative is to be homozygous recessive (rr). Everyone else is Rh positive.

Select the **one *or* two** terms below that describe the *RH positive* trait.

simple dominant	simple recessive
co-dominant	polygenic
incomplete dominance	multiple allele

Phenotypes.
Print your offspring picture. **Complete** the data sheet by filling out the phenotype for each genotype entered.

Take the post-quiz now and print your results.

Check page 3 to be sure you have everything to turn in!!