

Name: _____

Period: _____ Date: _____

Genetics, Student Learning Guide

- Go to learn-biology.com. Use the menu from your course to find “Genetics.”
- If you’re submitting this electronically to your instructor, please type your answers in **blue**, **red**, or any other color your instructor suggests.
- As you go, click on this ☐ to change it to ☒

Tutorial 1: Mendelian Genetics and Punnett Squares

- ☐ 1. Watch the introductory slideshow on Mendelian Genetics. Then complete the “Cystic fibrosis” Interactive Reading. Check the box when you’re done.

Reflection: At a party, you hear that a neighbor has had a baby with cystic fibrosis. A friend who has not studied biology asks you to explain what it is. Based on what you’ve read, write a 3 sentence explanation below.

- ☐ 2. **Extending your learning:** Follow the link to the Genetics Home Reference page about Cystic fibrosis (which will open in a new tab). Set a timer to five minutes, and spend that time reading the 1st three sections (description, frequency, and genetic changes). Fill the space below with additional material that you’ve learned.

- ☐ 3. Complete the Genetics Vocabulary Flashcards.

Reflect: Why is it easier to tell a person’s phenotype than their genotype?

- ☐ 4. Complete the reading about Punnett squares. Complete the three guided Punnett squares.

Checking Understanding: Mendel found that in Pea plants, purple flower color (P) is dominant to white (p). Cross a white pea with a heterozygote. Complete all six steps, and show your work below.

Follow the link to the next tutorial

Tutorial 2. Solving ABO Blood Type Problems.

1. Depending on your teacher’s instructions (and network settings), you can go through the slideshow or skip it.

- ☐ 2. Read “Blood type and blood transfusions.” Then complete the interactive table, and the interactive reading. Check the box when you’re finished.

Checking Understanding:

Whereas cystic fibrosis has _____ alleles and _____ phenotypes, blood type has _____ alleles and _____ phenotypes

Reflection: You hear on the radio that in response to an earthquake in a neighboring country, the Red Cross is asking for blood donations, especially type O. Your 8th grade neighbor, knowing that you’re studying biology, says “what’s type O?” Briefly explain blood type to her.

- ☐ 3. Read “The Genetics of ABO Blood Type,” including the “Blood type: Genotype and Phenotypes” interactive table.

Knowing the terms:

Define *multiple alleles*:

Define *Co-dominance*:

4. Follow the links in “Extending Your Learning.” Read for about five minutes, and record what you’ve learned in the space below.

5. Complete the Interactive Punnett Squares for the two blood type problems in this tutorial

Follow the link to the next tutorial

Tutorial 3: Sex-Linked Alleles

1. Depending on whether you’re completing this tutorial before or after lecture, you can read or skip the slideshow.
2. Complete the “Reading about Hemophilia,” and complete the “Sex Linked Alleles: Interactive Table.” Record the genotypes in the table below.

Description	Genotype
Normal male	
Hemophiliac male	
Homozygous Normal Female	
Heterozygous Normal female	
Hemophiliac Female	

Checking Understanding

You arrive home after a day at school, and someone asks you “What did you learn at school today?” Use the space below to explain how sex-linked genes work.

- ☐ 3. Read “A Pedigree for a Sex Linked Trait,” and complete the interactive pedigree
- ☐ 4. Read “Solving a Genetics Problem Involving Sex linkage,” and complete the interactive Punnett square.

SUMMATIVE Reflection.

In these first three tutorials, you learned about inheritance of three types of alleles

- Regular autosomal alleles
- Multiple Alleles in the ABO blood type system
- Sex linked alleles

In the space below, use terms like *as opposed to*, *in contrast to*, *is similar to*, *is different from*, *as with*, etc., to compare and contrast the way these three types of alleles are inherited.

Here’s a sentence frame that you might use:

As opposed to autosomal alleles, which ..., sex linked alleles...

Create as many sentences as you need to...

Continue to the next tutorial, Dihybrid crosses

Tutorial 4: Dihybrid Crosses

- ☐ 1 and 2: Read the Introduction, and “From Segregation of Alleles...to Dihybrid Crosses.” As you do, complete the interactive reading “Mendel’s Dihybrid Crosses...”
- ☐ 3. Read “Solving Dihybrid Cross (and Related Problems).” As you do, solve the sample problems in the space below. You’ll learn much more if you try to solve the problems on your own without looking at the solutions

SAMPLE PROBLEM 1:

In peas, round seeds (R) dominates over wrinkled seeds (r). Yellow seed color (Y) dominates over green (y). What is the genotype of an organism that is heterozygous round and heterozygous yellow? What gametes could this organism form?

SAMPLE PROBLEM 2:

In peas, round seeds (R) dominates over wrinkled seeds (r). Yellow seed color (Y) dominates over green (y). What is the genotype of an organism that is homozygous round and heterozygous yellow? What gametes could this organism form?

SAMPLE PROBLEM 3:

In peas, round seeds (R) dominates over wrinkled seeds (r). Yellow seed color (Y) dominates over green (y). What is the result of a cross between a dihybrid Round Yellow parent and a parent that is homozygous round and heterozygous yellow?

4- 9. Complete the practice problems (problems 4 – 9, which are a continuation of 1-3 above) .Write down your answers below and on the next column. *Try to answer the questions yourself before flipping the card and looking at the solution.*

- ☐ **Follow the link to the Meiosis and Genetics Flashcards and Quizzes.** After finishing these...
- ☐ Continue to the tutorial about “Linked Genes”

Tutorial 5: Linked Genes

- ☐ 1. Read the introduction: "Linked Genes are on the Same Chromosome."

CHECKING UNDERSTANDING:

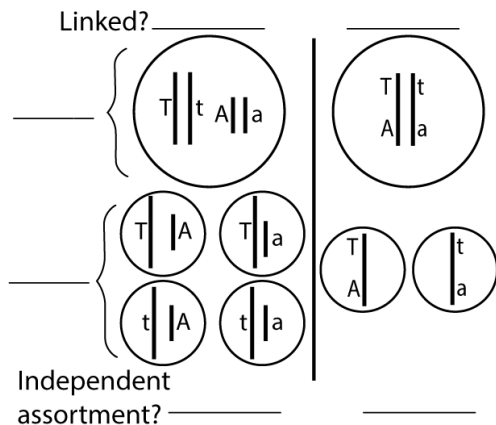
a. Copy and complete the following sentence frames

Whereas genes on separate chromosomes linked genes...

Whereas wild type alleles.... mutant alleles...

2. Read "Non-Linked Genes vs. Linked Genes,"

Label the following diagram. Then write a few sentences explaining it.



- ☐ 3. Read "Genetic Crosses Involving Linkage."

a. What's a "testcross?"

b. After reading, complete the following sentences explaining what you'd expect from crossing

$b^+b \text{ } vg^+vg$ x $b b \text{ } vg vg$ with two assumptions

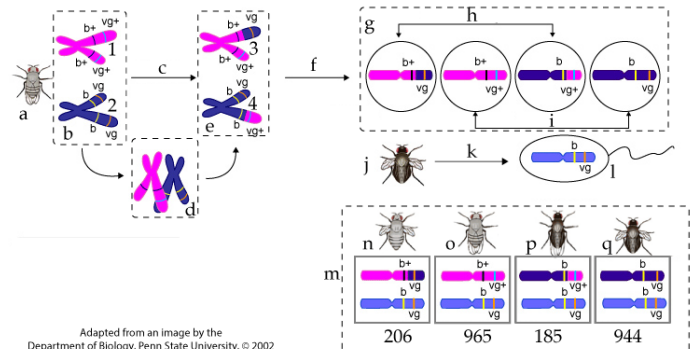
* If the b and vg alleles are linked, then you'd expect...

* If the b and vg alleles are NOT linked, then you'd expect...

- ☐ 4. Read "When linked genes recombine, it's because of crossing over."

5. Complete "Linkage and Recombination: Checking Understanding."

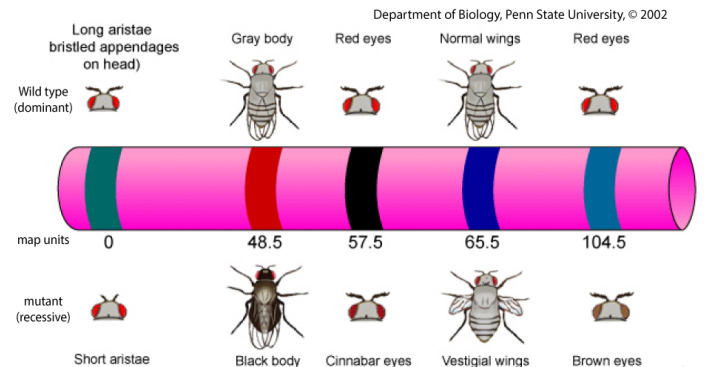
When you're finished, create a key to the diagram below. Add a short conclusion explaining the results.



6. Read "Recombination Frequency and Chromosome Mapping."

7. Take the quiz "Linked Genes, Linkage Mapping, and Recombination, Checking Understanding."

SUMMARIZING



Explain the linkage map above: what do the numbers mean?
How were they determined?

Continue to the tutorial about " χ^2 (chi) square"

Tutorial 6: χ^2 (Chi) Square

- ☐ 1. Read the introduction: "Expected and Observed Values Usually Differ."
- ☐ 2. Read "Understanding the Null Hypothesis."

When you get to the first flashcard, solve this problem on your own (without looking on the back of the card)

Use a Punnett square to solve a cross between a white eyed male (genotype X^wY) and a red-eyed heterozygous female, genotype X^WX^w

The big idea: What's *the null hypothesis*?

3. Read "How to do a χ^2 test in 7 steps." As you read, complete each step below.

	Red Eyed Female	White Eyed Female	Red eyed male
Observed	109	113	137
Expected	119	119	119
O-E			
(O-E) ²			
(O-E) ² /E			

Add the values of (O-E)²/E: _____

Checking understanding:

1. What are degrees of freedom?
2. Pretend that your table partner has missed the lesson on chi square. You have to explain how you use degrees of freedom to determine whether or not to accept the null hypothesis. Write down your explanation below.

- ☐ 4. Complete the " χ^2 Checking Understanding Quiz."
- 5. Use the space below to complete the four χ^2 Practice problems. Create a table for each problem.

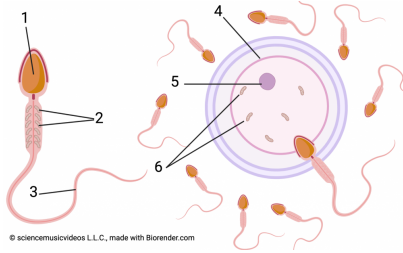
Continue to Mitochondrial Inheritance, Incomplete Dominance, and Genotype-Environment Interaction

Tutorial 7: Mitochondrial Inheritance, Incomplete Dominance, and Genotype-Environment Interaction

- ☐ 1. Read about mitochondrial inheritance and take the "Mitochondrial Inheritance Quiz."

SUMMARIZING

Task 1: Using the space to the right of and below this diagram, explain the cellular basis of mitochondrial inheritance.



Task 2: Describe the genes carried by mitochondria.

Task 3: Pretend that you're a geneticist. You're studying a pedigree, and you suspect that a patient has a condition with a mitochondrial inheritance pattern. What does that pedigree look like? Note: *Kudos if you draw an original pedigree!*

- ☐ 2. Read about mitochondrial inheritance and take the "Mitochondrial Inheritance Quiz." That includes solving the problems.

SUMMARIZING

Task 1: Define incomplete dominance.

Task 2: Explain the molecular basis of incomplete dominance.

Task 3: Explain how incomplete dominance is different from codominance?

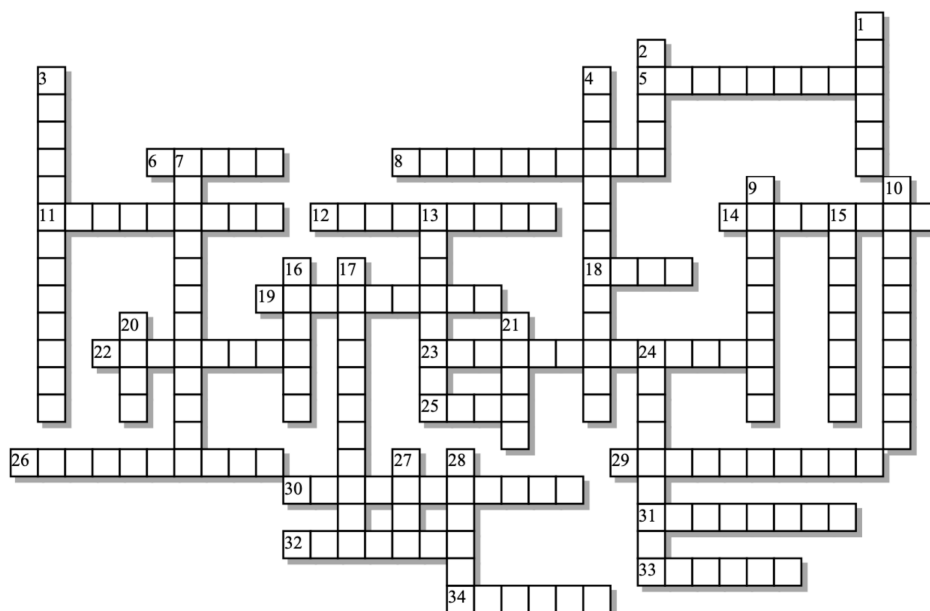
Task 4: What are polygenic traits? What kind of distribution pattern will these traits show in a population?

- ☐ 3. Read about Genotype Environment Interaction.
☐ 4. Take the Cumulative Quiz

SUMMARIZING

Task 1: What is genotype environment interaction?

Task 2: Think of three conditions (not listed in this tutorial) in humans or other organisms that involve genotype environment interactions. Write these down below, with a justification of why you think they're good examples.



Note: if you can't print this out, make a table below these clues and put your answers there.

Across:

- 5 - Type O is the _____ donor
- 6 - Fruit flies with a X-linked mutation have ____ eyes
- 8 - When both of your alleles for a trait are the same
- 11 - Your appearance
- 12 - An allele on the X chromosome causes red green color
- 14 - A chart used to show inheritance of a gene or trait
- 18 - This hypothesis says there's no statistical difference between observed and expected results.
- 19 - An allele that can be masked by the dominant one.
- 22 - Heterozygous for two genes
- 23 - A big word for happens in the blood if the wrong blood type is transfused
- 25 - This kind of cross is used to determine the genotype of a parent with the dominant phenotype.
- 26 - The allele for hemophilia is on the X _____.
- 29 - The principle of independent _____ says that allele pairs segregate independently from one another.
- 30 - The principle of _____ says that parents have two alleles, but only send one on to their offspring.
- 31 - If there are more than two alleles (as in blood type), we say there are _____ alleles.
- 32 - In genetics, this square is awfully useful
- 33 - Genes on the same chromosome are _____
- 34 - The royal family of this cold northern country had a problem with hemophilia.

Down:

- 1 - An alternative version of a gene
- 2 - People with cystic fibrosis can't clear _____ from their lungs.
- 3 - The ABO system is about _____ on your red blood cells.
- 4 - When linked alleles separate, it's because of _____ during meiosis.
- 7 - When you possess two different alleles for a trait
- 9 - Cystic fibrosis is caused by a faulty transport protein on cell _____.
- 10 - A sex-linked recessive blood disorder
- 13 - An allele that always shows up in the phenotype
- 15 - Your underlying alleles
- 16 - The Austrian monk who discovered the basic principles of genetics.
- 17 - The unit for recombination frequency.
- 20 - The allele found in nature; almost always dominant
- 21 - "The blood of hemophiliacs _____ very slowly, if at all. "
- 24 - _____ genes are found on any chromosome except the X or Y
- 27 - A man's name and a unit of heredity
- 28 - Hemophilia is caused by a defective clotting _____.

Possible Answers: Mendel, Punnett, Russia, agglutination, allele, assortment, autosomal, blindness, centiMorgan, chromosome, clots, dihybrid, dominant, factor, gene, genotype, glycoproteins, hemophilia, heterozygous, homozygous, linked, membranes, mucus, multiple, null, pedigree, phenotype, recessive, recombination, segregation, test, universal, white, wild

SUBMITTING THIS ELECTRONICALLY? TYPE ANSWERS DOWN HERE!