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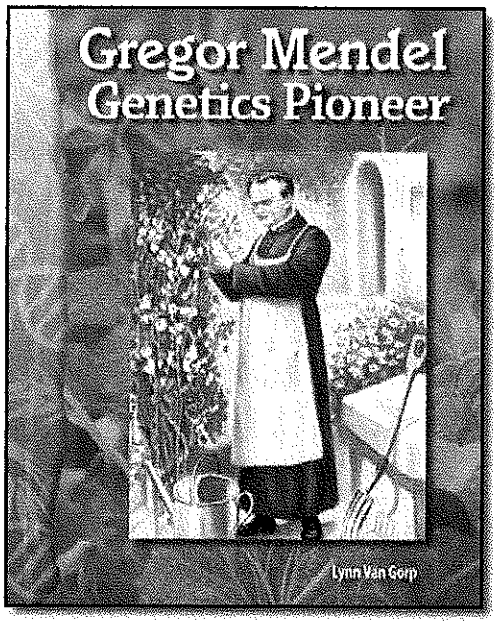
Science Readers

Lesson Plans for

Gregor Mendel



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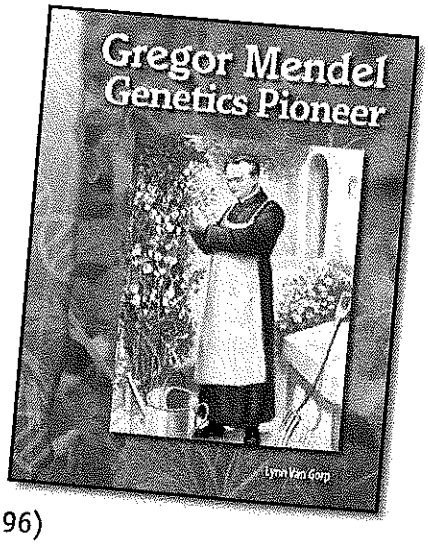
Teacher Created Materials Publishing
5301 Oceanus Drive
Huntington Beach, CA 92649
http://www.tcmpub.com
TCM 11117 (i2372)

Gregor Mendel: Genetics Pioneer Reader



Learning Objectives

Students will reflect on what has been learned by reading and will formulate ideas, opinions, and personal responses to text. (Nonfiction Reading Objective)

Students will develop controlling ideas in writing that convey opinions. (Persuasive Writing Objective)

Students will explore concepts related to genetics. (Science Content Objective)

Materials

- writing paper and pencils
- *Hand-Me-Down Genes* activity sheet and transparency (page 196)
- red and blue transparency markers (or any other two colors)
- markers, crayons, or colored pencils
- *Color Confusion* activity sheet (page 197)
- *Create a Critter* activity sheet (page 198)
- materials for Lab (see page 184)
- *Reader Quiz* (page 199)

Before Reading

Complete the Introductory Activity (page 180) with the whole class. Then divide the students into reading groups. The students who read this book should be reading below level.

Explain to students that when they read, they should **interact** with the text. This means they should think about the information presented and formulate their own questions, ideas, and opinions related to it.

Distribute copies of *Gregor Mendel: Genetics Pioneer* and have students open to the table of contents. Ask students to read the sections of text. Then ask the following questions:

- What do you know about genes?
- What have you heard or learned about heredity?
- Do you look like someone in your family?
- Do you have other traits that are similar to someone in your family?

Take time to review new words and terms in the glossary and tell students they will encounter these words as they read the text. If they need a reminder of the definition of words, they can turn to the glossary for assistance.

Read aloud pages 4 and 5 of the reader and ask students to think about any ideas or opinions that come to mind as they listen.

Before Reading *(cont.)*

Allow students to share the ideas and opinions that came to mind and encourage them to do this as they read the remainder of the text.

During Reading

Read the book with the students or have them read independently.

Check for comprehension by asking students the following questions:

- What are some things that Mendel loved to do?
- What impact has Mendel's work had on modern agriculture?
- What does "cross-pollinate" mean?
- How did Mendel's study of garden peas relate to human heredity?

Further question the students about their ideas and opinions related to genetics and Mendel's work.

- What thoughts come to mind about the idea of making food healthier or developing plants that can survive in harsh conditions?
- What opinions do you have about this kind of science?

Lead a discussion about how Mendel's work allows for prediction of physical traits, such as eye and hair color. Reread pages 14–17 about dominant and recessive traits.

Display the *Hand-Me-Down Genes* transparency for students. Explain that the color combinations of the parents can help them predict some physical traits of the offspring. Have students use the tongue rolling trait described on page 20. This is the dominant trait. Using an overhead marker, write in "Tongue Rolling" on the Dominant Allele line and "No Tongue Rolling" on the Recessive Allele line. Color in the top box blue and the bottom box red.

In the first example on page 20, both parents have two dominant alleles for this trait. Color both halves of both parents blue. When all the combinations are organized, all the children also have two dominant alleles. Color both halves of each child blue. In the second example, both parents have two recessive alleles for this trait. Color both halves of both parents red. When all the combinations are organized, all the children also have two recessive alleles (color appropriately). In the third example, each parent has one of each allele. Color one half of each parent red and one half of each blue. Then color in the children appropriately: one all blue, one all red, and two half blue and half red. Explain that any children with at least one blue half could roll their tongue. The child would have a 3/4 or 75% chance of being able to roll their tongue.

Distribute *Hand-Me-Down Genes* (page 196) to students. Review how the use of color can predict trait outcomes in offspring. Have students complete the activity sheet in pairs as you circulate through the room, checking for correct procedure.

After Reading

Have each student select a passage of text to write about in a persuasive manner. The student should summarize the information in writing, expressing his or her own thoughts and opinions related to it.

Review the definition of inherited traits, and how traits are inherited. This is also true of unique conditions, such as color blindness (page 21), jumping DNA (page 24), and disabilities. Reread pages 22–23 about Mendel's work and how it led to future genetic studies.

Distribute *Color Confusion* (page 197) to students. Read the information in the charts together. Allow time for students to complete the activity sheet. Show students where they can use electronic resources to test for color blind disorders in addition to the one in the book.

Students can apply their understanding of dominant and recessive traits by genetically engineering (on paper, that is!) a unique species. Reread pages 18–21 about dominant and recessive traits. Discuss what has to happen for anyone to show the dominant or recessive traits listed on page 20.

Distribute *Create a Critter* (page 198) to students and allow them to work on their own. Each student will need two coins.

Complete the lesson by instructing each student to write a summary of the information in the reader in six sentences or less.

Use the *Reader Quiz* (page 199) to further assess student learning.

Gather students together as a whole class to complete the Lab (pages 183–184).

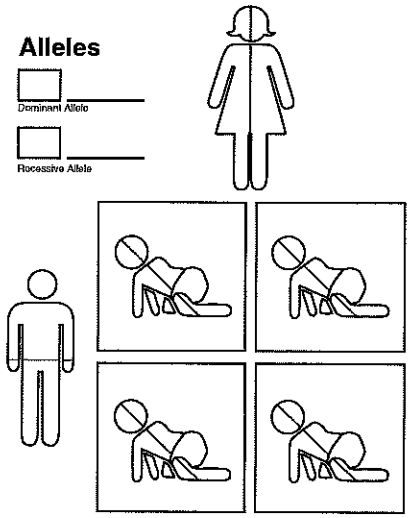
Gather the students together as a whole class to complete the Concluding Activities described (page 181).

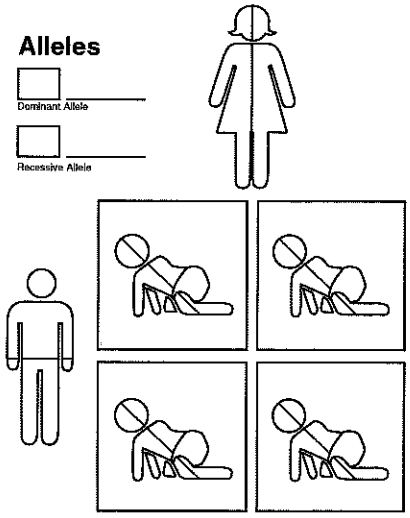
Hand-Me-Down Genes

Mendel's work with pea plants led to discoveries about genetics. One of the discoveries is the predictable nature of traits. What works for peas also works for human beings.

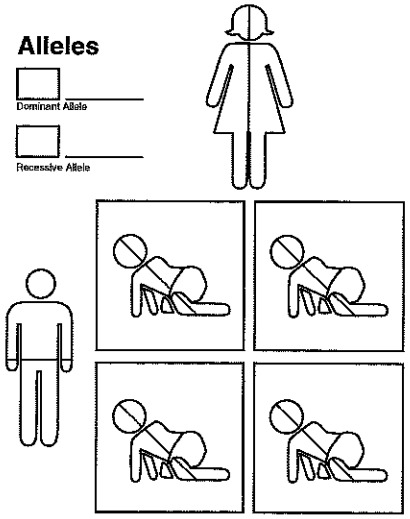
Directions: Use what you read in *Gregor Mendel: Genetics Pioneer* to determine the possible outcomes of these dominant and recessive traits. Use blue to mark dominant alleles and red to mark recessive alleles.

The father has two dominant alleles. Color both his halves blue. The mother has two recessive alleles. Color her halves red. What combinations can occur in their offspring? Color them to show the outcomes. Will the offspring show a dominant or recessive trait?





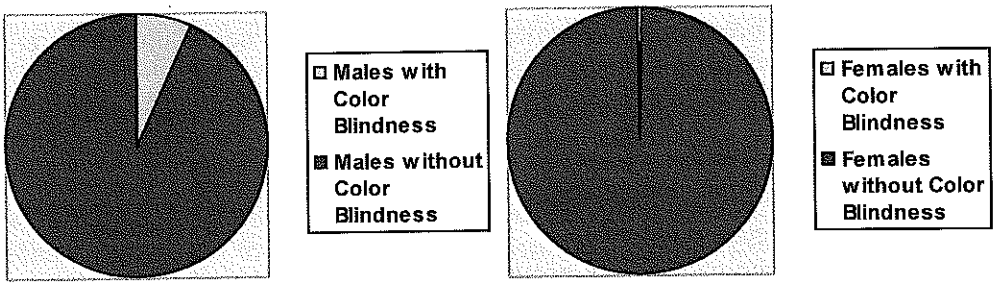
Earlobes are a genetic trait. The father has attached earlobes, which is the recessive trait. The mother has hanging earlobes, which is the dominant trait. She has one attached earlobe allele and one hanging earlobe allele. Color the parents and children. What is the probability of the child having attached earlobes?



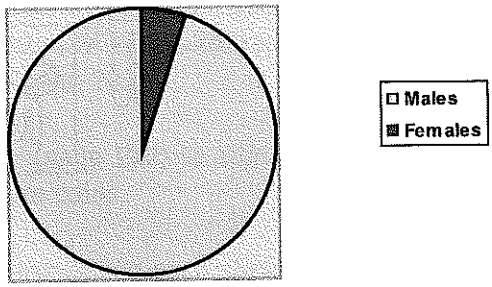
Lactose intolerance is a genetic disorder. It is also a dominant trait. If both the mother and father are lactose intolerant (with one lactose intolerant allele each), what is the probability that the child will be lactose intolerant?

Color Confusion

Color blindness, or the inability to tell colors apart, is genetic. That means that parents pass it down to their children through their genes. The following charts show the differences between male (7%) and female (.5%) populations who are color blind.



This chart shows the population of colorblind people (93% are male).



Directions: Use the information above and what you read in *Gregor Mendel: Genetics Pioneer* to answer the questions.

1. How does a person get color blindness?
2. How many more times do men get color blindness than women?
3. Of the people who are colorblind, what percent are female?
4. How did Mendel's work help scientists discover the gene for color blindness?
5. The most common form of color blindness is red/green. Some people also have blue/yellow color blindness. Only a few people see the world in shades of gray. They cannot see color at all! Think about the world through the eyes of color. List three additional places or situations where people with color blindness may have trouble.

People who are color blind may have trouble:

- reading a weather map
- reading a road map
- following color-by-number directions
- testing pool water

Create a Critter

Mendel's Laws of Heredity explain how a person, animal, or plant has certain traits. Mendel worked with pea plants. Today scientists study the DNA of people and animals, too.

Directions: Use what you read in *Gregor Mendel: Genetics Pioneer* to genetically create a critter.

1. Pick three genetic traits for your critter species.

Trait	Dominant	Recessive
Example: Fur Color	*Green*	*Blue*
1.		
2.		
3.		

2. Name four critters of your new species and label the three genetic traits of their species in the numbered boxes below. Then flip a coin for each small box. If the coin is heads, write in the dominant allele for that trait. If the coin is tails, write in the recessive allele. Then draw and color a picture of that critter.

Name:								
1.								
2.								
3.								
Picture:								

3. Now it's time to breed your critters. The first two critters have one offspring, and the last two critters have one offspring. Name them in the boxes below. Label the genetic traits of your critter species, as well. Then go through each box. The children get one allele from each parent for every trait. Flip a coin for each box. If the result is tails, it gets the parent's first allele for that trait. If the result is heads, it gets the parent's second allele. Once you know their alleles, draw their pictures.

Name:				
1.				
2.				
3.				

4. Breed the second generation of your critters. The two critters that you created in Step 3 can produce offspring. Do the same steps you did in Step 3 to produce a new critter on the back of this page. How many recessive traits does the second generation have? How many recessive?

Reader Quiz

Directions: Use what you learned from reading *Gregor Mendel: Genetics Pioneer* to choose the best answer for each question.

1. Gregor Johann Mendel was...
   a. a monk.
   b. a botanist.
   c. the father of modern genetics.
   d. all of these

2. Where do a baby's chromosomes originate?
   a. Half come from a mother's egg cell, and half come from a father's sperm cell.
   b. They are created as the baby grows.
   c. They come from the parents' DNA.
   d. Chromosomes are created during childhood.

3. Why did Mendel select pea plants for his genetic research?
   a. They were easy to grow.
   b. They had a short breeding time.
   c. They could be cross-pollinated.
   d. all of these

4. When geneticists speak of phenotypes, they are referring to...
   a. the individual's genes.
   b. the traits seen on an individual.
   c. the individual's DNA.
   d. the behaviors displayed by an individual.

5. Which of the following statements is true of Mendel's work?
   a. His work was readily accepted by the scientific community.
   b. He proved the theory of blending.
   c. Mendel discovered dominant and recessive genes.
   d. Mendel's work applied to human behavior.

6. How are Mendel's ideas used in modern genetic research? Use details and examples from the book to support your answer.

7. How was Mendel's work like Rosalind Franklin's? Use details and examples from the book to support your answer.

Gregor Mendel Answer Key

Hand-Me-Down Genes

1. The only possible combination is one dominant and one recessive. The dominant trait will express.
2. 50%
3. 75%

Color Confusion

1. from his or her parents' genes
2. 14 times
3. 7%
4. He provided the base for future work with genetics.
5. Students should have listed three additional situations where people may have difficulty with color blindness.

Create a Critter

Answers will vary. Check student work for consistency.

Reader Quiz

1. d 2. a 3. d 4. b 5. c
6. Scientists use Mendel's research to create better plants. These plants are stronger, bigger, and can be resistant to insects. Some plants have additional nutrients, such as vitamin A, to be more healthy to eat.
7. Both Franklin and Mendel worked with genetics. They both died before their work was accepted by the scientific community.

Lab Lesson Plan: Genetic Dominant/Recessive Trait Survey

Before the Lab

Review with students what they learned about dominant and recessive traits.

How has scientific work with genes helped people?

Decide if you will require students to survey people in the building, or at home. If this lab is to be done at school, arrange for groups of students to visit other classrooms to conduct the survey and gather data.

Introduce the Lab

Read the introductory information with students. Which of these traits did they read about? Which traits are they surprised to learn are recessive or dominant?

Read the list of materials. Provide each lab group or student with the necessary materials.

Read through all the procedures with the students at least once before they engage in the lab. Check for understanding of the required steps.

Have students prepare their survey form (Step #1).

Conduct the Lab

Allow time for lab groups or individuals to conduct the lab.

Instruct students to think about the questions listed in the Conclusion using their survey data.

After the Lab

Have each lab group share its results. Compile the information into a class data table, similar to the one the students used to conduct their survey (Step #5).

Have students make a chart to reflect their group data while the teacher makes a chart to reflect the class data. Have students compare their group data to the class data. What similarities or differences do they observe?

Have students respond to Step #7 and the Conclusion in their lab journals.

(Optional) Allow time for students to conduct additional research related to genetics (see Lab Extension Idea for Further Study, page 182).

Lab: Genetic Dominant/Recessive Trait Survey

Materials

- paper
- pencil
- computer with spreadsheet application and a printer

Dominant	Recessive
free earlobes	attached earlobes
can roll tongue in a *U* shape	can't roll tongue in a *U* shape
no widow's peak	widow's peak
brown eyes	grey, green, or blue eyes
index finger shorter than ring finger	ring finger shorter than index finger
dark hair	light hair
non-red hair	red hair
curly hair	straight hair

Procedure

1. Prepare a genetic dominant/recessive trait survey form. Using each of the categories listed at the top of this page, make a chart. Leave space after each column to tally total numbers. Above the left-hand column, add the title Dominant Traits. Above the right-hand column, add the title Recessive Traits.
2. Ask your family members and friends which traits they have.
3. Record their responses on your form.
4. Total the number of responses you tallied for each trait.
5. Create a bar graph to display your results. If you have them, use a computer and printer to create your graph.
6. Summarize your results.

Conclusion

Dominant traits show up more often than recessive traits. Genetic traits show up in predictable patterns within families. Did you come to the same conclusion?

Extension Idea

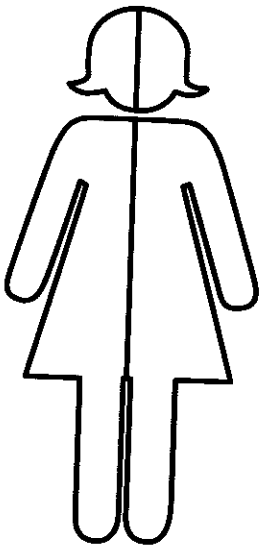
Use genetics as a keyword to research genetic traits on the Internet. Share your most interesting findings by creating a poster.

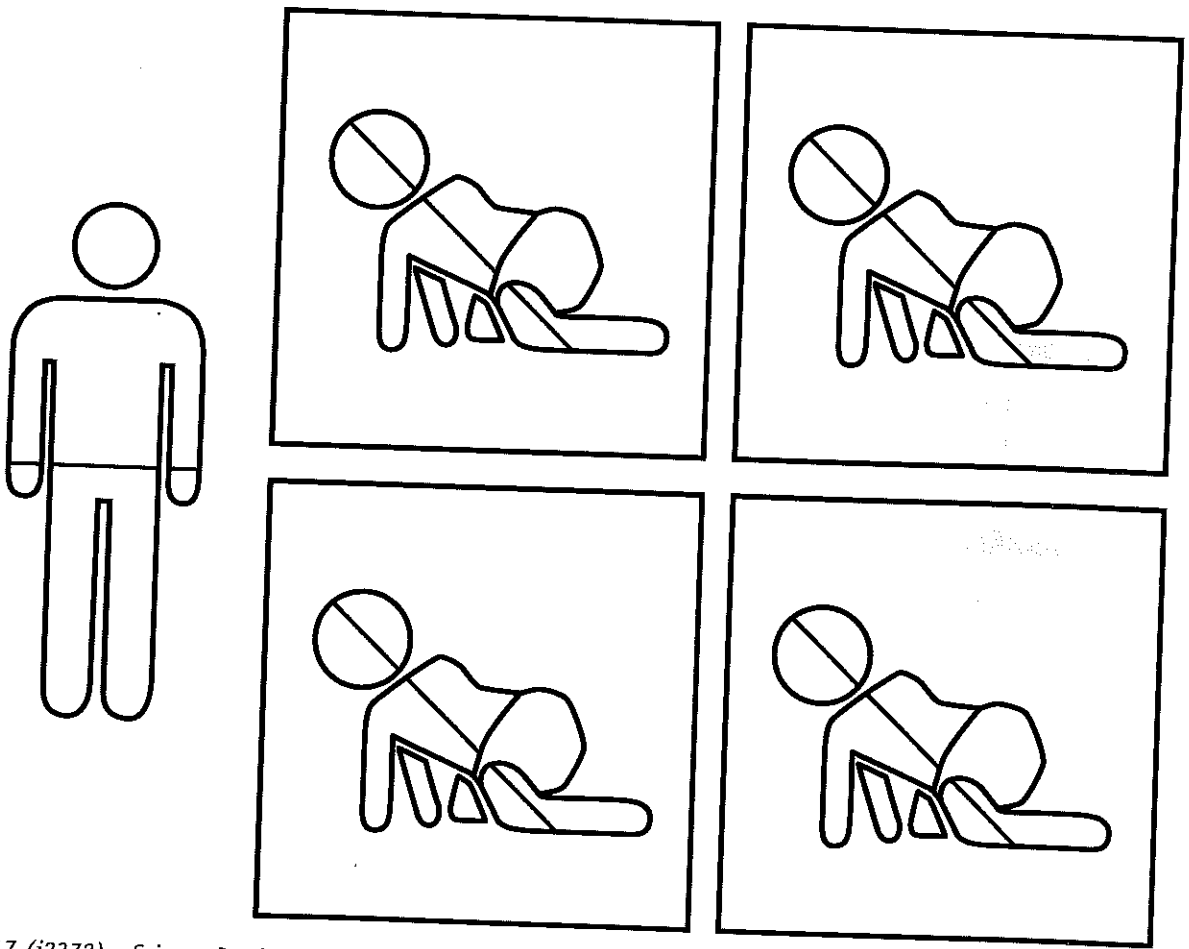
Hand-me-down Genes Transparency

Alleles

Dominant Allele _____

Recessive Allele _____





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