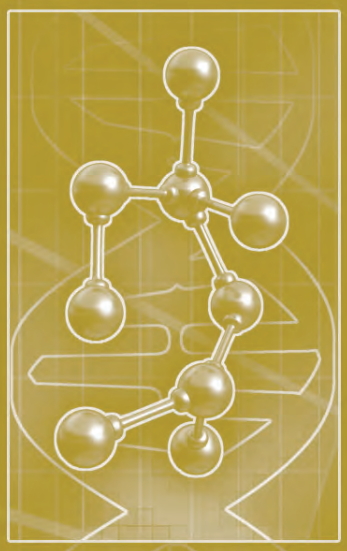

MODULE 4

Genes – What are they good for?

FACILITATOR'S GUIDE

GENETICS FOR KIDS

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Genes – What are they good for?

Introduction

A basic knowledge of genetics is vital in understanding how genetics affect our daily lives. Public discourse on genetic technologies is increasing, particularly in the fields of medicine, ecology, and law enforcement. Prior to discussing ethical and moral implications of the application of genetic technologies, students need to understand the basis of genetic research. This module presents basic genetic concepts to enable students to understand and participate in public genetic discourse.

In this module, students will work in small groups to identify their phenotype or distinct personal features, also known as traits. Students will also learn about dominant and recessive genes, and the relationship between their phenotypes and genotypes. Students will then participate in an activity to identify other students with identical phenotypes and demonstrate variation in human traits.

Learning Objectives

- ✓ Recognize that genes (genotype) can contain instructions for making proteins that create traits (phenotype)
- ✓ Understand that humans have many of the same genes
- ✓ Explain that variation in genes account for different traits found in humans

Prior Knowledge

To complete this module, students should already be able to:

- ✓ Understand the basic structure of cells
- ✓ Locate different cell organelles and understand their functions
- ✓ Recall basic functions of DNA, including how proteins are made from DNA
- ✓ Recognize that cells of all organisms contain DNA

Relevant Standards of Learning

National Science Education Standards
Life Science, Content Standard C

Structure and function in living systems

- All organisms are composed of cells – the fundamental unit of life. Most organisms are single cells; other organisms, including humans, are multicellular.

Reproduction and heredity

- Every organism requires a set of instructions for specifying its traits. Heredity is the passage of these instructions from one generation to another.
- Hereditary information is contained in genes, located in the chromosomes of each cell. Each gene carries a single unit of information. An inherited trait of an individual can be determined by one or by many genes, and a single gene can influence more than one trait. A human cell contains many thousands of different genes.

New York State Intermediate Science Standards (Grades 5 - 8)
Standard 4: The Living Environment

Major Understandings

- 2.1a: Hereditary information is contained in genes. Genes are composed of DNA that makes up the chromosomes of cells.
- 2.1b: Each gene carries a single unit of information. A single inherited trait of an individual can be determined by one pair or by many pairs of genes. A human cell contains thousands of different genes.

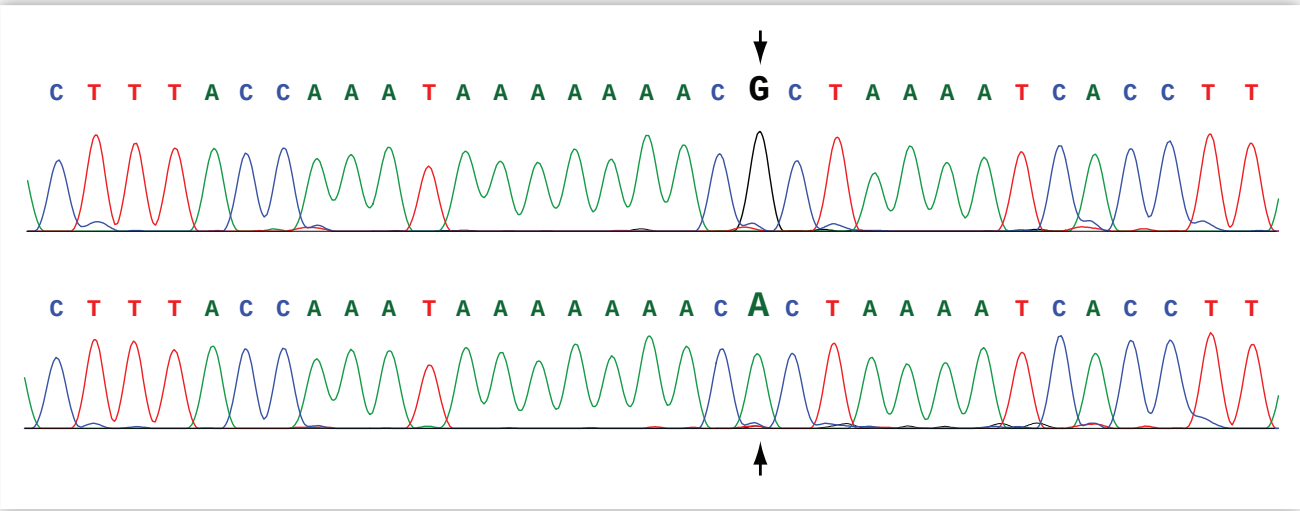
Background

Genes are sequences of **DNA** that contain instructions for the creation of **proteins** that determine physical traits. The genetic makeup of a person is called the **genotype**. The physical manifestation (traits) of a person's genotype is called the **phenotype**. Genes come in different forms called **alleles**. An offspring receives one allele from each parent. Alleles come in two forms, **dominant** and **recessive**.

It is important to understand that there are some traits that are influenced by a single gene (one pair of alleles). Single gene or Mendelian traits are what typically come to mind when we think of dominant and recessive traits. However, it is more common that traits are influenced by many different genes (multiple pairs of alleles) and the environment. For example, it was long thought that eye color was a Mendelian trait. However, eye color is the result of a complex interaction of many different genes and environmental factors that produce countless variations of colors and patterns. **The discussion of dominant and recessive traits should be handled with care so as not to perpetuate the misconception that all traits are single gene traits.**

Humans share 99 percent of genes with other humans. The many possible combinations of alleles and their interactions with the environment lead to many different phenotypes. Despite this, there are some traits that almost all humans share–traits that are advantageous to human survival. For example, human eyes are located on the front of the head facing forward, rather than being located on the sides of the head, like on horses. The advantage of forward-facing eyes is better depth perception, which increases the likelihood of human survival through increased ability to find food and avoid danger by locating predators.

Mutations in DNA can lead to variations in traits. A common misconception is that genetic changes occur in response to different environments, such as warm or cold climates, but mutations occur randomly in a population. Mutations can be harmful or advantageous depending upon the environment. Mutations that improve the likelihood of survival and reproduction are likely to persist in the population. Mutations that decrease the likelihood of survival and reproduction are likely to decrease in frequency.



Demonstration of a DNA mutation. Two DNA sequenses are compared and mutated sites are marked by arrows.

Vocabulary

1. **Allele**: One of multiple forms of a gene (humans usually have two copies of every gene). One allele or copy comes from your mother and one allele or copy come from you father.
2. **DNA (deoxyribonucleic acid)**: A double-stranded nucleic acid that contains the genetic information for cell growth, division, and function.
3. **Dominant gene**: Gene that produces the same phenotype in an organism whether or not its other allele is identical. You can have two dominant alleles or a dominant allele and a recessive allele in your genotype and still have the same phenotype.
4. **Gene**: A DNA sequence that is transcribed to produce a functional product (proteins).
5. **Gene pool**: The combined genetic information (all of the genes) within a population or group of people.
6. **Genotype**: The specific genes, or instructions, encoded in the DNA of an organism.
7. **Phenotype**: The physical, observable traits of an organism, determined by the genes.
8. **Protein**: Fundamental molecules in living cells necessary for the functioning of an organism.
9. **Recessive gene**: Gene that only produces a visible phenotype in an organism if its allele is identical. For the recessive trait to be expressed (show in your phenotype), you must have two copies of the allele.

Materials List

Before you begin, ensure that you have all of the items necessary to complete the module.

- ✓ **Student Handout**
- ✓ **Hand mirrors**

Procedure

Day of the Lesson

1. Seat students in groups of four.

   Inform students that in today's module, they will learn the difference between a genotype and phenotype, and they will identify their own genotype and phenotype. Students will work through today's activities in small groups. You will gather the class together at the end of the module to complete the final activity as a group.

2. Distribute a **Student Handout** to each student.

3. Instruct students to read **Part I: Introduction**.

   Ask students to silently read **Part I: Introduction** on the **Student Handout**. Provide students with enough time to read the introduction. Circulate around the room as students read. Redirect students with questions, and check for comprehension as needed.

4. Emphasize key points from **Part I: Introduction**.

   When all students are finished reading, address any questions students may have about genotypes and phenotypes. Emphasize the following key points:

   - ➥ A genotype is the specific set of alleles that make up the DNA of an organism (an organism's genetic code).

- A phenotype is the physical, observable traits of an organism (an organism's appearance).
- Genes can be dominant or recessive. Only one copy of a dominant gene is needed in the genotype to be visible in the phenotype. Two copies of a recessive gene are needed in the genotype to be visible in the phenotype.
- Humans share 99 percent of their genes with other humans, but the 1 percent difference makes each human unique.

5. Check students' understanding of **Part I: Introduction**.

   After you have emphasized the key points of the introduction, ask students the following questions *(see Teacher Note 1)*:

   - What is the difference between a genotype and a phenotype?
   - How many copies of a recessive gene are needed in a genotype for a trait to appear in a phenotype?
   - Do you think anyone else in the class has your genotype?

6. Instruct students to read the directions for **Part III: *Activity 1: What's your phenotype?*** on the **Student Handout** *(see Teacher Note 2)*.

   In ***Activity 1***, students will complete Table 1 – My phenotype by circling the traits that match their appearance. Allow students enough time to complete the table. Circulate around the room and assist students as needed.

7. Instruct students to read material for **Part III: *Activity 2: What's your genotype***?

   Read the material together with students or allow students to read in groups. Gather the class to answer any questions they may have about the reading.

   Ensure students understand the difference between dominant and recessive genes, and the difference between phenotype and genotype. Depending on students' prior knowledge of these topics, you may need to spend some time answering questions. Understanding these four concepts will guide students' thought process for determining their genotype.

8. Instruct students to continue with ***Activity 2: What's your genotype?*** by making a prediction about which traits are dominant or recessive.

   Instruct students to make a prediction about which alleles are dominant or recessive in Table 2. Ask students to share information about their phenotypes and to use this to inform their predictions. Do students think that popular phenotypes are always dominant? Emphasize that students should make their predictions without looking at the table on the next page.

9. Instruct students to complete Table 4 – My genotype *(see Teacher Note 3)*.

   Ask students to copy their phenotypes from Column C of Table 1 – My phenotype.

   Instruct students to use Table 3 – Genotype coding to determine whether their traits are dominant or recessive. Ask students whether their predictions on the previous page were correct.

   Instruct students to determine their genotype using the information in the reading above. Explain that Table 3 should guide their thinking.

10. Guide students through ***Activity 3: Find your match*** *(see Teacher Note 4)*.

    This activity is designed to have students split into groups based on phenotype to emphasize human variation. Each group will divide based on whether or not they have the dominant or recessive trait of a particular common phenotype. Then each subgroup will divide again based on whether members of the group have the dominant or recessive trait of another common phenotype. The process will continue until there are sixteen groups based on four common phenotypes–dimples, attached earlobes, curling tongue, and mid section finger hair.

    a. First division: Ask students to stand up. Instruct all students with dimples go to the right of the classroom and all the students without dimples go to the left. Ask students for observations about the way their class is divided. Are there more people with or without dimples? Is the recessive (no dimples) or dominant (dimples) trait more popular? Students should record the number of people in their group on the **Student Handout**.

    b. Second division: With students still in two groups, instruct each group to divide based on whether students have attached or unattached earlobes. Instruct students with attached earlobes to move to the front of the room and students with unattached earlobes to move to the back of the classroom. It is critical that the original groups, dimples/no dimples remain intact. There should now be four groups of students in the classroom. Ask students for observations. Are there any groups that are very large? Are any groups very small? What could be some reasons for this? Students should record the number of people in their group on the **Student Handout**.

    c. Third division: Instruct each of the four groups to divide based on whether they can curl their tongue. Students who can curl their tongue move to the right, students who cannot curl their tongue move to the left. There should be eight groups. Ask students for observations. Students should record the number of people in their group on the **Student Handout**.

    d. Fourth division: Each of the eight groups will now divide based on whether or not they have hair on the mid section of their fingers. Instruct those who do have hair should move to the front, those who do not should move to the back. There should now be 16 groups. Students should record the number of people in their group on the **Student Handout**.

11. Lead a closing class discussion about the module's activities.

    Ask students for observations about the way the class divided. Use questions to guide the conversation such as:

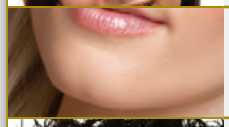
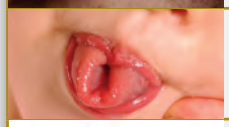
    - Do you agree with the statement that humans share the majority of their genes?
    - Did any of you share all four *phenotypes*?
    - Did of you share all of the same *genotypes*?

    During the closing discussion, it is important to stress that humans have many of the same genes, although there is also much variation as they saw with their classroom division. If students are resistant to the notion of sharing many genes with their classmates, point out that genes control for things that all humans share, such as having two eyes and one nose *(see Teacher Note 5)*.

Extension Lesson

My Traits

Students can check more of their real traits, such as oval face or attached earlobes, using the chart below. Once all the students have checked off their traits, have students make a class chart tallying how many people have what traits. Students can discuss which traits are rarer in their class gene pool, and which traits are more common.

Trait		Dominant	Recessive
	**Face shape**	Oval	Square
	**Chin cleft**	No cleft	Cleft
	**Hairline**	Widow peak	Straight
	**Eyebrow shape**	Separated	Joined
	**Eyelash length**	Long	Short
	**Freckles**	Freckles	No freckles
	**Tongue folding**	Inability	Able
	**Hitchhiker's thumb**	Straight	Angled
	**Bent little finger**	Bent	Straight
	**Interlaced fingers**	Left over Right	Right over Left

Facial Recognition

Humans are good at recognizing faces. A fun online game that tests a student's ability to memorize facial features is available at the *Neuroscience for Kids* website *(see Additional Resources 3)*. Humans are good at recognizing right-side-up faces, but we are not very good at distinguishing features in upside down faces. Damage to certain parts of the brain can cause a loss of ability to recognize faces at all, a condition known as prosopagnosia, or face blindness. Students may be interested in learning more about the condition, especially after documenting some facial features in the module.

Teacher Notes

1. It may be useful to go over the steps involved in protein creation.
   - ➥ Information from a gene's DNA is transferred to messenger RNA (mRNA) in a process called transcription.
   - ➥ mRNA carries the information from the DNA out of the nucleus into the cytoplasm.
   - ➥ An organelle called the ribosome reads the mRNA to produce the needed protein in a process called translation.
   - ➥ The protein then travels to where it is needed.
2. Relate the discussion to why students may have the characteristics they have. Can students think of anyone in their family who has the same traits? Encourage students to talk to their parents to see if anyone in their family has a similar phenotype.
3. Advanced students may quickly catch onto how to determine the genotype based on whether a trait is dominant or recessive. Other students may need more time. If students are having trouble, encourage students to write out possible combinations of traits until they find one that matches their phenotype.

   If students are having difficulty with the vocabulary word "alleles," concentrate on the idea that genes affect traits because they are the instructions for making the building blocks (the proteins) for those traits.
4. Emphasize that humans share most genes. For example, human genes code for the fact that our arms are attached to our body, not our heads. You might want to brainstorm with your students as to which activities might be harder, and which might be easier to do if our arms grew out of our heads. For example, would it be more difficult to brush your teeth or reach a top shelf? Students may be interested in the intricate ways in which all of our parts work together. For instance, if arms did grow out of heads, would heads have to be much larger to accommodate the muscle and bone structures that support our current arm placement? If that were so, then what kind of spinal cord and back support would be needed to support upright heads?
5. Inform students that there is still much information about genes being discovered. Also discuss why understanding gene function is so important, such as in the production of food crops that ripen faster, are drought or insect resistant, or contain more beneficial nutrients. Gene function is also important in designing new medicines that work more effectively with a person's specific genes, which may decrease negative side effects.

Additional Resources

1. Dolan Learning Center, *DNAi Teacher Guide*. This website provides a variety of classroom activities on genetics topics, and teacher pages and student worksheets. http://www.dnai.org/teacherguide/guide.html
2. University of Kansas Medical Center, *Genetics Education Center*. This website provides a variety of genetics lesson plans, curriculum development resources, and barriers to teaching about genetics, science, and molecular genetics. http://www.kumc.edu/gec/lessons.html
3. University of Washington, *Neuroscience for Kids*. This website has a variety of memory tests appropriate for K-12 students. See the Face Memory Test to follow up on the in-class activity. http://faculty.washington.edu/chudler/chmemory.html

Part I: Introduction

Genes are sequences of **DNA** that contain instructions that determine the physical traits of organisms. Traits include physical characteristics such as eye color and hair color. The genetic makeup of a person is called the **genotype**. The physical appearance (traits) is called the **phenotype**. Even though there is a lot of phenotypic variation among people, human beings share 99 percent of genes with other human beings. Genes come in different forms called **alleles**. An offspring obtains one allele from each parent. Alleles may be **dominant** or **recessive**.

Some traits are **dominant**, which means only a single copy of that dominant allele is needed in the genotype for the trait to be present in the phenotype. For example, if you have the dominant allele for dark hair, then your hair will be dark. A **recessive** trait is one that can be present in the genotype, but will not be present in the phenotype if the second allele is dominant. For example, if you have one allele for dark hair (dominant) and one allele for blonde hair (recessive), your hair will still be dark. If, on the other hand, there are two copies of the recessive allele, then the trait will be present in the phenotype. For example, if you have two copies of the allele for blonde hair, then your hair will be blonde.

In this module, you will learn and apply basic genetic concepts. You will work in small groups to identify differences in phenotypes and to identify possible genotypes.

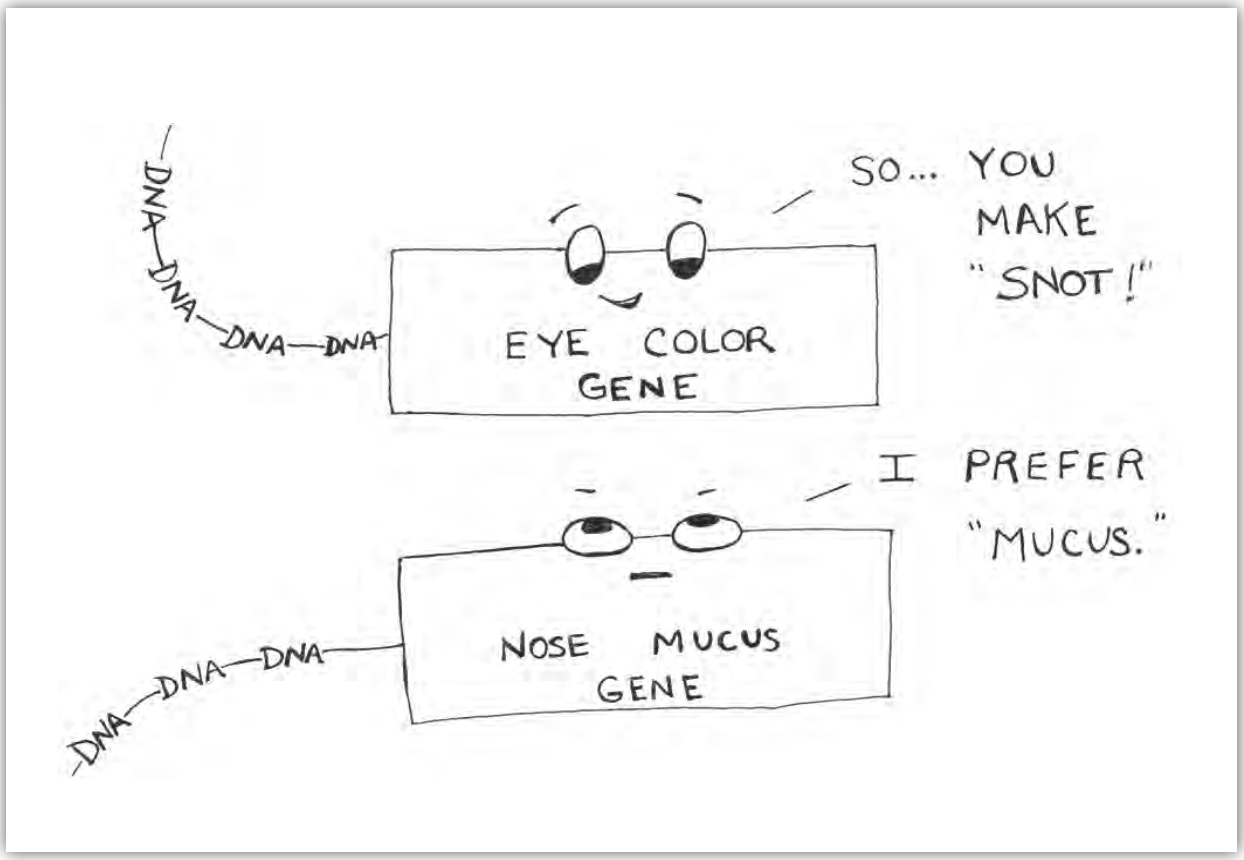


Image 1: Genes produce proteins that make up your eye color and even mucus.

Part II: Vocabulary

1. **Allele**: One of multiple forms of a gene (humans usually have two copies of every gene). One allele or copy comes from your mother and one allele or copy come from you father.
2. **DNA (deoxyribonucleic acid)**: A double-stranded nucleic acid that contains the genetic information for cell growth, division, and function.
3. **Dominant gene**: Gene that produces the same phenotype in an organism whether or not its other allele is identical. You can have two dominant alleles or a dominant allele and a recessive allele in your genotype and still have the same phenotype.
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9. **Recessive gene**: Gene that only produces a visible phenotype in an organism if its allele is identical. For the recessive trait to be expressed (show in your phenotype), you must have two copies of the allele.

Part III: Activities

Activity 1: What's your phenotype?

In this first activity, you will work with your group to identify your phenotype (physical traits) using Table 1. You will circle the phenotype in column C that best describes your physical traits.

Table 1 – My phenotype

A. Trait	B. Example pictures	C. My phenotype (Circle the one that applies to you)
Dimples	 Dimples	Dimples No dimples
Earlobe attachment	 Attached earlobe	Unattached earlobe Attached earlobe
Tongue rolling	 Can roll tongue	Can roll my tongue Cannot roll my tongue
Finger mid-section hair	 Mid-section hair	Mid-section hair No mid-section hair

Activity 2: What's your genotype?

In this activity, you are going to work backwards to figure out which genes you inherited from your parents to create your **phenotype**. This is called a **genotype**.

Before we do that, we need to know a little bit about how we inherit genes. Every parent has two copies, or **alleles**, of a gene. Each parent provides one allele for a particular trait to his or her child. This way, you inherit one allele (copy of a gene) from your mother and one allele (copy of a gene) from your father.

There are two kinds of alleles: **dominant** and **recessive**. If you have two dominant alleles, you have the dominant trait. If you have two recessive alleles, you have the recessive trait.

Things get tricky if you have one dominant allele and one recessive allele. Dominant alleles are "more powerful" than recessive alleles. So, if you have one dominant allele and one recessive allele, the dominant allele is visible and the recessive allele is not. For example, in the table below, tongue curling is a dominant trait and the dominant allele is represented with a "T." Not having the ability to curl your tongue is a recessive trait and the recessive allele is represented with a "t." If you have a "Tt" genotype (one dominant allele and one recessive allele), you can curl your tongue because tongue curling is the dominant trait.

Sample map of the human genome.

If a trait is recessive, you need to have two recessive alleles in your genotype to see the recessive trait in your phenotype. According to the table below, not being able to curl your tongue is recessive. If you cannot curl your tongue, your genotype has to be "tt" (two recessive alleles).

Before you turn the page, take a look at the traits of the people in your group, and make a prediction about which traits are dominant. Record your prediction in Table 2. If you think the trait listed is dominant, put a "D" in the box below. If you think the trait is recessive, put an "r" in the box below. The first one is done for you.

Table 2 – Prediction

Trait:	Tongue rolling	Attached earlobe	Dimples	Finger mid-section hair
Dominant or Recessive?	D			

To figure out your genotype, use Table 3 – Genotype coding on the right to identify whether your traits are dominant or recessive. Then, use your knowledge about dominant and recessive alleles to identify a possible genotype. Record your possible genotype(s) in Table 4 – My genotype below. Sometimes, there is more than one possible genotype for a trait (for example, the genotype for tongue curling can be "Tt" or "TT"). If you can find a second genotype for your phenotype, write it in the last column.

Table 3 – Genotype coding

Dominant trait	Recessive trait
Tongue curling	**No tongue curling**
Dominant **T**	*Recessive* **t**
Mid-section hair on fingers	**No mid-section hair on fingers**
Dominant **F**	*Recessive* **f**
Unattached earlobe	**Attached earlobe**
Dominant **E**	*Recessive* **e**
Dimples	**No dimples**
Dominant **D**	*Recessive* **d**

Table 4 – My genotype

My phenotype (trait)	Dominant (D) or recessive (r)?	My genotype (genetic code)	Another possible genotype?
Dimples			
Earlobe			
Tongue roll			
Mid-section hair			

Activity 3: Find your match

In this activity, you will find out whether anyone else in your class has the same phenotype for the four phenotypes you have examined. As you go through the activity, record the number of people with whom you share phenotypes.

1. How many other people share your dimple phenotype? _____
2. How many other people share your dimple and earlobe phenotype? _____
3. How many people share your dimple, earlobe, and tongue curling phenotypes? _____
4. How many people have **all** of the same phenotypes? _____

Part IV: Conclusion questions

1. Did you find anyone who had at least two phenotypes in common with you?

2. Can two people have the same phenotype for a trait, but have different genotypes?

3. Using what you learned in today's activities, explain the following statement: Humans share many of the same genes. Provide at least one example to support your idea.

Part V: Notes

Part I: Introduction

Genes are sequences of **DNA** that contain instructions that determine the physical traits of organisms. Traits include physical characteristics such as eye color and hair color. The genetic makeup of a person is called the **genotype**. The physical appearance (traits) is called the **phenotype**. Even though there is a lot of phenotypic variation among people, human beings share 99 percent of genes with other human beings. Genes come in different forms called **alleles**. An offspring obtains one allele from each parent. Alleles may be **dominant** or **recessive**.

Some traits are **dominant**, which means only a single copy of that dominant allele is needed in the genotype for the trait to be present in the phenotype. For example, if you have the dominant allele for dark hair, then your hair will be dark. A **recessive** trait is one that can be present in the genotype, but will not be present in the phenotype if the second allele is dominant. For example, if you have one allele for dark hair (dominant) and one allele for blonde hair (recessive), your hair will still be dark. If, on the other hand, there are two copies of the recessive allele, then the trait will be present in the phenotype. For example, if you have two copies of the allele for blonde hair, then your hair will be blonde.

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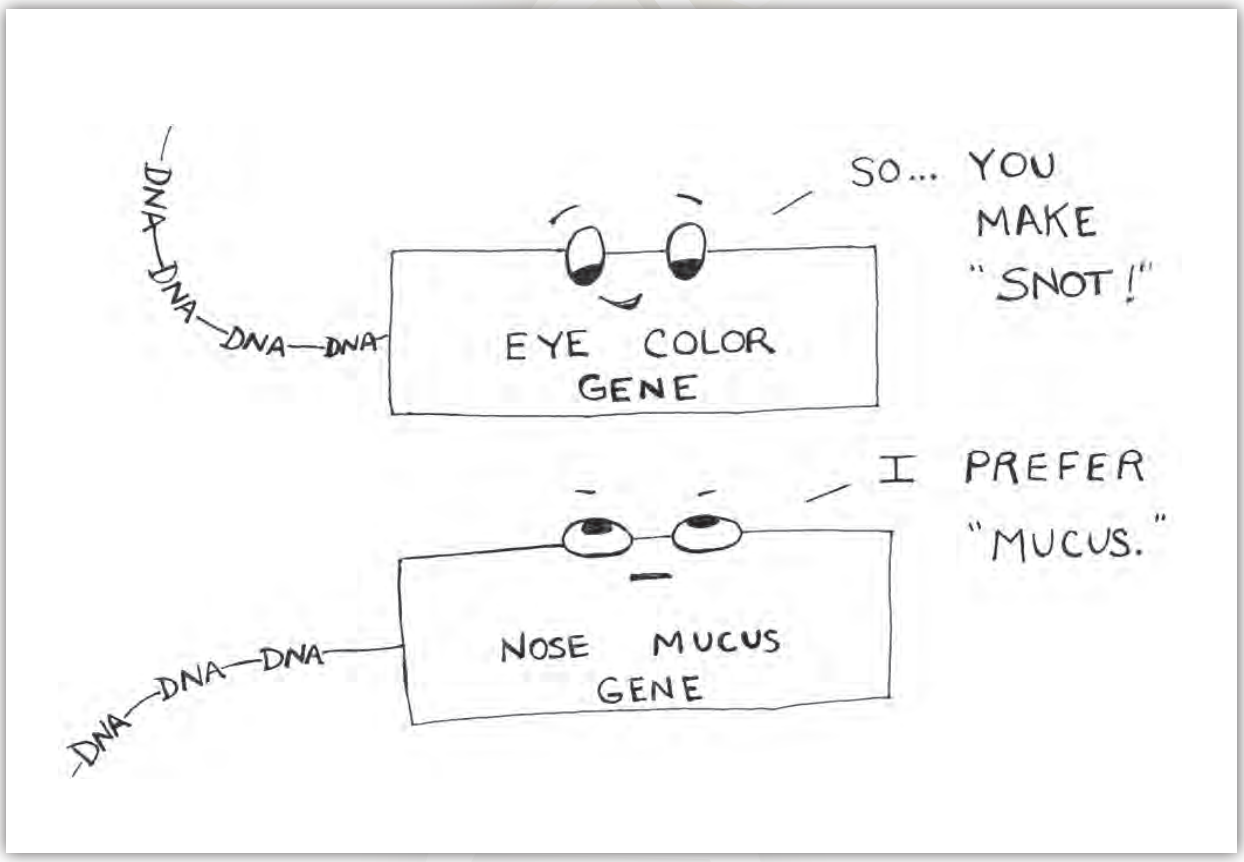

Image 1: Genes produce proteins that make up your eye color and even mucus.

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Part III: Activities

Activity 1: What's your phenotype?

In this first activity, you will work with your group to identify your phenotype (physical traits) using Table 1. You will circle the phenotype in column C that best describes your physical traits.

The traits selected in this table will vary for each student.

Table 1 – My phenotype

A. Trait	B. Example pictures	C. My phenotype (Circle the one that applies to you)
Dimples	 Dimples	Dimples No dimples
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Activity 2: What's your genotype?

In this activity, you are going to work backwards to figure out which genes you inherited from your parents to create your **phenotype**. This is called a **genotype**.

Before we do that, we need to know a little bit about how we inherit genes. Every parent has two copies, or **alleles**, of a gene. Each parent provides one allele for a particular trait to his or her child. This way, you inherit one allele (copy of a gene) from your mother and one allele (copy of a gene) from your father.

There are two kinds of alleles: **dominant** and **recessive**. If you have two dominant alleles, you have the dominant trait. If you have two recessive alleles, you have the recessive trait.

Things get tricky if you have one dominant allele and one recessive allele. Dominant alleles are "more powerful" than recessive alleles. So, if you have one dominant allele and one recessive allele, the dominant allele is visible and the recessive allele is not. For example, in the table below, tongue curling is a dominant trait and the dominant allele is represented with a "T." Not having the ability to curl your tongue is a recessive trait and the recessive allele is represented with a "t." If you have a "Tt" genotype (one dominant allele and one recessive allele), you can curl your tongue because tongue curling is the dominant trait.

Sample map of the human genome.

If a trait is recessive, you need to have two recessive alleles in your genotype to see the recessive trait in your phenotype. According to the table below, not being able to curl your tongue is recessive. If you cannot curl your tongue, your genotype has to be "tt" (two recessive alleles).

Before you turn the page, take a look at the traits of the people in your group, and make a prediction about which traits are dominant. Record your prediction in Table 2. If you think the trait listed is dominant, put a "D" in the box below. If you think the trait is recessive, put an "r" in the box below. The first one is done for you.

Table 2 – Prediction

Trait:	Tongue rolling	Attached earlobe	Dimples	Finger mid-section hair
Dominant or Recessive?	D	The answers for this table will vary for each student.		

To figure out your genotype, use Table 3 – Genotype coding on the right to identify whether your traits are dominant or recessive. Then, use your knowledge about dominant and recessive alleles to identify a possible genotype. Record your possible genotype(s) in Table 4 – My genotype on the right. Sometimes, there is more than one possible genotype for a trait (for example, the genotype for tongue curling can be "Tt" or "TT"). If you can find a second genotype for your phenotype, write it in column 4.

Table 3 – Genotype coding

Dominant trait	Recessive trait
Tongue curling	**No tongue curling**
Dominant **T**	*Recessive* **t**
Mid-section hair on fingers	**No mid-section hair on fingers**
Dominant **F**	*Recessive* **f**
Unattached earlobe	**Attached earlobe**
Dominant **E**	*Recessive* **e**
Dimples	**No dimples**
Dominant **D**	*Recessive* **d**

Table 4 – My genotype

My phenotype (trait)	Dominant (D) or recessive (r)?	My genotype (genetic code)	Another possible genotype?
Dimples			
Earlobe			
Tongue roll			
Mid-section hair			

The answers for this table will vary for each student.

Activity 3: Using Find your match

In this activity, you will find out whether anyone else in your class has the same phenotype for the four phenotypes you have examined. As you go through the activity, record the number of people with whom you share phenotypes.

1. How many other people share your dimple phenotype?

The answer to this question will vary for each student.

2. How many other people share your dimple and earlobe phenotype?

The answer to this question will vary for each student.

3. How many people share your dimple, earlobe, and tongue curling phenotypes?

The answer to this question will vary for each student.

4. How many people have **all** of the same phenotypes?

The answer to this question will vary for each student.

Part IV: Conclusion questions

1. Did you find anyone who had at least two phenotypes in common with you?

The answer to this question will vary for each student.

2. Can two people have the same phenotype for a trait, but have different genotypes?

Two people can have the same phenotype, but have different genotypes. For example, if a person has the genotype DD, the phenotype is dimples. If a person has the genotype Dd, the phenotype is also dimples.

3. Using what you learned in today's activities, explain the following statement: Humans share many of the same genes. Provide at least one example to support your idea.

Most humans share all of the same genes, although each person has different combinations of alleles for each gene. Also, for example all humans have the genes that determine humans have two eyes and one nose.

Part V: Notes

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Genes – What are they good for?

Module 4