

This 5E model for instruction will connect the concepts of genes and chromosomes, asexual and sexual reproduction, and selective breeding through the examination of the genetic basis for why some foods may not be good for you. This lesson is part 2 of 2 of the instructional segment on Structure and Function in Living Systems.

Student Science Performance

Grade or course: 7th Grade Life Science

Title:

Topic: Structure and Function in Living Systems

“I can’t eat this food, but my sibling can.”

Performance Expectation for GSE:

S7L3. Obtain, evaluate, and communicate information to explain how organisms reproduce either sexually or asexually and transfer genetic information to determine the traits of their offspring.

- a. Construct an explanation supported with scientific evidence of the role of genes and chromosomes in the process of inheriting a specific trait.
- b. Develop and use a model to describe how asexual reproduction can result in offspring with identical genetic information while sexual reproduction results in genetic variation.
(Clarification statement: Models could include, but are not limited to, the use of monohybrid Punnett squares to demonstrate the heritability of genes and the resulting genetic variation, identification of heterozygous and homozygous, and comparison of genotype vs. phenotype.)
- c. Ask questions to gather and synthesize information about the ways humans influence the inheritance of desired traits in organisms through selective breeding.
(Clarification statement: The element specifically addresses artificial selection and the ways in which it is fundamentally different from natural selection.)

Performance Expectations for Instruction:

Students will:

- will ask questions to obtain and evaluate information about the cause of a person having the condition.
- obtain and evaluate information from teacher provided resources about the role of genes and chromosomes in the process of inheriting the condition.
- develop and use a model to explain the relationship between genes and chromosomes associated with the condition.
- construct an explanation supported by evidence of the role of genes and chromosomes in the process of inheriting a specific trait.
- ask questions to gather and synthesize information about ways humans influence the inheritance of desired traits in organisms through selective breeding.
- construct an explanation of the ways humans influence the inheritance of desired traits in organisms through selective breeding.

[Additional notes on student supports](#)

Materials

Print or digital resources for research purposes
Craft materials with which to build gene and chromosome models

Students will continuously obtain, evaluate, and communicate information. This is not a linear process. Students will communicate through writing and discussions to allow for formative assessment. This benefits the teacher, student, and whole group to guide instruction to clarify misconceptions or extend content.

Engaging Learners

Phenomenon

- Some foods may not be good for you. People in the same family may not have the same reaction to the nutrients, or ingredients, in food.

Teacher will provide access to print and/or digital resources (informational text, personal narrative, or video segment) about a condition associated with the nutrients, or ingredients, in food. Possible conditions and its causal nutrient are provided below:

- food allergies (proteins in various foods),
- diabetes (sugar),
- celiac disease (gluten),
- phenylketonuria, or PKU (phenylalanine), or
- lactose intolerance (lactose in milk).

Teacher Notes: Students will work individually or in pairs as they are introduced to this phenomenon. You will need multiple copies of the information so that each student, or pair of students, is introduced to one condition and all conditions are introduced to the class. You may randomly assign a condition to students or differentiate based on the compatibility of the student's reading level to the resource.

Students, in pairs, will read or view the resource provided to them.

After students have read or viewed the media, teacher will ask students to share with one another what they notice and wonder about the condition depicted in the media.

Teacher will form groups of students based on the condition presented to the students. Students introduced to the same condition will discuss what they notice and wonder about the condition. Students will make a T-chart (Notice and Wonder) on a sheet of notebook paper.

Class Discussion:

- Teacher will initiate a brief class discussion where a student from each group will share with the class the T-chart from the group.
- Teacher will post the students' responses in a T-chart on chart paper or the board and refer back to these throughout the lesson.
- Students and teacher will summarize what the class noticed and wondered about the conditions to produce general questions about the conditions. (Post students' "wonder statements" as questions.) Possible student questions:
 - Why does someone have this condition?
 - Is someone born with this condition?
 - Does someone grow out of the condition?
 - How does someone get this condition?
 - Can someone pass on this condition to their children?

Students will select a condition, from those presented in the class, they are interested in investigating.

Teacher Notes: Students should be given options of investigating conditions with a genetic basis associated with the nutrients, or ingredients, in food.

Students will ask questions to obtain and evaluate information about the cause of a person having the condition.

Exploring

Teacher will provide students with access to print and/or digital text resources ([possible resources](#)) from which students can obtain and evaluate information to answer their questions about the cause of the condition they selected to investigate.

Class Discussion:

- Engage in a brief class discussion where students share with the class the information on the condition they selected to investigate.
- Refer to the T-chart depicting what the students initially noticed and wondered about the condition.
- Ask students if they have anything new to add to the notice column.
- Ask students if they can provide any information to address, or answer, what they wondered about. Ask students what new things they wonder about now that they have learned more about the condition.

Teacher Notes: Students will discover there is a gene, or multiple genes, associated with the condition.

Students will obtain and evaluate information from teacher provided resources about the role of genes and chromosomes in in someone having the condition.

- [What is a gene?](#) and [What is a chromosome?](#) (National Institute of Health: Genetics Home Reference)

Students, in pairs or individually, will develop and use a model to explain the relationship between genes and chromosomes associated with the condition.

- Students' models could be produced using print, digital, or craft products.
- Students could build a model of a chromosome and use various colors in groups to represent the genes that make up the chromosome.

Class Discussion:

- Engage in a brief class discussion where students communicate information about the cause and effects of the condition. Students will communicate information about the genes and chromosomes associated with the condition. Students could share their models of the chromosome(s) and its associated gene(s).
- Use the discussion to lead into the question: How does someone get the gene(s) and chromosome(s) that cause the condition?

Students will use teacher provided print and/or digital resources to obtain information about how the condition is inherited.

Class Discussion:

- Students will communicate information they obtained about how the condition is inherited.
- Refer to students' initial questions from the notice and wonder chart and give them the opportunity to address their existing questions or post new questions.
- Throughout the discussion, pose questions to students to get them to consider how sexual reproduction results in offspring with different genes and chromosomes.

	<p>Students will obtain information from teacher provided print and/or digital resources to describe how the outcome of sexual reproduction is different from that of asexual reproduction.</p> <p>Students will develop and use models to describe how asexual reproduction can result in offspring with identical genetic information while sexual reproduction results in genetic variation.</p> <ul style="list-style-type: none"> ● Students’ models could include monohybrid Punnett squares and pedigrees. ● Students’ models will show the difference in the genetic outcomes of sexual and asexual reproduction.
<i>Formative Assessment of Student Learning</i>	
<p><i>Explaining</i> Finalizing Model</p>	<p>Students will construct an explanation supported with evidence of the role of genes and chromosomes in the process of inheriting a specific trait.</p> <p>Students will develop and use a model to construct an explanation of why siblings from the same parents may not have the same condition.</p> <ul style="list-style-type: none"> ● Students will use the model to explain how sexual reproduction produces offspring with different genetic variations. ● Students will develop a pedigree or Punnett square to model how sexual reproduction results in offspring that have and do not have the condition. <p>Students will develop and use models to describe how asexual reproduction can result in offspring with identical genetic information while sexual reproduction results in genetic variation.</p> <p><i>Teacher Notes: Punnett squares are used for charting the passing of information and asexual reproduction is different. Have students clarify why they are different and how to chart in their models.</i></p> <ul style="list-style-type: none"> ● Students’ models could include monohybrid Punnett squares and pedigrees. ● Students’ models will show the difference in the genetic outcomes of sexual and asexual reproduction. <p><i>Teacher Notes: The two student performance tasks above can be combined or completed as two separate models. With either option, the students should have the opportunity to communicate their ideas to peers before producing their final models and explanations.</i></p> <p><i>As students develop their models and explanations ask students to share their ideas with you. Ask questions that may be necessary to guide students to further develop their ideas. Use this opportunity to formatively assess students’ work and select students to share their ideas during the discussion.</i></p> <p>Students will participate in a gallery walk in order to offer feedback and/or ask questions to guide the revisions of their models and/or explanations.</p> <p><i>Teacher Notes: As students participate in the gallery walk, ask questions that may be necessary to guide students to further develop their ideas. Use this opportunity to formatively assess students’ work and select students to share their ideas during the discussion.</i></p>

	<p>After the gallery walk, students will retrieve their work and review the feedback and/or questions left by their peers.</p> <p>Class Discussion:</p> <ul style="list-style-type: none"> ● Ask selected students to share their models and/or explanations with the class ● Ask selected students to share helpful feedback and/or questions left by their peers and questions left by their peers that they need help answering ● Use the students’ models to review, summarize or clarify core ideas ● Make connections between students’ models and accepted scientific explanations and terminology ● Refer back to the students’ initial questions and address any remaining unanswered questions <p>Students will revise their models to include any information obtained from the class discussion.</p>
<p>Elaborating Applying Model to Solve a Problems</p>	<p><i>Teacher Notes: This phase of the lesson has two components to address all of the conditions associated with the nutrients in food that may not be good for someone. The first phenomenon that a condition that has a genetic basis can be controlled with the proper diet addresses all the conditions examined in the lesson. The second phenomenon specifically address a condition related to a nutrient in milk that could explain why someone has a reaction to milk though they are lactose tolerant. This phenomenon is included to allow students to examine selective breeding.</i></p> <p>Phenomenon The effects of some conditions related to the nutrients in food can be controlled with the proper diet.</p> <ul style="list-style-type: none"> ● Students will obtain and evaluate information from teacher provided resources (possible resources) construct an explanation of how the condition, though it is genetically based, can be controlled with the proper diet. <p>Some researchers propose that a type of protein in milk, rather than lactose, may be the cause of the response, or reaction, some people may experience when consuming milk. There is a breed of cows whose milk does not contain this protein.</p> <ul style="list-style-type: none"> ● Students will ask questions to gather and synthesize information about selective breeding and how this has influenced production of cows that produce milk with or without a certain protein.
<p>Evaluation</p>	<p style="text-align: center;">Assessment of Student Learning</p> <p>Students will construct an explanation supported with scientific evidence of the role of genes and chromosomes in the process of inheriting a specific trait.</p> <p>Students will develop and use a model to describe how asexual reproduction can result in offspring with identical genetic information while sexual reproduction results in genetic variation.</p> <p>Students will construct an explanation of the ways humans influence the inheritance of desired traits in organisms through selective breeding.</p>



Georgia Department of Education

<i>SEP, CCC, DCI</i>	Science Essentials
Science and Engineering Practices	<ul style="list-style-type: none">● Asking questions and defining problems● Obtaining, evaluating and communicating information● Developing and using models● Constructing explanations
Crosscutting Concepts	<ul style="list-style-type: none">● Structure and function● Systems and system models● Cause and effect● Patterns
Disciplinary Core Ideas	From <u><i>A Framework for K-12 Science Education</i></u>: <ul style="list-style-type: none">● LS3.A: Inheritance of Traits● LS3.B: Variation of Traits● LS4.B: Natural Selection● LS4.C: Adaptation

Additional Supports for struggling learners:

The following supports are suggestions for this lesson and are not the only options to support students in the classroom. These supports target students that struggle with science material, this lesson or a previous lesson. These are generalized supports and do not take the place of IEP accommodations as required by each student’s Individualized Education Program.

General supports for the following categories:

Reading:

1. Provide reading support by reading aloud or doing partner reads
2. Have the teacher model what they are thinking when reading the text
3. Annotate the text with students so that they may refer to it as they work through the activities.

Writing:

1. The teacher can provide a sentence starter for the students.
2. The teacher can give students an audience to write to (i.e. Write a letter to your sibling explaining this topic).
3. The teacher can provide constructive feedback during the writing process to help students understand the expectations.

Math:

1. Provide calculators as needed.
2. Provide graph paper as needed.

Supports for this specific lesson if needed:

Performance expectations for instruction:

1. The teacher should provide information to students in various formats to reach as many students as possible.
2. The students should be given adequate time to complete each part of the lesson.
3. The students should be allowed to express their knowledge in various formats.
4. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material.

Engage:

1. The teacher should consider using a video, article or personal experience story to engage the students with the material.
2. The teacher should use intentional and flexible grouping to group students. Best practice is to use data to drive student grouping.
3. The teacher should consider giving students the ability to use a text to speech program, videos or infographics to assist students in obtaining information.
4. The teacher should consider giving students a T-chart to record their information.
5. The teacher should have clear and consistent guidelines for class discussions. These guidelines should help students feel more comfortable and be more likely to participate in the discussion.
6. The teacher should consider giving students an organizer and questions stems to record questions and research.

Exploring:

1. The teacher should consider giving sources for students to use in their research.
2. The teacher should have clear and consistent guidelines for class discussions. These guidelines should make students feel more comfortable and be more likely to participate in the discussion.
3. The teacher should use flexible and intentional grouping to group students. Best practice is to use data to drive student grouping.
4. The teacher should consider providing students with a rubric to self-assess their work. This increases student ownership.
5. Students may need additional time to complete their research and develop their models.
6. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material. These formats could include writing, drawing or using technology.

Explaining:

1. The teacher should consider providing students with an organizer to assist in developing models.
2. The teacher should consider providing students with a rubric to self-assess their work.
3. The teacher should use flexible and intentional grouping to group students. Best practice is to use data to group students.
4. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material. These formats could include writing, drawing or using technology.
5. Students may need additional time to complete their models.
6. The teacher should consider having students share their work in various ways. The students can share their work in a gallery walk, presentation or using technology.
7. The teacher should consider having students give feedback to one another.
8. Then the students can revise their work based on peer feedback.
9. Students may need additional time to complete their models and revise their models based on feedback.

Elaborating:

1. The teacher should consider providing students with an organizer to record their research.
2. The teacher should consider providing students with sources to use in their research.
3. Students may need additional time to complete their research.

Evaluating:

1. The teacher should consider giving students multiple options to express their knowledge. These options could include writing, drawing or designing a presentation.
2. The teacher should consider having students explain their models, data and reasoning as they move through the lesson.
3. The teacher should complete a formative assessment several times throughout the lesson and re-teach, review and enrich as needed.

Possible Digital Resources:

- U.S. Department of Agriculture, Food and Nutrition Services--[The Food Allergy Book: What School Employees Need to Know](#)
- Kids with Food Allergies.Org--[So What's the Big Deal About Food Allergies](#)
- Nutrition.gov
 - [What's In Food](#)
 - [Food Allergies and Intolerances](#)
- MedlinePlus
 - [Diabetes](#)
 - [PKU](#)
- National Institute of Health: Genetics Home Reference
 - [PKU](#)
- U.S. Department of Health and Human Services/National Institute of Health: National Institute of Diabetes and Digestive and Kidney Diseases
 - [The Digestive System & How it Works](#)
 - [Celiac Disease](#)
 - [Lactose Intolerance](#)
 - [Diabetes](#)

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