

# Unit 8.6 Natural Selection & Common Ancestry

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| Content Area: | Science   |
| Course(s):    | Science 8 |
| Time Period:  | MP3-4     |
| Length:       | MP3-4     |
| Status:       | Published |

## Essential Questions

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Lesson 1 How are we connected to the patterns we see in the sky?

Lesson 2 What patterns are happening in the sky that I have experienced and can observe (through models and tools)?

Lesson 3 How can we explain the Sun's path change over time?

Lesson 4 How do these changes in sunlight impact us here on Earth?

Lesson 5 How can we explain phenomena like Manhattanhenge?

Lesson 6 Why do we see the shape of the Moon change?

Lesson 7 Why do we see eclipses and when do we see them?

Lesson 8 What does a lunar eclipse look like and how can we explain it?

Lesson 9 Why do the Moon and Sun appear to change color near the horizon?

Lesson 10 How does light interact with matter in the atmosphere?

Lesson 11 How does the shape of a water droplet or an ice crystal cause sunlight to form into a rainbow?

Lesson 12 Why does the Moon always change color during a lunar eclipse?

Lesson 13 What new patterns do we see when we look more closely at other objects in the sky?

Lesson 14 Why do some solar system objects orbit planets and others orbit the Sun?

Lesson 15 How did the solar system get to be the way it is today?

Lesson 16 What patterns and phenomena are beyond our solar system that we cannot see with just our eyes?

Lesson 17 How are we connected to all of the systems in space beyond the planet we live on?

## Big Ideas

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At the beginning of this unit, students hear about the surprising fossil of an ancient penguin (nicknamed "Pedro") in a podcast from the researchers who found and identified the fossil. Students analyze data about modern penguins and Pedro to develop initial explanations for how these penguins could be connected. They brainstorm about 1) Where did all the ancient penguins go? 2) Where did all the different species of modern penguins come from? and 3) What other organisms alive today might also be connected to organisms that

lived long ago?

After exploring variations in body structures and behaviors in modern penguins and ancient penguins, they also analyze data from ancient and modern species of horses, whales, and horseshoe crabs to see whether these organisms have similar patterns. Then, to figure out the cause of the changes they have observed in populations, students explore more recent cases of changing heritable trait distribution in populations and explain them by developing a model for natural selection.

In the last part of the unit, students use their model for natural selection to explain how some body structure variations in different species of modern penguins could result from natural selection and how they could descend from a common ancient ancestor penguin population. They analyze embryological data to their argument supporting how different species may be connected. Finally, students take stock of all the questions they answered in this unit and previous OpenSciEd units and identify questions they look forward to figuring out in high school.

## **CRLLKS- Career Education**

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9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

9.2.8.B.4 Evaluate how traditional and nontraditional careers have evolved regionally, nationally, and globally.

9.2.8.B.5 Analyze labor market trends using state and federal labor market information and other resources available online.

9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

Connection:

Instruct students to include a section about career options that go along with their research project topic. Example, if the research topic is high cholesterol and its harmful effects, students should connect careers in food science and/or in the medical field.

## **Cross-Curricular Integration**

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**Additional Mathematics and ELA integration can be found within each lesson plan**

### **Integration Area: Language Arts**

W.IW.8.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

- A. Introduce a topic clearly, previewing what is to follow; and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia) when useful to aid in comprehension.
- B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
- C. Use appropriate transitions to create cohesion and clarify the relationships among ideas and concepts.
- D. Use precise language and domain/grade-level- specific vocabulary to inform about or explain the topic.
- E. Establish and maintain a formal style/academic style, approach, and form.
- F. Provide a concluding statement or section (e.g., sentence, part of a paragraph, paragraph, or multiple paragraphs) that synthesizes the information or explanation presented.

**Activity:**

Students will use CERs (Claim, Evidence & Reason) to explore Climate Change to show if students are able to convey their thinking and decision making in written form.

- Students will be answering the question, “What are causes of cancer and mutations?”
- Students provide evidence that supports their claim.
- Students will then write a reasoning that explains what their claim is, state knowledge they have on the topic, evidence to prove their topic, and close their reasoning with their claim again.

**Integration Area: Math**

8.EE.C.7.a Give linear equations in one variable.

**Activity:**

Students will take notes on a lesson about Punnett Squares which relates to probability, fractions, and percentages. Once Punnett Squares is taught, the students will work in groups to complete a worksheet on different scenarios relating to the possible outcomes of the offspring of varied traits of sexual reproductive parents: homozygous recessive and dominant as well as heterozygous.

**Language Arts Companion Standards:**

W.IW.8.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

- A. Introduce a topic clearly, previewing what is to follow; and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia) when useful to aid in comprehension.
- B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other

information and examples.

- C. Use appropriate transitions to create cohesion and clarify the relationships among ideas and concepts.
- D. Use precise language and domain/grade-level- specific vocabulary to inform about or explain the topic.
- E. Establish and maintain a formal style/academic style, approach, and form.
- F. Provide a concluding statement or section (e.g., sentence, part of a paragraph, paragraph, or multiple paragraphs) that synthesizes the information or explanation presented.

RL.CI.8.2. Determine a theme of a literary text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

RI.CI.8.2. Determine a central idea of an informational text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.

Activity:

Water on Earth: One way in which NJ residents could help control the mosquito population is to eliminate or decrease the amount of standing water around their homes. Using evidence from one or more credible sources, explain why this procedure might be effective to reduce the mosquito population? Be sure to explain how this evidence supports your claim.

## **Diversity**

### **Race and Ethnicity**

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Objective:

- Students should be able to identify the genetic diversity within the classroom.
- Students should be able to explain how genetic diversity relates to biodiversity.
- Students should be able to gather the information from their survey to find the population of students who carry specific traits.
- Students should be able to graph this information in a pie chart.

Activity:

Students will obtain a list of traits they need to look for within their class. They are to mingle and record the data on the phenotypes of the students.

They must determine if the traits they are recording are acquired or genetic.

They will use a tool to create polls and/or pie chart on their findings.

## **Science and Engineering Practices**

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- **Developing and Using Models:** Students develop, use, and revise models beginning in Lesson 1 and throughout the unit to explain patterns in the sky ranging from why Manhattahenge occurs twice a year in the same spot, why the seasons in Australia are opposite of seasons in the Northern Hemisphere, why the Moon appears redder during a lunar eclipse but does not go completely dark, why planets go around the Sun and moons go around planets, our place in the solar system and galaxy, and more.
- **Analyzing and Interpreting Data:** Students use multiple graphical displays (e.g., maps, scatter plots) of large data sets to identify and explain patterns in sky (such as solar elevation, length of day, location and paths of motion for objects in the sky, and the organization of the solar system).
- **Obtaining, Evaluating, and Communicating Information:** Throughout the unit students are gathering, reading, synthesizing and information from multiple sources (e.g., text, data, maps, graphs, images). This is an 8th grade unit toward the end of the year, so students have already had much experience in this practice so while students are given several close reading or listening protocols, some of the scaffolding has been removed from previous units so they can execute the practice on their own.

## **Science and Society**

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### **Robert Hooke**

The cell was first discovered and named by Robert Hooke in 1665. He remarked that it looked strangely similar to 'cellula' or small rooms which monks inhabited, thus deriving the name.

### **Theodor Schwann**

Schwann demonstrated that animal tissues contained cells, and in 1839 concluded that all tissues are made up of cells: this laid the foundations for the cell theory. Combined with Schleiden's findings of plant tissue containing cells, they concluded that all living things are made up of cells and that cells are the basic units of life.

### **Robert Virchow**

Concluded that all cells come from pre-existing cells

### **Antonie Van Leeuwenhoek**

The first to observe living bacteria and protista.

### **Gregor Mendel**

Discovered the basic principles of genetics concerning dominant and recessive traits within pea plants. He also proved that traits undergo independent assortment; traits are able to separate from each other.

### **Rosalind Franklin**

Rosalind Franklin was a chemical physicist (1920–1958), who used x-ray diffraction to determine the structure of DNA.

### **Francis Crick and James Watson**

Crick and Watson, together with Maurice Wilkins, won the 1962 Nobel Prize in Medicine for their discovery of the structure of DNA. Watson and Crick created the first accurate 3D model of DNA.

### **Charles Darwin**

English naturalist whose scientific theory of evolution by natural selection became the foundation of modern evolutionary studies. Darwin stated that animals and humans shared a common ancestor.

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### **CSDT Technology Integration**

8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product

Action: Students will identify, compare, and contrast the evolution of the microscope. Students will work with the compound light microscope, identify the parts, and explain how it works.

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### **Service Learning**

**Community Issue:** Students will choose between one of these issues to research, create a presentation on how they can help with this issue in Milltown, and then make a pamphlet to be posted.

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### **Focus Areas:**

- **Mosquito Pathogens:** Investigate the diseases and viruses mosquitoes carry. Determine the most prevalent pathogens as well as their effects on humans and other organisms. Using the internet, library,

and other resources, students can create a PowerPoint or brochure to share with the community.

- **Mosquito Population Control:** Learn about the breeding grounds of mosquitoes and how to reduce their population. Using the internet, library, and other resources, students can create a PowerPoint or brochure to share with the community.
- **Natural Predators:** Use the internet and other resources to gather information about mosquito predators and the predator's ideal environments. Students will research the cost, the materials needed, and the placement of these objects in the environment. The information can be shared with the public.
- **Natural Pest Control:** Learn alternative methods of pest control and the different impacts that these methods have on the environment. Create a brochure to demonstrate how everyone in town can do this and not use harmful pesticides.

## Activity:

- **Pre-Reflection:**
  - Students in their groups, will look over the list of types of projects they can do their project on.
  - They will talk about what they already know about mosquitos, their breeding seasons, and what they can do to share their information with the community in the most effective way. Using their previous knowledge, they will choose the best project for their group.
- **Research:**
  - Students will research their topic. They will brainstorm and come up with a concept map of how they want to create their presentation Google Slides and their pamphlet in Google Docs.
- **Presentation & Pamphlet:**
  - Students will take all of their research on their chosen topic and create a presentation in Google Slides. This presentation will be presented to the class.
  - Students will also come up with a pamphlet summarizing their presentations that can be shared on Parent Square to help bring awareness to the Milltown Community.
- **Reflection:**
  - Students will then reflect (in a Google Doc) on how they think their project went, and how they will use the suggestions they provided to help the environment.

## Enduring Understandings

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### NGSS Performance Expectations

- MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- MS-PS2-5: Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
- MS-PS3-2: Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
- MS-PS2-2\*: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- MS-PS3-1\*: Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
- MS-PS3-5\*: Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object (p. 61).

## Disciplinary Core Ideas

The unit expands students' understanding of forces and energy transfer, which include these grades 6-8 DCI elements:

### PS2.B: Types of Interactions

- Electrical and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)
- Forces that act at a distance (electrical, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, a magnet, or a ball, respectively). (MS-PS2-5)

### PS3.A: Definitions of Energy

- A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)
- When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)

The parts of the DCI elements that are not developed in this unit are crossed out. In the OpenSciEd Scope and Sequence, students will develop an understanding of gravity in OpenSciEd Unit 8.4. Electricity is treated as an extension opportunity within this unit. The placement of this OpenSciEd Unit 8.3 and associated units within the [OpenSciEd Middle School Scope and Sequence](#).

## Crosscutting Concepts

- Cause and Effect: This unit intentionally develops this crosscutting concept through the application of cause-effect sentence frames. Students routinely identify, test, and use relationships to explain change throughout.
- Systems and System Models: This crosscutting concept is key to the sensemaking in this unit. Students spend the unit breaking down and modeling the speaker system, describing and explaining the system in terms of its components and interactions
- Energy and Matter: This crosscutting concept is key to the sensemaking in this unit. Students figure out and apply the idea that energy can be transferred in various ways and between objects in order to explain how the speaker system works.
- The following crosscutting concepts are also key to the sensemaking in this unit:
  - Patterns
  - Scale, Proportion, and Quantity

## Resources

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## Scientific Inquiry

- MS-LS1-1 Plant, Animal, Bacteria Lab
- MS-LS1-2 Cell Organelle Project - Inner Life of a Cell Multiple Project Choice, 2D Cell Project, 3D Cell Project
- MS-LS3-1 Strawberry DNA Lab
- MS-LS4-5 Technologies that Influence Inheritance of Traits
- MS-LS4-1 Investigating Natural Selection
- MS-LS4-3 Comparative Embryology