

Scientific Discoveries: *Discussion Guide*

Overview

From the earliest discoveries of fire and gravity to today's technology-trained insights like the mapping of the human gene, scientific breakthroughs can change the ways humans view their world. Students will explore exciting discoveries in physics, astronomy, biology, and chemistry—learning how each came about and absorbing the excitement of each new finding.

Classroom Activities

1. Show the video segment “The World That Darwin Never Saw” from *Galapagos: Beyond Darwin* program.
 - **Discussion:** This video presents “the thrill of discovering something new,” specifically species of the Galapagos. Ask students: What kind of scientists are shown working in this video? What equipment are they using, and how does it help them? How has technology affected scientific discoveries? What is unique about the species discovered in the Galapagos?
 - **Research:** Describe the ecological system of the Galapagos, a group of Pacific islands on the equator with a tropical environment. Ask students to research types of fish and animals that live in this habitat and how they interact. Assign each student a fish, bird, or animal to research and report on to the class. One group may wish to report on the endangered species of the Galapagos, such as the sea lion.
 - **Mural:** Have students create a classroom mural of the unusual wildlife of the Galapagos. Assign students to paint on the mural a fish or animal they researched.
 - **History:** Consider why the video clip is called “The World That Darwin Never Saw.” Provide students with background information about Charles Darwin and his discovery of evolution by natural selection in 1895.
 - **Scientific Vocabulary:** Have students create flashcards defining these scientific terms: adaptation, evolution, tectonic plates, habitat, ecology, species. Have them explain how each term applies to the Galapagos.
 - **Writing:** The video conveys the thrill of discovering something new. Ask students to write a journal entry describing a personal discovery. Encourage them to convey their

emotions at the time of the discovery.

- **Map:** Using a map, have students point out these places referred to in the video: Galapagos Islands, Caribbean Sea, Panama, Pacific Ocean.
2. Show the video “The Planets Move” from *Greatest Discoveries with Bill Nye: Astronomy*. (Access to *unitedstreaming* is required.)
- **Atlas:** Identify where Mesopotamia and ancient Greece were located in an atlas of the ancient world. Help students to understand when these cultures existed, up to 4,000 years ago.
 - **Myths and Legends:** For ancient people, gods and myths explained what is now explained by science. For example, the Greek myth of Persephone being kidnapped by Hades, the god of the underworld, explained the onset of winter. Read to the class a myth from ancient Mesopotamia, such as the similar myth of Ishtar and the underworld or the myth of creation. Discuss what the myth shows about how that civilization explained its world and why the discovery of the planets moving would have been shocking during those times.
 - **Predicting:** Ask students to predict what the “next great discovery” is that Bill Nye refers to at the end of the video clip.
 - **Discussion:** Ask students: How did ancient people discover the movement of the planets? What led to this discovery? What traits of human nature does this discovery reveal? How did this discovery change the way ancient people viewed their world?
 - **Research:** Ancient astronomers used towers and clay tablets, such as the 7th-century Venus Tablet of Ammisaduqa. Show photographs of the Venus Tablet and demonstrate how it was used to record the rise of Venus. Then invite students to research the kinds of technology astronomers use today, such as the Hubble telescope and satellites. Have groups report to the class.
3. Show the video segment “Argentinasaurus: Entire Skeleton Found, Skull Intact” from *When Dinosaurs Ruled: South America* program. (Access to *unitedstreaming* is required.)
- **Pre-Video Activity:** Introduce the video by explaining that the bones of a dinosaur dubbed Argentinasaurus were discovered in 1996 in Argentina. The Argentinasaurus was determined to be a dinosaur of the Cretaceous Period.
 - **Timeline and Map:** Show students on a timeline when the Cretaceous Period occurred, approximately 70 million years ago, when dinosaurs roamed Earth. Refer to www.dinosauria.com/dml/dmlf.htm to show students a map of the continents during the Cretaceous Period.

- **Simulation:** After reviewing how the scientists created a model of the Argentinasaurus, challenge students to create a computer model or drawing of a newly discovered creature using this information:
 - a. Upright skeleton 30 feet tall with a 10-foot neck, 6-foot head, two 5-foot legs, and two 2-foot arms
 - b. Webbed feet, a duck bill, and two 5-foot bony horns on the sides of the head
 - c. Feathers over the top half of the body and 5-foot round, scaly plates over the bottom half

 - **Discussion:** Encourage discussion with these questions: Who would be the enemy of the Argentinasaurus? Why would it have to be a carnivore? Why do you think the skull of the Argentinasaurus remained intact? What do you think it's like to be a paleontologist, a scientist who studies dinosaurs?

 - **News Writing:** Guide students in writing news articles announcing the discovery of the Argentinasaurus. Tell students that news stories usually tell who, what, when, where, why, and how about a news event early in the article. Invite students to bring to class news clippings about current-day scientific discoveries, and post them on a classroom bulletin board.

 - **History:** Assign groups to research and report to the class about a famous discovery in science, such as the rotation of the Earth (J. B. Foucault, 1851), radioactive elements (Marie Curie, 1898), the planet Neptune (J. Galle, 1846), or the laws of heredity (Gregor Mendel, 1865).
4. Show the video segment “Minisatellite DNA” from *Greatest Discoveries with Bill Nye: Genetics*. (Access to *unitedstreaming* is required.)
- **Scientific Method:** Review the steps in the scientific method: observe, make a hypothesis, gather data, test the hypothesis, and revise the hypothesis. Have students make charts showing how the scientific method was used in the case of the boy from Ghana.

 - **Definition:** Define minisatellite DNA as repetitive sequences in DNA that are especially useful for “fingerprinting,” or identifying the individuality of, genetic material. Tell students that minisatellite DNA was first discovered in 1980 by A.R. Wyman and R. White, and its value for DNA fingerprinting was discovered by Alec Jeffreys.

 - **Genetics:** Use the “Minisatellite DNA” video as a springboard to teach about genetics and DNA. Have students create K-W-L charts showing what they know about genetics, what they would like to know, and what they learned from the video. After watching the video, diagram the structure of double-helix DNA, as well as the composition of genes and chromosomes. Make sure that students understand the significance of James Watson and Francis Crick’s discovery of DNA, as well as the Genome Project, which mapped the human gene.

- **Diagram:** Explain to students that certain traits, such as curly hair, can be recessive or dominant and a recessive gene might not be evident unless it is paired with another recessive gene. Help students make Punnett square diagrams (see www.people.virginia.edu/~rjh9u/monohyb.html or www.borg.com/~lubehawk/psquare.htm) showing the potential pairings between dominant genes (RR, Rr) and recessive genes (rr) for a specific trait when a child receives half its genes from one parent and half from the other. As a follow-up activity, encourage students to trace a single genetic trait, such as curly hair, through two or three generations of their family on a family tree.
- **Discussion:** Debate the following ideas about discovery expressed by famous authors and scientists:
 - “The more original a discovery, the more obvious it seems afterwards.” — Arthur Koestler, author
 - “Discovery consists of seeing what everybody has seen and thinking what nobody has thought.” — Albert von Szent-Gyorgyi, scientist
 - “The beginning of knowledge is the discovery of something we do not understand.” — Frank Herbert, author
 - “Genius is one percent inspiration and ninety-nine percent perspiration.” — Thomas Edison, inventor
 - “The greatest obstacle to discovery is not ignorance — it is the illusion of knowledge.” — Daniel J. Boorstin, historian
 - “Mistakes are the portals of discovery.” — James Joyce, author

Academic Standards

This discussion guide addresses the following national standards:

National Science Education Standards

www.nap.edu/readingroom/books/nses/html/

- History of science

Mid-continent Research for Education and Learning (McREL)

<http://www.mcrel.org/compendium/browse.asp>

- Language Arts
 - Writing: Uses the general skills and strategies of the writing process, uses the stylistic and rhetorical aspects of writing
- Science
 - Understands the nature of scientific knowledge