

RESOURCE LIBRARY
ACTIVITY : 50 MINS

Introduction to Genetic Markers

Students brainstorm human traits that are inherited from one generation to the next. They learn how genes pass on the information and how this information allows scientists to reconstruct early human migration routes.

GRADES

9, 10

SUBJECTS

Biology, Geography, Human Geography

CONTENTS

1 Link, 1 Video

OVERVIEW

Students brainstorm human traits that are inherited from one generation to the next. They learn how genes pass on the information and how this information allows scientists to reconstruct early human migration routes.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/introduction-to-genetic-markers/>

Program



DIRECTIONS

1. Brainstorm lists of inherited family traits.

Take a poll. Ask students how many of them can raise just one eyebrow and not the other. Then ask how many can wiggle their ears. Finally, ask how many can curl their tongues. Not all students will be able to do all three things. Ask: *Can you guess why some of us can do these things and others cannot?* Explain that these specialized skills are inherited. Have students brainstorm other traits that we inherit from our parents and grandparents. Write their answers on the board, sorting them into different categories. For example, students might come up with physical traits such as curly hair, eye color, and height; personality traits such as shyness or aggressiveness; and talents such as artistic and athletic abilities. Some students may suggest traits that have an environmental component in addition to a genetic component. If students suggest traits such as being good at a particular sport or good at spelling, explain that although there may be a genetic component, such as good hand-eye coordination in the case of sport, they may have learned some of this ability through teaching by their parents and others around them.

2. Discuss the role genes and DNA play in heredity.

Ask: *How are traits like the ones on our brainstormed list passed on in families?* Some students may mention "genes" or "DNA." Both are correct. Make sure that students understand the following concepts:

- Genes determine what traits we inherit. They are blueprints for making everything the body needs.
- Genes are made up of long strings of complex molecules called DNA.
- DNA also contains regions where there are no genes. In fact, in humans, genes may account for as little as 25% of DNA.

3. Explore a chromosome.

Have students look at the provided website. Explain that genes are packaged in bundles called chromosomes, which are located in every cell of our bodies. Each chromosome contains thousands of genes, and each gene determines a different trait. Point out that the image students are looking at actually contains two chromosomes. Ask: *Why would chromosomes come in pairs?* Explain that every pair consists of one chromosome that we inherit from our mother, and one from our father. Then have students look at the small drawings of chromosomes at the top. Explain that each of us has 22 pairs of chromosomes carrying different genetic information, as well as a single pair that determines our sex.

4. Explain mutations and genetic markers.

Ask: *Do you think there are ever mistakes as all this genetic information is passed from one generation to another? Would these mistakes continue to be passed on?* Explain that mistakes occasionally happen. Information can get switched, dropped, or repeated. These mistakes are called mutations, and they are passed on to future generations. Explain that mutations passed down through generations serve as genetic markers, or clues, that researchers can use to actually reconstruct the routes early humans took as they spread around the world over the past 60,000 years. Explain that most mutations are "silent," meaning they have no detectable effect on the next generation. This is often because the mutations occur in regions of the DNA where no genes are located. It is usually these silent mutations that researchers in the Genographic Project use to trace ancestry.

5. Introduce the Genographic Project.

Explain that National Geographic's Genographic Project has used genetic markers from thousands of people to create a map showing routes humans took as they populated the world. Show students the video "The Genographic Project." Ask students to think about how the DNA samples were obtained and used to identify the ancestors of the four persons in the video. In this nine-minute video, project director Spencer Wells invites four strangers in New York City's Grand Central Station to donate DNA that is then used to identify where their ancient ancestors came from. Afterward, discuss how the DNA was obtained, what different routes were identified, and how all the routes can be traced back to Africa.

Extending the Learning

- Show the video *Journey of Man*, about the Genographic Project. Go to the [PBS](#) website to find out where you can get the *Journey of Man* documentary.

OBJECTIVES

Subjects & Disciplines

Biology

Geography

- [Human Geography](#)

Learning Objectives

Students will:

- list traits that they inherit from their families
- describe how genetic information is passed on from one generation to the next
- explain the relationship between DNA, genes, and chromosomes
- explain how genetic markers enable researchers on the Genographic Project to reconstruct early human migration routes

Teaching Approach

- Learning-for-use

Teaching Methods

- Brainstorming
- Discussions
- Multimedia instruction

Skills Summary

This activity targets the following skills:

- Critical Thinking Skills
 - Analyzing
 - Understanding
- Geographic Skills
 - Acquiring Geographic Information

National Standards, Principles, and Practices

NATIONAL COUNCIL FOR SOCIAL STUDIES CURRICULUM STANDARDS

- Theme 3:

People, Places, and Environments

NATIONAL GEOGRAPHY STANDARDS

- **Standard 9:**

The characteristics, distribution, and migration of human populations on Earth's surface

NATIONAL SCIENCE EDUCATION STANDARDS

- **(9-12) Standard C-3:**

Biological evolution

Preparation

What You'll Need

REQUIRED TECHNOLOGY

- Internet Access: Required
- Tech Setup: 1 computer per classroom, Projector, Speakers

PHYSICAL SPACE

- Media Center/Library

GROUPING

- Large-group instruction

BACKGROUND & VOCABULARY

Background Information

The Genographic Project studies where our early human ancestors came from and how humans came to populate the entire planet. Following genetic markers through thousands of human generations enables scientists to track our human origins back to Africa and to determine the pattern of routes by which humans migrated around the world. Understanding how genetic information is passed on within families and over long periods of times helps students understand how researchers use this information to reconstruct ancient human migration routes.

Prior Knowledge

Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
chromosome	noun	strand of DNA and associated proteins in the nucleus of cells that carries the organism's genetic information.
DNA	noun	(deoxyribonucleic acid) molecule in every living organism that contains specific genetic information on that organism.
gene	noun	part of DNA that is the basic unit of heredity.
genetic marker	noun	gene that is located on a specific place on a chromosome.
mutation	noun	sudden variation in one or more characteristics caused by a change in a gene or chromosome.

For Further Exploration

Articles & Profiles

- [National Geographic Explorers: Spencer Wells, Geneticist](#)

Books

- [Wells, Spencer. *Deep Ancestry: Inside The Genographic Project*. Washington, D.C.: National Geographic, 2006. Print.](#)
- [Wells, Spencer. *The Journey of Man: A Genetic Odyssey*. New Jersey: Princeton University Press, 2002. Print.](#)

Websites

- [National Geographic: The Genographic Project](#)

FUNDER



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