

RESOURCE LIBRARY
ACTIVITY : 50 MINS

Using Genetic Markers to Create Lineages

Students engage in a hands-on activity in which they build a trail of genetic markers through several generations and create a tree showing the relationships among descendants.

GRADES

9 - 12+

SUBJECTS

Biology, Geography, Human Geography

CONTENTS

1 PDF, 1 Link

OVERVIEW

Students engage in a hands-on activity in which they build a trail of genetic markers through several generations and create a tree showing the relationships among descendants.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/using-genetic-markers-to-create-lineages/>

Program



DIRECTIONS

1. Introduce the activity.

Tell students that researchers on the Genographic Project are using DNA collected from many thousands of people to reconstruct different branches of humanity's family tree. The

researchers do this by connecting genetic markers from different populations of humans over time. Make sure students understand what genetic markers are—occasional mutations in DNA that are passed on through generations. Tell students that they are about to play a game that will help them understand how this process works.

2. Prepare for the activity.

Divide students into four small groups. Give each group one set of colored markers, 50 index cards, and the Descendant Randomizer worksheet. Have students cut out the numbers, fold them, and put them into a cup or hat. Assign each group to a table or space on the floor where they have room to lay the cards out in a tree structure.

3. Complete round one.

Tell each group to:

- Write “1” on one side of a blank index card to represent the number of the round.
- Draw a unique symbol, such as a heart, star, or circle, on the other side. Tell students the symbol represents a mutation, or genetic marker.
- Pull a descendant randomizer number from the cup or hat. Tell students the number represents the number of descendants they have during that round.

If groups draw a zero in the first few rounds, they can draw again. After the first few rounds, a zero means no descendants.

4. Complete round two.

Tell each group to:

- Write a “2” on the back of the index card for each descendant.
- Draw the unique symbol from round one on each descendant card. If the number is red, draw a different unique symbol on one of the cards to introduce a new genetic marker into the game.
- Place the new cards in a row directly below the card from round one. See the Genetics Diversity layer of the Population Genetics section in the Genetics Overview interactive for an example of how the cards should form a tree.
- Pull a descendant randomizer number for each card in row 2.

5. Complete round three.

Tell each group to:

- Write a “3” on the back of the index card for each descendant.
- Draw the unique symbols inherited from the corresponding round on two descendant cards. If a number is red, draw a third unique symbol on one of the cards to introduce a new genetic marker into the game.
- Place the new cards in a row directly below the corresponding cards from round two. There should be one card from round one, one to three cards from round two, and one to nine cards from round three.
- Pull a descendant randomizer number for each card in row 3.

6. Complete rounds four to ten.

Tell each group to repeat the steps in round three, recording each new round number on the back of each descendant card, until they have 15-20 cards in the final round.

7. Record the results.

Have each group draw their group's family tree on a piece of paper, using lines to connect each descendant to its ancestor. Have students draw lines around groups of descendants with the same symbols, or genetic markers. Explain that these represent lineages—groups of people that descended directly from the same ancestor. Ask: *Do all descendants of a particular individual inherit the same genetic markers? Explain.* Have students try tracing several descendants on the bottom line back to their original ancestor. Discuss how the genetic markers enable them to do this.

Alternative Assessment

Have groups trade cards and, using the information on them, reconstruct their classmates' cards into a tree. Have groups compare the results with the original tree made by their classmates.

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:

- describe how genetic markers enable researchers to identify human lineages

Teaching Approach

- Learning-for-use

Teaching Methods

- Discussions
- Hands-on learning

Skills Summary

This activity targets the following skills:

- Critical Thinking Skills
 - Analyzing
 - Applying
 - 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

MATERIALS YOU PROVIDE

- Colored markers
- Hats
- Index cards
- Paper cups
- Scissors

PHYSICAL SPACE

- Classroom

GROUPING

- Large-group instruction
- Small-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. The project relies on the identification of genetic markers—occasional mutations to DNA that are passed on through generations. Different populations carry distinct genetic markers. Following the markers through thousands of human generations enables scientists to track our human origins back to Africa and to reconstruct the major lineages that evolved as early humans spread around the world.

Prior Knowledge

["genes","genetic markers","lineages","The Genographic Project"]

Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
descendant	<i>noun</i>	children, grandchildren, and other offspring.
DNA	<i>noun</i>	(deoxyribonucleic acid) molecule in every living organism that contains specific genetic information on that organism.
gene	<i>noun</i>	part of DNA that is the basic unit of heredity.
genetic marker	<i>noun</i>	gene that is located on a specific place on a chromosome.
lineage	<i>noun</i>	line of descendants of a particular ancestor.
mutation	<i>noun</i>	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. *The Journey of Man: A Genetic Odyssey*. New Jersey: Princeton University Press, 2002. Print.](#)
- [Wells, Spencer. *Deep Ancestry: Inside The Genographic Project*. Washington, D.C.: National Geographic, 2006. Print.](#)

Websites

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

FUNDER



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