TEACHING THE GENOME GENERATION

Ancestry Testing

The Jackson Laboratory
Leading the search for tomorrow's cures

NIH National Institutes of Health
Turning Discovery Into Health

SEPA SCIENCE EDUCATION PARTNERSHIP AWARD
SUPPORTED BY THE NATIONAL INSTITUTES OF HEALTH

KSON LABORATORY

Contents

Ancestry Testing Module Overview ____ ***3***

Introduction & Theme ____ **3**

Learning Outcomes ____ **3**

Lesson Descriptions & Learning Objectives ____ **4**

Activity 1: Introduction to Ancestry Testing ____ 4

Activity 2: Sequence Comparison in Ancestry Testing ____ 4

Lessons & Activities ____ ***5***

Activity 1: Introduction to Ancestry Testing ____ **5**

Activity 2: Sequence Comparison in Ancestry Testing ____ **5**

Implementation Strategies ____ ***5***

NGSS Alignments ____ ***5***

Supporting Materials ____ ***6***

Feedback ____ ***6***

Ancestry Testing Module Overview

Introduction & Theme

This module aims to introduce students to the concept of ancestry DNA testing, using a narrative to frame the learning activities. Students will follow the fictional story of Sam, a high school student who wants an at-home ancestry DNA test for their 18th birthday. Each activity will begin with a scene from Sam's life:

> In Part 1, Sam discusses wanting an ancestry test kit for their birthday, and students familiarize themselves with ancestry tests and make predictions around different "case study" scenarios. In Part 2, Sam learns about how ancestry testing works, and students perform calculations to generate allele count and frequency data and compare DNA sequence data.
>
> *Parts 3-5 are still in development and will be released as additional activities when available. Part 3 continues Sam's learning, and students discover how human migration patterns influenced variant allele frequencies across populations. In Part 4, students learn about the connections between ancestry and human health, exploring databases and performing calculations for variants with known phenotypes (TtGG genes). Finally, Part 5 finds Sam contemplating whether or not to take the test, and students are asked to debate and finish Sam's story.*

In addition to the biology concepts introduced, students will use quantitative skills to calculate DNA variations in individuals and across populations. They will also interpret and explain results, such as associating individuals with geographic populations.

Each part of the Ancestry Testing module also includes accompanying sections on bioethics and careers that can be added to the activity or used separately. In each Bioethics section, students will connect social and cultural themes to the biology concepts in the activity through predictions, discussions, and/or debates. In each Career Exploration section, students will perform self-directed exploration of jobs associated with the learning topics they just learned about in the main activity.

Learning Outcomes

Essential Questions

- How does ancestry testing work?
- Why do ancestry test results change?
- What do ancestry test results mean, for me, for my family, for my health?
- How does my ancestral DNA information connect with my identity?

Enduring Understandings

- DNA is inherited (and lost) across generations, such that not all genealogical ancestors are genetic ancestors.
- Ancestry testing typically involves sequencing of genomic single nucleotide variants.
- Reference genomes for ancestry tests are comprised of aggregate single nucleotide variant data from varying numbers of individuals.
- Ancestry information can inform about personal and family history and health outcomes.

Skills

Data table usage and interpretation; computation (math skills); asking questions and formulating hypotheses; problem solving; pattern recognition; constructing explanations; reading comprehension.

Lesson Descriptions & Learning Objectives

Activity 1: Introduction to Ancestry Testing

Description

Sam discusses wanting an ancestry test kit for their birthday, and students familiarize themselves with ancestry tests and make predictions around different "case study" scenarios.

Skills	• Reading comprehension • Asking questions and formulating hypotheses • Constructing explanations
Concepts	• Genetic testing • Data privacy
Learning Objectives	• Genetic testing can inform about personal and family history, as well as health outcomes
	• A variety of career paths relate to this activity

Activity 2: Sequence Comparison in Ancestry Testing

Description

Sam learns about how ancestry testing works, and students perform calculations to generate allele count and frequency data and compare DNA sequence data.

Skills	• Data table usage and interpretation • Spreadsheet usage • Computation (math skills) • Asking questions and formulating hypotheses • Problem solving • Pattern recognition • Constructing explanations
Concepts	• Basic principles of inheritance • Genetic variation and single nucleotide variants • Allele frequencies • Tables and spreadsheets
Learning Objectives	• Ancestry testing typically involves sequencing of single nucleotide variants
	• Ancestry reference genomes are aggregate single nucleotide variant data from varying numbers of individuals
	• Allele frequencies represent the proportion of each allele at a DNA site in a population
	• Population descriptors do not neatly fit in geographic categories
	• A variety of career paths relate to this activity

Lessons & Activities

Activity 1: Introduction to Ancestry Testing

Introduction to Ancestry Testing Activity

Activity 2: Sequence Comparison in Ancestry Testing

Sequence Comparison in Ancestry Testing Paper-based Activity

Sequence Comparison in Ancestry Testing Spreadsheet-based Activity

Implementation Strategies

Coming soon.

NGSS Alignments

Coming soon.

Supporting Materials

Coming soon.

Feedback

Did you use the Ancestry Testing content in your class(es)? If so, we'd love to hear how it went. Use the following form to provide the TtGG team with feedback:

Feedback Form

Questions? Email ttgg@jax.org