

DNA in Real Life: Implications of Human Gene Research

Lesson Plan

Grade Level: 9-12

Curriculum Focus: Genetics

Lesson Duration: Two class periods

Student Objectives

- Learn about the goals of the Human Genome Project (HGP).
- Discuss the scientific and ethical implications of the project.

Materials

- Discovery School video on *unitedstreaming: Human Genome*
Search for this video by using the video title (or a portion of it) as the keyword.

Selected clips that support this lesson plan:

- DNA and the Human Genome Project
 - DNA Sequencing in the Human Genome
 - Proteins, Amino Acids, and Messenger RNA
 - Hunting Down the Genes Involved in Disease
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- Internet access
 - News media articles and other current resources about the Human Genome Project
 - Posterboard

Procedures

1. Begin the lesson by asking students what they know about genes. Explain that genes are made up of double strands of deoxyribonucleic acid, or DNA, which provides the genetic instructions for everything a cell does. In particular, the sequence of the bases, or subunits of DNA, play a part in determining whether a person will get sick and how that person will respond to medication. To understand how the body works, scientists must understand the human genome, or the complete set of genetic instructions. They are mapping these instructions in the Human Genome Project, or HGP.
2. Share the information below about the HGP with the students.

- The primary goal was to locate the estimated 30,000 or more human genes on all the chromosomes and determine their sequence along each strand of DNA.
 - By June 2000, scientists had completed a rough draft of the human genome. The final draft was finished in April 2003, two years ahead of schedule.
 - Scientists use this information to understand how genes function, how genetic material varies among people, and how some genetic variations predispose people to disease.
3. Tell students that the HGP has scientific, ethical, and medical ramifications. During this lesson, students will work in small groups to research the project. Before students divide into groups, provide them with an overview of the HGP. The following Web sites will be useful:
 - http://www.ornl.gov/sci/techresources/Human_Genome/home.shtml
 - <http://www.genome.gov/>
 4. Divide the class into three groups to research different facets of the HGP. Have them use the Web sites listed in step 3 to begin their research in the following areas:
 - Group 1: Scientific findings. The number of genes discovered and their sequence, and definitions of key scientific terms such as chromosome, DNA, gene, and protein
 - Group 2: Potential applications. The tools used to detect genes carrying disease and how this information can be applied to individual treatment plans
 - Group 3: Ethical implications. Issues involved with screening adults and fetuses for genetic diseases, using new technology to treat diseases, and others associated with mapping the human genome
 5. Give students time in class to work on their research. Students can record their findings on the computer or in notebooks. Tell students that they can use illustrations to depict some of their findings, such as the structure of DNA or the shape of a chromosome.
 6. Have each group present its findings. Then have them create displays. Scientific findings could include a labeled diagram showing the relationships among DNA, genes, chromosomes, and proteins. Potential applications could be a case study showing how scientists identified the genes responsible for an illness and how they developed treatment. Ethical implications could present a list of issues that have emerged from new knowledge.
 7. Place the displays on a large piece of posterboard. Use them to discuss the complexity of the project.
 8. Conclude by discussing students' overall reaction to the Human Genome Project. Do the advantages outweigh the challenges? Does this information have the potential to save lives:

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students exhibited strong research skills; showed above-average ability to compile findings and present them to the class; demonstrated the ability to share keen insights and ideas during class discussions.

- **2 points:** Students exhibited on-grade research skills; showed average ability to compile findings and present them to the class; demonstrated on-grade ability to share insights and ideas during class discussions.
- **1 point:** Students exhibited slightly below-average research skills; had some problems in compiling findings and presenting them to the class; demonstrated difficulty sharing insights and ideas during class discussions.

Vocabulary

chromosome

Definition: A physically separate molecule made up of DNA

Context: DNA in the human genome is arranged into 24 chromosomes.

DNA (deoxyribonucleic acid)

Definition: The chemical inside a cell's nucleus that carries the instructions for everything the cell does; made up of four chemical sub-units referred to as bases

Context: The human genome contains 600,000 pairs of DNA.

gene

Definition: The functional and physical unit of heredity passed from parent to offspring

Context: Scientists estimate that human beings each have between 30,000 and 35,000 genes.

human genome

Definition: The complete set of DNA in each human being

Context: Scientists completed a rough draft of a map of the human genome in June 2000.

Academic Standards

National Academy of Sciences

The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K-12. To view the standards, visit <http://books.nap.edu>.

This lesson plan addresses the following science standards:

- Life Science: Molecular basis of heredity
- Science as Inquiry: Understandings about scientific inquiry

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit <http://www.mcrel.org/>.

This lesson plan addresses the following national standards:

- Science – Life Sciences: Understands the principles of heredity and related concepts



- Language Arts – Viewing: Uses viewing skills and strategies to understand and interpret visual media; Reading: Uses reading skills and strategies to understand and interpret a variety of informational texts
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Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>