

Colorful Chromosomes

Developmental biologists study how plants and animals grow. In this Science Friday Video, developmental biology researcher Cassandra Extravour explains how cells that are part of a multicellular organism are specialized. Some cells help with digestion, others with storing energy, and still others with reproduction. DNA is the set of instructions found in these cells that determine the special “duties” of each cell.

In this activity, students review how human physical traits, such as eye color, are determined by specific segments of genes. Students will use basic crafts materials to build a simplified model of a pair of chromosomes that represents some of their own physical traits. Then students will compare and contrast their models, to determine which traits are most frequently found among their classmates and therefore can be called high frequency traits.

Grade Level: 6th– 8th grade

Subject Matter: Life Science

National Standards: [NS.5-8.1](#), [NS.5-8.3](#)



CreatureCast: Why Cells Cooperate, <http://www.sciencefriday.com/videos/watch/10252>

How did multicellular organisms evolve? Science journalist Sophia Tintori and Cassandra Extravour, a developmental biologist at Harvard University, talk about the development of multicellular organisms, and in particular the specialization of reproductive cells. Visit CreatureCast.org for more intriguing animal stories.

Activity Materials

Pipe cleaners – two for each student, available at crafts stores or tobacconists.

16 sets of different colored or types of beads, available at crafts stores. Each bead’s diameter must be wide enough to fit around the pipe cleaner. The number of beads you need depends on the number of students or groups of students.

16 small containers, one for each color or type of bead.

Several small hand mirrors (optional).

Colorful Chromosomes handout. After reading the “What to Do” section below, print out one copy for each student from the bottom of this lesson.

Pencils – one for each student.

Vocabulary

DNA (deoxyribonucleic acid): genetic information found in every living organism.

Chromosomes: rod-shaped structure that contains genes.

Genes: basic unit of DNA that codes for specific traits or characteristics in an organism, such as eye or hair color.

What To Do

Prep: Sort the 16 sets of different colored or types of beads into small containers, so that each container contains one specific type or one specific color of bead. Label each container with one of the traits listed in the Colorful Chromosomes template, below. (For example, place all red beads into a container labeled

“dark hair.”) Write the color or type of bead that matches the trait in the appropriate column on the Colorful Chromosome template before making copies for students.

1. Begin the lesson by having students watch the Science Friday Video, “CreatureCast: Why Cells Cooperate.” Explain to students that every cell contains DNA (deoxyribonucleic acid), a set of instructions that enables each cell to perform its duties.
2. Ask students to explain what a physical human trait is. Can they name some physical characteristics (eye color, hair color, etc.) that they observe among their classmates? How does DNA relate to human traits?
3. Inform students that our physical traits are determined by a specific segment of genes, which are grouped together to form chromosomes. Tell students that they are going to make a simple model of a chromosome using pipe cleaners, and that they will add beads to represent some of their own genetic traits.
4. Give every student two pipe cleaners. Have students overlap the pipe cleaners so that they form an X-shape. At the center of the ‘x,’ students should twist the two pipe cleaners together securely. Tell students that the pipe cleaners represent a pair of chromosomes, the structural unit that holds genes.
5. Distribute copies of the Colorful Chromosomes handout to each student. Have students circle the traits that they themselves have, along with the corresponding bead color that represents that trait. Inform students that each bead color represents the set of genes for that particular trait. Students can use a mirror, or partner with each other, to determine if and which traits they have for hairline, dimples, earlobe and tongue rolling.
6. Have each student collect the beads that represent his or her genes, and lace the beads through any of the four parts of the pipe cleaners. Once students have placed all of their traits on the chromosome model, have them bend all four ends of the pipe cleaner so that the beads do not fall off.
7. Tell students that they have created a simple model of a pair of chromosomes that represents them. Ask students to compare and contrast their own chromosome model with those of the other students in the class. Create a chart on the board that graphs the number of students that have each trait. Why are some traits collectively found in everyone? Why are some traits not found in everyone? Which are some of the traits that occur the most often (high frequency) and the least often (low frequency)?

What’s Happening?

DNA, or deoxyribonucleic acid, is located in the nucleus of almost every cell in the human body. DNA is coiled into structural units called chromosomes that contain all of our genetic information. Humans have 46 chromosomes in each of their cells: 23 from our mother and 23 from our father. Our chromosomes contain smaller segments called genes that determine our physical traits. Some traits are general human traits, such as two arms, two legs, or two eyes. Other characteristics are more specific, such as curly or straight hair, attached or detached earlobes, etc.

In this activity, students are identifying some of the physical traits that are determined by their genes. There are some traits that occur more frequently than others, and therefore are called high frequency traits. High frequency traits can vary, depending on the population. For example, the high frequency traits for a small, secluded population living on an island may be very different from those living in a densely populated city.

Topics for Science Class Discussion

- What are some advantages or disadvantages to being a multicellular organism?
- Do all organisms inherit 23 chromosomes from their mother and 23 from their father?
- What are examples of other observable human traits? What are examples of non-observable human traits?
- Why would a scientist study high frequency traits in the human population?

Extended Activities and Links

Extend the activity by having students perform the same experiment with another class or group of students, or “population.” Compare and contrast the results. Are they surprised by the results? What are possible reasons for similar or different results?

Have students research how closely related our DNA is to that of other organisms, such as chimpanzees, fruit flies, sponges, etc. Compare some of the similarities and differences between humans and these other organisms. Students can present their findings to the class.

Conduct a debate concerning current ethical issues on genetic testing. Divide students into a pro-genetic testing group and an anti-genetic testing group. Give students time to research and prepare for the debate, using scientific facts and examples.

View another Science Friday Video, “Delicious DNA,” on how two high school students tested the DNA in their hotdog. Learn how to extract DNA from a strawberry:

<http://www.talkingscience.org/2010/01/delicious-dna/>

Learn more about DNA by playing the double helix game at NobelPrize.org.

http://nobelprize.org/educational/medicine/dna_double_helix/index.html