

Genetic Testing Through the Web Educator Guide

A resource for using QUEST video in the classroom Watch it online <u>http://www.kqed.org/quest/television/view/102</u> [9:30 minutes

QUEST SUBJECTS

Life Science	Biology Health	
	Environment	
Earth	Geology	

Science

NCE Weather Astronomy

Physical Physics Science Chemistry Engineering

CA SCIENCE STANDARDS

Grade 7

Genetics

2. A typical cell of any organism contains genetic instructions that specify its traits. Those traits may be modified by environmental influences. (b)

Grades 9-12

Genetics 2. Mutation and sexual reproduction lead to genetic variation in a population (g)

3. A multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization. (a,c)

4. Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. (c)

5. The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. (d)

PROGRAM NOTES

If you could learn your odds of getting cancer, heart disease or diabetes, would you want to? A new generation of home genetic testing kits allows anybody with a cotton swab and a mailbox to find out. But does convenience come with a privacy risk?



In this segment you will find...

- Image: why people are doing online genetic testing.
- \odot what the arguments are for and against it.
- In how the cancer gene can be hereditary.

TOPIC BACKGROUND

DNA is an intricate database of chemical information with a set of instructions for making proteins. It's found in the nucleus, or center, of every cell in the body except red blood cells, which have no nucleus.

Human cells contain two sets of 23 **chromosomes**, one set inherited from the mother and one from the father. Each cell holds a full complement of DNA, which contains between 50,000 and 100,000 **genes**. A gene is a segment of DNA that's made up of thousands—even hundreds of thousands—of the four chemical bases **adenine**, **thymine**, **cytosine**, **and guanine**. Different combinations of these bases determine the information encoded in the DNA. That information in each gene holds the instructions for a cell to produce a specific product, typically a protein such as an enzyme. Each protein initiates one specific cellular action.

Cells use genes selectively. Some genes enable cells to make the proteins needed for basic functions. However, other genes are inactive most of the time. Some genes play a role in the early development of the embryo and then shut down forever. A normal cell activates just the genes it needs at the moment and suppresses the rest.

Genes, through the proteins they encode, determine all body processes, including how efficiently we process foods, how effectively we detoxify poisons, and how vigorously we respond to challenges from the environment, such as infections.

More than 4,000 diseases are thought to stem from mutated genes inherited from one's parents. Heart disease, most cancers and other common disorders arise from a complex interplay among multiple genes and factors in the environment.

Genes can be altered, or **mutated**, in many ways, including a change in one base or the loss or gain of a base. Sometimes long segments of DNA disappear or get multiplied for no reason. Some mutations are silent. That means they affect neither the structure of the encoded protein nor its function. Other mutations change the protein. In some instances the protein remains normal enough to function, but not well. In other instances the protein can be totally disabled. The outcome of a particular mutation depends not only on how it changes a protein's function but also on how vital that particular protein is to survival.

Media Enhance Education

Video and audio can be powerful tools for meaningful learning. It all depends on you, the educator. The key to using media effectively is preparation. Make the most of learning opportunities by encouraging students to become active viewers and listeners. Pick and choose from the suggested guestions and activities to offer an engaging media experience.

Questioning

Oftentimes, teachers and students become frustrated during a media segment when students can't find the answers to a long list of questions. Provide a limited number of questions or topics for students. This focuses their attention during a media segment, helps to keep them engaged and generally results in higher quality answers. QUEST Ed. has provided a number of options for focus questions ranging from fact based to opinions, as well as "big picture" ideas.

PRE - VIEWING

- Which diseases are known to be hereditary?
- What do mutations do to genes and genetic information?
- If you had the opportunity to find out what disease you might get in the future, would you want to?
- How do you think scientists test your blood to find out if you have diseases?

VIEWING FOCUS

NOTE: You may choose to watch the story twice with your students: once to elicit emotional responses and to get an overview of the topic and again to focus on facts and draw out opinions.

- Record any facts you find interesting while you watch.
- What decision did Judy make when she got genetic testing? Why?
- San Francisco's DNA Direct offers what services to people regarding their health?
- What is the first step in deciding whether genetic testing should be done?
- What percentage of cancers are hereditary?
- Why are people afraid of having their genetic information be a part of their medical history?
- What are the benefits to online genetic testing?

POST- VIEWING Links to activities mentioned here can be found on the following page.

- **Review** students' answers to the Viewing Focus Questions.
- **Submit** questions to a geneticist who will answer your questions on anything relating to genes.
- Explore more about DNA by viewing real photos of a cell and chromosomes.
- **Construct** a family tree with the help of your parents. Find out if there is a history of certain diseases in your family.
- **Conduct** a debate on the ethics of genetic testing with your class. Divide into groups and have one team be *for* genetic testing and one *against*.

LESSON PLANS / ACTIVITIES

Understanding Genetics Web site The Tech Museum

http://www.thetech.org/exhibits/online/ugenetics/

 Features interviews with scientists, online exhibits on DNA and the ability to ask a geneticist your questions

Zoom into DNA

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http://www.thetech.org/exhibits/online/ugenetics/

· Go through an online exhibit showing real photos of cells and chromosomes

What Color Eyes Will Your Children Have?

http://www.thetech.org/exhibits/online/ugenetics/

• Learn about genetic inheritance while having fun with our interactive eye calculator.

My DNA Web site

http://www.dnai.org/teacherguide/guide.html

 Find over 10 activities for students exploring DNA, including coding, sequencing, the human genome and dealing with the DNA controversy.

ARTICLES / READING

San Francisco DNA Direct

http://genesanddrugs.dnadirect.com/patients/about/

An overview of the company and its online testing

Access Excellence @ The National Health Museum

http://www.accessexcellence.org/AE/AEPC/NIH/index.html

Understanding genes, DNA and genetic testing, with photos that explain cell processes

Inside Cancer

http://www.insidecancer.org/

• Explore a multimedia guide to cancer biology, including causes, prevention, diagnosis and treatment.

DNA from the Beginning

http://www.dnaftb.org/dnaftb/

A featured animation on the basics of DNA, genes and heredity

Sir Paul Nurse

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life

"DNA is helping to unlock the secrets of

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indicating resources from QUEST partner organizations

QUEST QUAD

FIELD NOTES	7 FI	IELD TRIP 😽
Go outside and	Vi	isit
 Create your own strand of DNA Have a worksheet with a table of AT & 0 strips. Cut out the strips and link them together in a long chain taping them to o other. Color code the different base pair 	GC each rs.	 The Tech Museum of Innovation 201 South Market Street San Jose, CA 95113. <u>http://www.thetech.org</u> Visit the "Genetics: Technology with a Twist" exhibit, where you can zoom in on a gene, see a genetic sequencer and more.
FIELD RESEARCH	FI	IELD TEST
 FIELD RESEARCH Find out more about How scientists find diseases caused by gene mutation. Explore a gene sequencer at the Tech Museum where you will use a real DNA sequencer and follow a simulated proce discover a gene mutation. Other diseases that are hereditary Pick a hereditary disease and find out if rare or common, if there is a genetic tes and if there are any treatments or cures the following Web site as a guide. http://www.accessexcellence.org/RC/AB/WYW/wkbooks/PAP/processes 	FI Example 2 Set of the se	 ELD TEST xperiment with Being a genetic scientist Visit The Tech Museum and insert glowing jellyfish DNA into bacteria to make the bacteria glow. Gene arrays Gene arrays Gene arrays help doctors perform genetic tests in order to determine the best treatments for their patients. Simulate a gene array test used for breast cancer patients at The Tech Museum.

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The Bay Institute www.bay.org

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Chabot Space and Science Center www.chabotspace.org

East Bay Regional Park District www.ebparks.org

Exploratorium www.exploratorium.edu

Girl Scouts of Northern California www.girlscoutsnorcal.org

Golden Gate National Parks Conservancy www.parksconservancy.org

The J. David Gladstone Institutes www.gladstone.ucsf.edu

Lawrence Berkeley National Laboratory www.lbl.gov

Lawrence Hall of Science www.lawrencehallofscience.org

Monterey Bay Aquarium www.mbayaq.org

Monterey Bay Aquarium Research Institute www.mbari.org

Oakland Zoo www.oaklandzoo.org

The Tech Museum of Innovation www.thetech.org

UC Berkeley Natural History Museums http://bnhm.berkeley.edu/

U.S. Geological Survey www.usgs.gov

MORE EDUCATIONAL RESOURCES FOR USING QUEST MULTIMEDIA TO ENHANCE 21st CENTURY SKILLS IN TEACHING AND LEARNING

Why Use Multimedia in Science Education?

http://www.kqed.org/quest/downloads/QUESTWhyMedia.pdf

• Read about the importance of using multimedia in the 21st century science classroom.

How to Use Science Media for Teaching and Learning

- http://www.kqed.org/quest/downloads/QUESTMediaTips.pdf
- A collection of tips, activities and handouts to actively engage students with multimedia.

Science Multimedia Analysis

http://www.kqed.org/quest/downloads/QUESTMediaAnalysis.pdf

• Give your students the tools to recognize the purposes and messages of science multimedia.

Create Online Science Hikes with Google Maps

http://www.kged.org/guest/files/download/52/QUEST ExplorationCreation.pdf

Do you like the science hike Explorations on the QUEST site? Use this
place-based educational guide to create similar science-based maps with
youth.

OTHER WAYS TO PARTICIPATE IN QUEST



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LISTEN

KQED 88.5 FM San Francisco & 89.3 FM Sacramento Mondays at 6:30am and 8:30am

WATCH

KQED Channel 9 Tuesdays at 7:30pm

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