

## Genetic Testing Through the Web

Watch it online <http://www.kqed.org/quest/television/view/102>

TV story length 9:30 minutes

### QUEST SUBJECTS

**Life Science**      **Biology**  
**Health**  
Environment

**Earth Science**      Geology  
Weather  
Astronomy

**Physical Science**      Physics  
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)

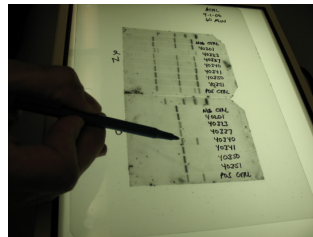
3. A multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization. (a,c)

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...

- ⦿ why people are doing online genetic testing.
- ⦿ what the arguments are for and against it.
- ⦿ 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 questions 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

<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.dnafb.org/dnafb/>

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

Look for the



indicating resources from QUEST partner organizations

# QUEST QUAD

## FIELD NOTES




### Go outside and ...

- Create your own strand of DNA
  - Have a worksheet with a table of AT & GC strips. Cut out the strips and link them together in a long chain taping them to each other. Color code the different base pairs.

## FIELD TRIP




### Visit ...

- **The Tech Museum of Innovation**   
201 South Market Street San Jose, CA 95113.  
<http://www.thetech.org>
  - Visit the “Genetics: Technology with a Twist” exhibit, where you can zoom in on a gene, see a genetic sequencer and more.

## 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 process to discover a gene mutation.
- Other diseases that are hereditary
  - Pick a hereditary disease and find out if it is rare or common, if there is a genetic test for it and if there are any treatments or cures. Use the following Web site as a guide.

<http://www.accessexcellence.org/RC/AB/WYW/wkbooks/PAP/profiles.html>

## FIELD TEST



### Experiment 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 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.

## VISIT OUR PARTNERS

The Bay Institute  
[www.bay.org](http://www.bay.org)

California Academy of Sciences  
[www.calacademy.org](http://www.calacademy.org)

Chabot Space and Science Center  
[www.chabot.space.org](http://www.chabot.space.org)

East Bay Regional Park District  
[www.ebparks.org](http://www.ebparks.org)

Exploratorium  
[www.exploratorium.edu](http://www.exploratorium.edu)

Girl Scouts of San Francisco Bay Area  
[www.girlscoutsbayarea.org](http://www.girlscoutsbayarea.org)

Golden Gate National Parks Conservancy  
[www.parksconservancy.org](http://www.parksconservancy.org)

Lawrence Berkeley National Laboratory  
[www.lbl.gov](http://www.lbl.gov)

Lawrence Hall of Science  
[www.lawrencehallofscience.org](http://www.lawrencehallofscience.org)

Oakland Zoo  
[www.oaklandzoo.org](http://www.oaklandzoo.org)

The Tech Museum of Innovation  
[www.techmuseum.org](http://www.techmuseum.org)

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

## OTHER WAYS TO PARTICIPATE IN QUEST



### LOG ON

[kqed.org/quest](http://kqed.org/quest)



### LISTEN

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



### WATCH

**KQED Channel 9**  
Tuesdays at 7:30pm

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