

Genetic Screening: Who Should Be Tested?

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Primary Learning Outcomes

- The students will define genetic screening.
- The students will identify the different types of genetic screening
- The students will identify risks and benefits to support a decision of whether or not to seek genetic screening.

Additional Learning Outcomes

The students will be able to identify common genetic disorders.

Materials

1. LCD projector
2. PowerPoint or similar presentation program
3. Computers with Internet access

Technology Connection

A PowerPoint presentation played on an LCD projector is running as students enter the classroom. Notes and lecture are delivered through a PowerPoint presentation with an LCD projector.

Total Duration

2 hours

Procedures

Step 1

Duration: Varies

Background Information

This lesson would be appropriate to use to wrap up one or several units on genetics. The students should have previous knowledge from other lessons of mitosis, cancer, and specific genetic disorders and diseases that are in this lesson. The Web sites below provide reference material for the teacher on mitosis, cancer, and genetic disorders and diseases.

Web Resources

Title: Genetic Testing of Breast Cancer

URL: http://cis.nci.nih.gov/fact/3_62.htm

Description: This web site from the National Cancer Institute gives information about genetic testing of BRCA1 and BRCA2 which are genes linked to breast cancer.

Title: Genetic Testing of Newborns

URL: <http://gslc.genetics.utah.edu/units/newborn/ngt.pdf>

Description: This PDF file from the Genetic Science Learning Center is an educational unit on genetic testing of newborns.

Title: Cell Cycle and Mitosis Tutorial

URL: http://www.biology.arizona.edu/cell_bio/tutorials/cell_cycle/main.html

Description: This Web site includes a tutorial about the cell cycle and mitosis. This tutorial would be appropriate for students to do during a cell cycle lesson or for a teacher to complete for background information.

Title: Genetic Testing and the Human Genome

URL: <http://www.genetests.org/img/teachtool/NABTpreview.pdf>

Description: Aimed at biology teachers, this PDF file includes information about genetic testing.

Title: Genetic Testing for Breast Cancer Risk – National Cancer Institute

URL: <http://www.nci.nih.gov/cancertopics/genetic-testing-breast>

Description: This Web site from the National Cancer Institute includes information about breast cancer and genetic testing.

Step 2

Duration: 5 minutes

To remind students about different genetic diseases/disorders and to introduce the idea of genetic screening, play the “Genetic Disorders” PowerPoint presentation as students are walking into class. On this PowerPoint presentation, there are pictures of different genetic disorders/diseases and a question slide.

Supplemental Document

Title: Genetic Disorders

File Name: [Genetic Disorders.ppt](#)

Description: This PowerPoint presentation is to be used by the teacher to remind students about genetic disorders and diseases and to introduce the idea of genetic screening. The PowerPoint loops continuously and can be played while the students walk into the classroom.

Step 3

Duration: 25 minutes

Students will be given information about genetic screening and genetic testing through a lecture using the “Genetic Screening and Genetic Testing” PowerPoint presentation. The information about genetic screening and testing will include examples using birth defects and screening for cancer. Web resources have been provided as a reference for the teacher.

Web Resources

Title: Genetic Testing of Breast Cancer

URL: http://cis.nci.nih.gov/fact/3_62.htm

Description: This Web site from the National Cancer Institute provides information about the genes associated with breast cancer.

Title: Newborn Screening

URL: <http://gslc.genetics.utah.edu/units/newborn/ngt.pdf>

Description: This PDF file is an educational unit from the Genetic Science Learning Center on the topic of newborn screening.

Title: Gene Testing Tutorial

URL: <http://press2.nci.nih.gov/sciencebehind/genetesting/genetesting00.htm>

Description: This Web site from the National Cancer Institute gives information about gene testing in a tutorial format.

Title: Genetic Screening Fact Sheet

URL: http://www.asrm.org/Patients/FactSheets/Genetic_screening-Fact.pdf

Description: This Web site provides a fact sheet from the American Society for Reproductive Medicine for a teacher's reference.

Title: Amniocentesis Web site

URL: http://www.modimes.org/professionals/681_1164.asp

Description: This Web site provides information about amniocentesis, a common prenatal test, from the March of Dimes.

Title: Chorionic Villi Sampling Information

URL: http://www.modimes.org/professionals/681_1165.asp

Description: This Web site from the March of Dimes gives information about another prenatal test, Chorionic Villi Sampling.

Title: Newborn Screening

URL: http://www.modimes.org/professionals/681_1200.asp

Description: This Web site from the March of Dimes gives information about newborn screening, including different types of screening, how some tests are conducted, what these tests can mean, and a link to information on specific tests required in each state.

Title: Genetic Testing of Breast Cancer

URL: <http://www.nci.nih.gov/cancertopics/genetic-testing-breast>

Description: This Web site from the National Cancer Institute provides information about genetic testing for the risk of breast cancer, including a background on breast cancer, a discussion of genetics and breast cancer, and information on who should be tested.

Supplemental Document

Title: Genetic Screening and Genetic Testing

File Name: [Genetic Screening and Genetic Testing.ppt](#)

Description: This is the PowerPoint presentation to use for the lecture. Notes have been added at the bottom for a teacher script or as teacher reference.

Step 4

Duration: 45 minutes

Use the following activity to introduce that genetic screening and testing can be hard on families and many decisions have to be made based on personal ethics. All of the scenarios included in this activity were provided by Lawrence Berkeley National Laboratory's ELSI in Science program on the Web site. Classroom scenarios can be accessed by clicking on "What would YOU do?" link under the "Where do we go from here?" heading. In addition to scenarios, discussion questions and answers are included.

Split the class into three groups. Hand out the "Scenario #1" to one of the student groups, "Scenario #2" to the second group of students, and "Scenario #3" to the third group of students. Have students read their assigned scenario. After reading the scenario, students should read the questions and discuss their answers. There are brief answers provided to these questions, however student should go deeper and thoroughly explore all aspects of the situation and questions. One person in each group should be assigned to record the group's final and complete answer. In addition, each group should choose one person to summarize their scenario, and another person to report the group's answers. Once all the groups are completed, the teacher should prompt each group's representative to share the scenario and share the

group's answers to the questions. The "Breast Cancer Scenario Teacher Notes" is provided to be used by the teacher to clarify answers provided in the scenarios.

Web Resources

Title: Breast Cancer Screening Scenarios

URL: <http://www.lbl.gov/Education/ELSI/screening-main.html>

Description: This Web site has a link to scenarios, questions, and answers from Lawrence Berkeley National Laboratory's ELSI in Science program. To access these scenarios, scroll down and click on "What would YOU do?" under the "Where do we go from here?" heading. A screen with the three scenarios will come up. Click on the scenario you want to use to view the scenario, question, and possible answers.

Title: National Cancer Institute

URL: <http://www.nci.nih.gov/cancertopics/genetic-testing-breast>

Description: This Web site from the National Cancer Institute should be used to provide up-to-date information about breast cancer.

Supplemental Document

Title: Breast Cancer Scenario Teacher Notes

File Name: [Breast Cancer Scenario Teacher Notes.doc](#)

Description: This document allows a teacher to supply students with more information in addition to the answers provided with the breast cancer scenarios.

Step 5

Duration: 40 minutes

Using the writing prompt provided in the "Genetic Screening Writing Assignment", have each student independently read the scenario about genetic screening of birth defects. Once each student has read the scenario, instruct the students to write a position paper in response to the scenario. The students must decide if the people should seek genetic screening or not and support their decision. Students should also include the pros and cons of their decision. Tell students their paper should be 3-5 paragraphs. This assignment could be completed in class, assigned as homework, or started in class and finished at home. The "Writing Assignment Rubric" can be used to grade the writing assignment or teachers could create their own rubric using Teachnology's "Online Rubric Generator".

Web Resource

Title: Online Rubric Generator

URL: http://teachers.teach-nology.com/web_tools/rubrics/

Description: This Web site by Teachnology allows teachers to make their own rubrics. The rubric for the genetic screening assignment was made at this Web site.

Supplemental Documents

Title: Genetic Screening Writing Assignment

File Name: [Genetic Screening Writing Assignment.doc](#)

Description: The document contains the writing prompt for students to use to write their essay. The essay should include a decision about whether or not to pursue genetic screening and a 3-5 paragraph discussion of the pros and cons of their decision.

Title: Writing Assignment Rubric

File Name: [Writing Assignment Rubric.doc](#)

Description: This document is a rubric for evaluating the "Genetic Screening Writing Assignment".

Assessment

The students' position paper in Step 5 will be graded using the "Writing Assignment Rubric" or the "Online Rubric Generator" at the Technology Web site.

Modifications

Extension

1. Students could research specific genetic diseases and the genetic screening available for these diseases.
2. Students could make brochures or pamphlets for placement in doctor offices.

Remediation

If students could not remember previously covered genetic diseases/disorders, review common genetic birth defects included in the opening Power Point presentation. The Web resources provided in Step 1 could aid in this review.

Education Standards

National Science Education Standards

LIFE SCIENCE, CONTENT STANDARD C:

As a result of their activities in grades 9-12, all students should develop understanding of

- The cell
- **Molecular basis of heredity**
- Biological evolution
- Interdependence of organisms
- Matter, energy, and organization in living systems
- Behavior of organisms

SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES, CONTENT STANDARD F:

As a result of activities in grades 9-12, all students should develop understanding of

- **Personal and community health**
- Population growth
- Natural resources
- Environmental quality
- Natural and human-induced hazards
- **Science and technology in local, national, and global challenges**

Georgia State Science Standards

Grade: 9-12, Science, Biology 11

Topic: Genetics (Patterns of Inheritance)

Standard: Describes patterns of inheritance and genetic engineering.

Grade: 9-12, Science, Applied Biology/Chemistry II 7

Topic: Continuity of Life

Standard: Predicts the special needs of the expectant mother and the developing fetus during different states of pregnancy and birth.

Grade: 9-12, Science, Applied Biology/Chemistry II 10

Topic: Continuity of Life

Standard: Outlines methods for altering the genetic makeup of an organism.

Breast Cancer Scenario Teacher Notes

Genetic Screening: Who Should Be Tested

Julie Hopp, CDC's 2004 Science Ambassador Program

Some of the answers supplied for the scenario questions are simple and can be misleading. Here are some points for students to consider in addition to the answers provided in the scenarios.

- Positive test results (BRCA-2) might motivate a person to pursue preventive measures such as appropriate lifestyle changes (diet, exercise).
- Positive test results might motivate a person to pursue medical screening with consequent detection of disease and treatment at an earlier stage.
- Positive test results could result in a better survival rate because of localized disease not because of treatment efficacy per se.
- Some people may not want to know years in advance that they have a predisposition for a life-threatening condition which cannot be cured and which they can pass on to future offspring.
- Negative test results do not necessarily mean that a person is not at risk for disease because a lab error could have occurred or a limited test panel focusing only on a few mutations or the most common ones would miss rare disease-causing mutations.

Genetic Screening Writing Assignment

Genetic Screening: Who Should Be Tested
Julie Hopp, CDC's 2004 Science Ambassador Program

Based on your knowledge of genetics, genetic disorders, and the risks and benefits of genetic screening, you should write a 3-5 paragraph persuasive paper in response to the scenario listed below. Make sure to state if genetic screening should be arranged and why/why not. Also, include the pros and the cons of your decision.

Jack and Diane have been trying to have children for the past five years. Diane has been pregnant four times in the last five years and has miscarried each one of the pregnancies. At least two of the miscarriages have been determined to be due to chromosomal abnormalities of the fetus. Diane is now 35 years old and concerned about a future pregnancy. Diane knows that there have been chromosomal abnormalities in prior fetuses. At age 35, Diane also knows the risk of chromosomal problems and miscarriages increases, and a child could be born with Down's syndrome. Jack desperately wants to have a child with Diane and is willing to take the risks. Diane believes it would be in their best interest to seek advice and possibly genetic screening before another pregnancy. Should Jack and Diane seek advice and genetic screening before another pregnancy or should they try again without any professional intervention?

Writing Assignment Rubric

Genetic Screening: Who Should Be Tested
Julie Hopp, CDC's 2004 Science Ambassador Program

Name: _____ Teacher: _____

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	4	3	2	1	
Position Statement (Is the student for or against the genetic screening?)	Position is clearly stated and consistently maintained. Clear references to the issue(s) are stated.	Position is clearly stated and consistently maintained. References to the issue(s) at hand are missing .	Position is stated, but is not maintained consistently throughout work.	Statement of position cannot be determined.	—
Supporting Information see below*	Evidence clearly supports the position; evidence is sufficient .	Evidence clearly supports the position; but there is not enough evidence .	Argument is supported by limited evidence .	Evidence is unrelated to argument.	—
Organization	Structure of work is clearly developed.	Structure developed reasonably well, but lacks clarity .	Some attempt to structure the argument has been made, but the structure is poorly developed .	There is a total lack of structure.	—
Tone	Tone is consistent and enhances persuasiveness.	Tone enhances persuasiveness, but there are inconsistencies .	Tones does not contribute to persuasiveness.	Tone is inappropriate to purpose.	—
Sentence Structure	Sentence structure is correct .	Sentence structure is generally correct. Some awkward sentences do appear.	Work contains structural weaknesses and grammatical errors .	Work pays little attention to proper sentence structure.	—
Punctuation & Capitalization	Punctuation and capitalization are correct .	There is one error in punctuation and/or capitalization.	There are two or three errors in punctuation and/or capitalization.	There are four or more errors in punctuation and/or capitalization.	—
				Total---->	—

Teacher Comments:

Teach-nology, Inc. Rubric Makers [online]. 2003 [date cited 27 July 2004] Available at URL: http://teach-nology.com/web_tools/rubrics/.

Guide for Supporting Information/Content

	4	3	2	1
Student Response is for Genetic Screening	<p>Sufficient evidence: 4-5 supporting statements have been included. These might include but are not limited to the following:</p> <ul style="list-style-type: none"> allowing informed decisions allowing reproductive choices diagnosis of the problem avoid emotional miscarriage no risk for miscarriage or damage to fetus since testing would occur before pregnancy allow parents to seek other parenting options like adoption 	<p>Not Enough Evidence: 2-3 supporting statements have been included. Refer to statements listed under sufficient evidence.</p>	<p>Limited Evidence: 1 supporting statement has been included. Refer to statements listed under sufficient evidence.</p>	<p>Unrelated Evidence: No supporting statements listed under sufficient evidence were included.</p>
Student Response is against Genetic Screening	<p>Sufficient evidence: 3-4 supporting statements have been included. These might include but are not limited to the following:</p> <ul style="list-style-type: none"> pregnancy might never be chosen as a parenting option no matter the risk Jack might refuse genetic screening If pregnancy is chosen, genetic screening might be necessary throughout the pregnancy which may risk the fetus' life or cause fetal damage If someone tests positive for genetic abnormalities it might cause blame between the couple 	<p>Not Enough Evidence: 2 supporting statements have been included. Refer to statements listed under sufficient evidence.</p>	<p>Limited Evidence: 1 supporting statement has been included. Refer to statements listed under sufficient evidence.</p>	<p>Unrelated Evidence: No supporting statements listed under sufficient evidence were included.</p>

