

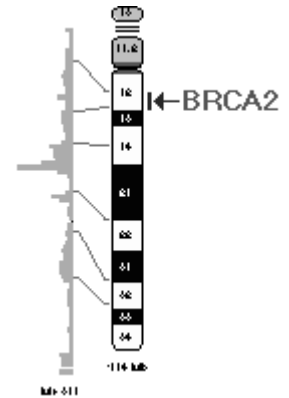
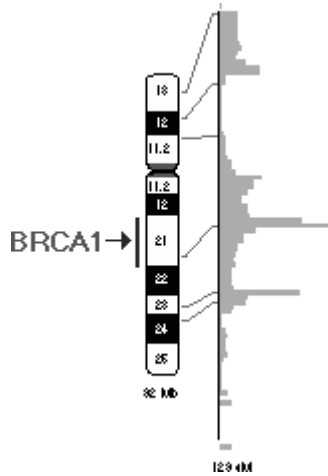
# CASE TEACHING NOTES

## for "Genetic Testing and Breast Cancer: Is a Little Knowledge a Dangerous Thing?"

by

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## INTRODUCTION / BACKGROUND

Genetic testing informs individuals about aspects of their genetic makeup that may indicate they are at risk for particular diseases. This case introduces students to genetic testing and illustrates its advantages and disadvantages in the context of a person at risk for breast cancer. The case scenario presents a dilemma about genetic testing requiring a decision about whether or not to get tested for known mutations in the breast cancer genes.

As scientists discover information about genetics, those who use the information need to analyze related issues. This case is appropriate for students in fields associated with genetics. The case is also well suited for students interested in bioinformatics, a new field of study that combines biology and information technology. Bioinformatics is used to analyze large databases of information, such as those resulting from the Human Genome Project. In addition, the case is appropriate for science or pre-med students studying biology or disease prevention, and for students studying ethical decision-making. A valuable aspect of this case is its illustration of how to make decisions: how to analyze aspects of a decision and how to debate their relative merit. In this context, the case is appropriate for all students.

We have taught this case successfully in several different contexts. We used the case in a summer bioinformatics program with high school senior women who were planning to major in science in college. In addition, we presented the case to college freshmen taking an introduction to biology course for non-majors and to college juniors majoring in biology.

A person has many factors to consider in deciding whether to get tested. Each time we have run the case, we ask students initially and then again at the conclusion of the case if they would be tested. We have different proportions of students deciding "yes" or "no" initially, with many changing their mind after the case is run. As with many decisions, it is never simple, and the case presents important factors—some clearly in favor, some clearly opposed, and some mixed—about genetic testing.

Each time we have presented the case, one or more students have approached us and thanked us for the information and the discussion. Frequently, they have told us about a friend or relative with breast cancer, and how this discussion has enhanced their understanding of the disease.

## Objectives

As outcomes of studying this case, students will:

- formulate a decision for or against genetic testing, taking into consideration various kinds of information, for a particular individual; and
- defend their decision by explaining the rationale, in the context of a particular individual.

While formulating and defending their decisions, students will also:

- analyze genetic testing and its role in maintaining health;
- examine disease prevention strategies, including diet, exercise, and stress reduction;
- critique the effect of obtaining genetic information on employment and health insurance and on personal decisions; and
- calculate the impact of obtaining genetic information on families, medical knowledge, and society.

## MAJOR ISSUES

This case presents information about five issues that impact the decision to be tested for genetic information. The five issues are:

1. the nature of the information available through genetic and DNA analysis;
2. genetic testing as a means to information;
3. insurance and employment risks as a result of genetic testing;
4. healthy eating, aerobic exercise, and stress reduction as means of reducing risk of disease; and
5. ethical decisions related to genetic testing.

During the case, students role-play, taking on the viewpoint of five characters, each representing one of the issues. Information about these issues is presented on the five Role-Play Sheets that accompany the case. Once the students have studied their Role-Play Sheets, they have sufficient and accurate information to discuss the dilemma and reach a decision. The information is presented on the Role-Play Sheets in outline form so that students can access it easily during discussion.

Teachers may choose to have students supplement the Role-Play Sheets using the resources listed below or other sources of information. This may be most appropriate after the case is run to enrich and extend students' knowledge.

## CLASSROOM MANAGEMENT

Students will engage in a role-play activity in cooperative learning groups. A *K-W-L* chart will facilitate organization of information.

### Role-Playing

Role-playing enables students to examine ideas from different viewpoints. By taking on the role of a particular character representing a specific issue, students gain understanding of the knowledge that generates the character's viewpoint. Whether or not the student agrees with the position of the role he or she plays, the student comprehends the rationale for the viewpoint.

## **K-W-L Chart**

The *K-W-L* chart (see [Figure 1](#)) keeps information organized.

- The *K* column will be filled with what students KNOW after reading the dilemma.
- The *W* column will be filled with what students WANT to learn in order to reach a decision.
- The *L* column will be filled with what was LEARNED after discussion.

The *K-W-L* chart is beneficial in several ways.

- While filling the *K* column, students confirm that they understand what they have read.
- While filling the *W* column, students can pose their own questions of what they want to know.
- After the *L* column is filled in, students realize that all their questions may not have been answered. They are motivated to do additional research.
- After the *L* column is filled in, students may pose new questions. This illustrates for them the iterative process of learning.

## **Cooperative Learning**

Cooperative learning groups ensure that all students participate actively and equitably. The jigsaw method enhances cooperative learning by making each student responsible for teaching a portion of material to his or her group (see [Figure 2](#)).

Jigsaw method places students into two different groups. For this case, they are called *Role Groups* and *Book Club Groups*.

This case begins with students sitting in five Role Groups. Each Role Group is assigned a portion of the material to learn. The portion is one of the five issues. Students take on the role of the character that represents the issue. Students learn about and discuss their issue to ensure that they understand it. Students analyze its impact on a decision to get tested.

Then the Role Groups break apart—jigsaw—and reassemble as Book Club Groups. Book Club Groups are composed of one student from each Role Group. The students in a Book Club Group represent all of the five issues. In Book Club Groups, students teach their portion of the material to each other. In Book Club Groups, students learn about and discuss all the issues, and weigh their relative impact on a decision.

## **Directions and Script for Presenters**

Before running the case, we recommend the following steps.

- Prepare copies of the case, enough for every student.
- Prepare copies of the Role-Play Sheets. Each Role Group will get copies of one of the Role-Play Sheets.
- Label the Role-Play Sheets within each Role Group 1, 2, 3, etc. These numbers will direct students from Role Groups to Book Club Groups during the case (see [Figure 3](#)).
- Prepare a *K-W-L* chart for chalkboard or overhead (see [Figure 1](#)).
- Prepare packets with all five Role-Play Sheets to distribute at the end of the case.

*Note:* Suggested verbal script is bulleted below. All other text indicates directions and information for the facilitator.

## **I. Introduction**

### **A. Introduce yourself (if needed).**

### **B. Place students into five groups.**

*Cooperative learning groups are usually arranged to be as heterogeneous as possible, based on academic ability, gender, and ethnicity (see [Group Assignment Details](#) for additional information).*

### **C. Explain DNA and the Human Genome Project.**

*Introduce bioinformatics.*

- Bioinformatics is a new scientific field that combines biology and information technology.
- It is used for analyzing databases of genetic information, such as the information from the Human Genome Project.
- It is used by researchers and pharmaceutical companies.

*Expand this introduction as appropriate for the students.*

### **D. Introduce role-playing.**

- You are going to read a true story that presents a dilemma about genetic testing that we will discuss and try to resolve.
- Our objectives are:
  - to discuss issues related to genetic testing,
  - to analyze information about the issues, and
  - to propose a decision about whether or not to get tested.

### **E. Distribute the case and tell students to read it.**

### **F. Place a K-W-L chart on overhead or chalkboard (see [Figure 1](#)).**

*Ask:*

- What do we KNOW about the dilemma? [list under K column]
- What do we WANT to know to help us reach a decision? [list under W column]

*You may need to prompt students if there are important ideas they do not suggest.*

### **G. Call for an initial decision.**

- Based on what you know, if you were Kathy and had to decide to be tested or not, right now, what would you decide?

*Have students record their own vote.*

## II. Role Groups

### A. Give each Role Group copies of one of the Role-Play Sheets, one for each student (see Figure 3).

- Each group will take on the role of one of the characters in the case.
- Each character has expertise about an issue and will help Kathy make a decision.
- The characters are:
  - Martha—Researcher at a Pharmaceutical Company
  - John—Father of Three Adopted Children
  - Sarah—Daughter of a Man who had Huntington's Disease
  - Peter—Yoga Instructor
  - Mary—Minister
- Study the information that the character you represent would know. All of the information on your Role-Play Sheet is factual information about the issue related to your role.
- Take on the assigned role.
- Discuss the issue so that everyone in your group is knowledgeable about it.
- Make a decision for or against genetic testing that your character would support.
- Then discuss together what advice your character would give to Kathy and the rationale for the advice.
- Discussion should proceed around the group, with all students participating in turn.

### B. Circulate while Role Groups discuss their issue.

*Sit with Role Groups. Listen to their discussion, answer questions, and pose questions. You are functioning as a facilitator.*

## III. Book Club Groups

### A. Have students "jigsaw" to Book Club Groups (see Figure 2).

- We are going to move into new groups. Notice the number (1, 2, 3, etc.) on the top of your Role-Play Sheet.

*Instruct students where to congregate for Group 1, Group 2, Group 3, etc.*

- As you are seated now, each group represents Kathy's Book Club. Each group has all five characters. Each Book Club Group will help Kathy make a decision.
- In your Book Club Group, each of you in turn is going to present the information and viewpoint of your character to your Book Club Group.
- Everyone needs to understand the relevance of all the issues and appreciate their significance.
- Then discuss within your Book Club Group what advice you would give Kathy. As each of you participates in the discussion, weigh the information presented by all the characters.

*Allow time for each Book Club Group to reach a decision.*

*Circulate while Book Club Groups discuss the roles.*

*Sit with Book Club Groups. Listen to their discussion, answer questions, and pose questions.*

**B. Call for everyone's attention, to conduct a class discussion.**

*Have each Book Club Group select a spokesperson.  
Sit on a chair facing the groups. Assume the role of Kathy.*

- I'm Kathy. I have to make a decision and I want to hear your advice.
- I'd like to hear from the spokesperson of each group in turn. Tell me your decision and your reasons for making it.

*The spokesperson from each Book Club Group presents its decision and rationale to the class.*

- Now that I have heard from each Book Club Group, any person may join in to add their ideas and viewpoint to the discussion. Be sure to support your statements.

**C. De-brief.**

- Let's list what we have learned.

*Use the K-W-L chart. List, under L, what have we LEARNED.*

**IV. Closure**

**A. Call for a final decision.**

- Vote—what would you, as yourself, decide now about being tested.

*[Have students record their own vote.]*

*Ask students to compare their new choice with their initial choice. Compare totals for and against testing, from both the original and the final tally. Also, record how many students made a change.*

*Frequently, the class will be evenly decided between "get tested" and "do not get tested," both at the start and the end of the case, with many individual changes occurring.*

*Students may share their reasons for changing or not changing.*

**B. Summary.**

- Tell one thing new you learned. Tell something you learned from a role other than your own role that helped you to make your individual decision.

*Discuss the fact that the decision is complex and may be different for different people, based on their particular circumstances.*

*Give each student a packet with all five Role-Play Sheets.*

## V. Extending Activities

*Educators may elect for students to conduct additional research on the issues raised by their role to enhance and extend learning.*

*An additional question to ask when students conduct their own research is: "How reliable do you judge, for example, Peter's information to be, and why?" This question, posed for each role, encourages students to evaluate the information.*

*Students may consult various resources to resolve questions that arose during the activity and to learn more about various aspects of genetic testing.*

*Students can be asked to write an opinion paper as an assignment, stating their personal opinion and defending it with information from the case and additional researched sources. This will further develop analysis skills.*

*The K-W-L chart can be used reiteratively. Students list what they now KNOW, and what they now WANT to learn.*

## Group Assignment Details

- Assigning students to groups:  
To follow cooperative learning guidelines, you will plan group composition ahead of time. Alternately, you may form random groups by having students count off (1, 2, 3, 4, 5) to form the five groups.
- When the number of students in the class does not divide evenly by 5:  
Assign the additional students to the five Role Groups evenly.
- When students move to Book Club Groups:  
Assign the additional students to the Book Club Groups evenly. This results in a few Book Club Groups with two students representing one of the characters. The two students will both present information about their issue.

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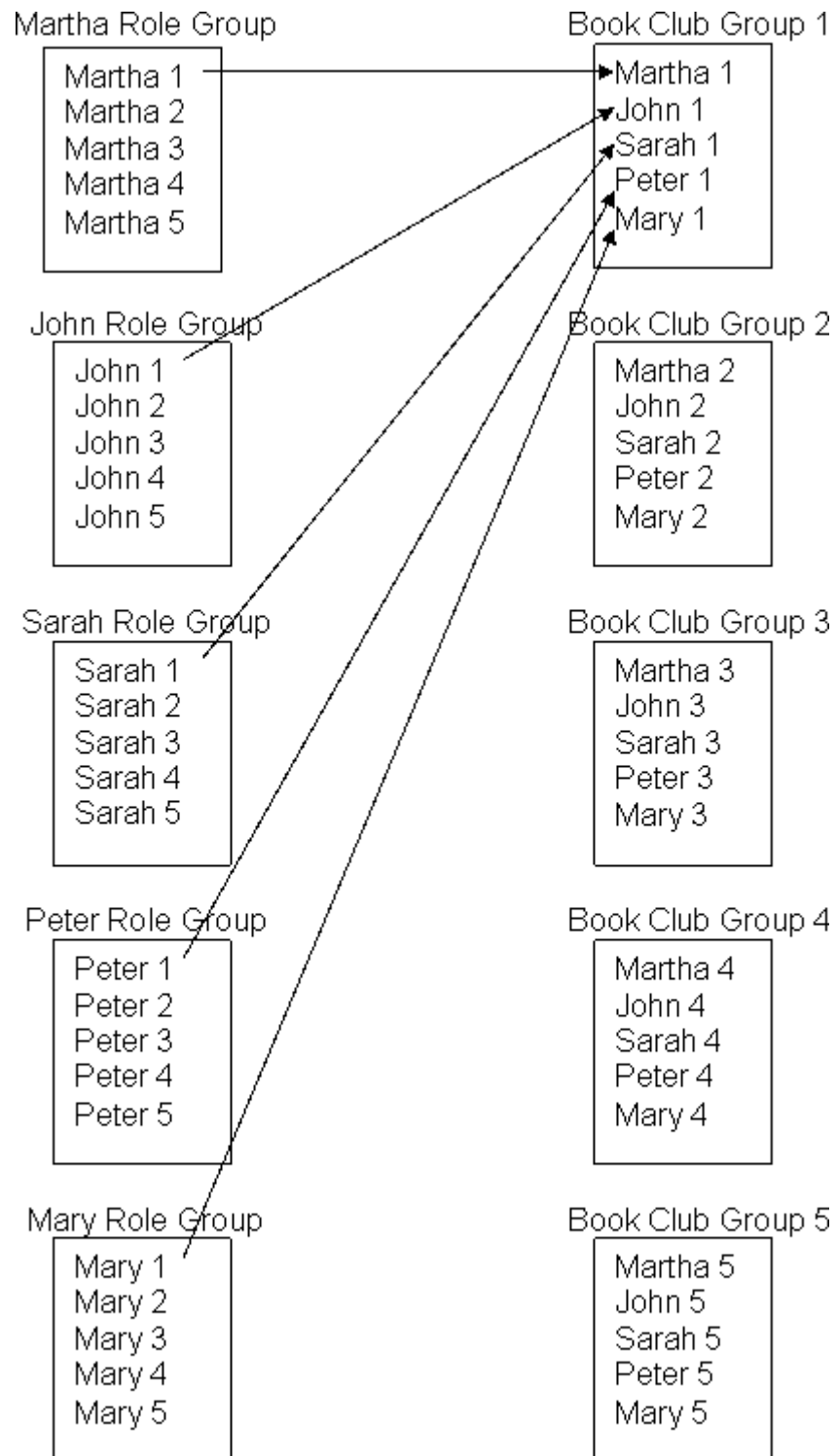
**Image Credit:** The BCRA1 and BCRA2 genes map, respectively, to chromosomes 17 and 13. Illustrations from the [National Center for Biotechnology Information](#).

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Figure 1. *K-W-L* Chart.

K	W	L
What we KNOW	What we WANT to know	What we have LEARNED

**Figure 2. Jigsaw Method**



**Figure 3. Role-Play Sheets**

