



Cancer Education Project

Your World: Fighting Cancer with Biotechnology

Overview:

This series of 6 activities is designed to accompany *Your World: Fighting Cancer with Biotechnology* magazine available online at

http://www.biotechinstitute.org/resources/pdf/yw11_1.pdf or in hard copy at

<http://www.biotechinstitute.org/yourworld/index.php>

The activities may be done as part of a “cancer unit” or divided into class or homework activities scattered through the school year.

Note: * Indicates an activity that may be done as homework.

Part 1: A Life Threatening Disease

Students are introduced to Anna, a young woman with cancer. Students develop questions about cancer, research the answers to these questions, and then play the role of “Anna” as she answers her friends’ questions.

Part 2: The Making of Cancer and A Cancer Turns Deadly

Students explore the many types of genes that may be involved in cancer. Student teams create a poster to explain the role of one of these genes. Student teams explain their poster to the class. As an alternative consider substituting “Part 1: Gene Expression and Cancer” from the DNA Microarrays (Gene Chips) activity.

Part 3: Designing Drugs to Defeat Cancer *

Students apply their understanding of the genes involved in cancer by explaining different ways that chemotherapy drugs could stop cancer growth.

Part 4: Reducing Cancer Risks *

Students create a poster campaign to encourage community members to reduce their cancer risks.

Part 5: Cancer and Heredity - Colon Cancer’s Jump Start *

Students answer questions to explore the relationship between cancer, heredity, and age.

Part 6: Cancer Drugs - Leukemia and a Magic Bullet *

Students answer questions about leukemia treatments and the rational drug design process.

Part 7: Detecting Cancer Risk Factors *

Students answer questions about genetic testing and the ethical issues that result from these tests.

Resources:

Accompanying the Your World: Fighting Cancer with Biotechnology magazine are:

- A Teachers Guide: http://www.biotechinstitute.org/resources/pdf/yw11_1_tg.pdf
- Transparencies: http://www.biotechinstitute.org/resources/pdf/yw11_1_oh.pdf

Some online resources on Hodgkin's lymphoma:

- American Cancer Society:
http://www.cancer.org/docroot/CRI/content/CRI_2_4_1X_What_is_Hodgkins_disease_2_0.asp
- National Cancer Institute: <http://www.cancer.gov/cancertopics/wyntk/hodgkins>
- Cancer Research UK:
<http://www.wales.nhs.uk/sites3/Documents/242/HodgkinsDiseaseFactsheet.pdf>

Part 1: A Life Threatening Disease (80 minutes)

This class activity introduces students to Anna, a young woman with cancer and encourages them to consider what they know and want to know about cancer. Students develop questions about cancer, research the answers to these questions, and then play the role of “Anna” as she answers her friends’ questions.

- Distribute one copy of the *Your World: Fighting Cancer with Biotechnology* magazine to each student. Refer students to pages 2 and 3.
- Distribute one copy of “Part 1: A Life Threatening Disease” handout to each student.
- Ask students to work individually to complete Part A.
- Ask students to work in teams to complete Part B in which they develop a list of questions about Anna’s cancer.
- Ask students to work in teams to complete Part C in which team members prepare to play the role of Anna to answer the questions they developed. Allow homework time for students to do additional research if possible.
- Ask the class to select two questions from the other teams’ posters that they would like “Anna” to answer during the Part D role play.
- Ask the team member assigned each question to play the role of Anna and answer the question.

During Part 1, teachers are encouraged to “coach” teams as the teams develop questions and conduct their research. Some possible coaching questions that may assist teachers in facilitating discussions within the teams are:

1. What symptoms did you have that made the doctor think you might have cancer?
2. How did the doctors figure out that you had cancer?
3. What is Hodgkin’s lymphoma?
4. What is the lymphatic system? Why is having cancer of the lymphatic system so serious?
5. Why couldn’t they just do surgery to remove your cancer?
6. What are doctors doing to stop your cancer?
7. Why did your treatment take so long?
8. Why did your treatment make you sick and make your hair fall out?
9. What caused your cancer?
10. What were your chances of being cured?
11. How could they tell if your cancer treatments were working or not?
12. What could we or other friends do to help?
13. Have you met other kids with your kind of cancer?
14. Why did you write some of the words in your poem in red and others in white?

Part 1: A Life Threatening Disease

(Pages 2 and 3 in *Your World: Fighting Cancer with Biotechnology*)

Part A: Getting to Know Anna (individual work)

Anna is a 15 year old who suffers from a common cancer of young adults called Hodgkin's lymphoma. Read her story and her poem. Think about what it would be like if you had to face telling your friends that you had cancer.

- Make a list of what you know about cancer and what you learned about Anna's cancer from reading her story.
- Make a list of questions you might have if Anna was your friend.

Part B: What Questions Might Anna's Friends Have? (team work)

Anna knew that her friends would probably have lots of questions once they found out that she had cancer. Some friends would ask these questions, but others would worry that Anna might not want to talk about her cancer. Anna decided that she didn't want to avoid talking about her illness. She knew that she would need to think carefully about how to answer her friend's questions openly and accurately.

- Work with your team. Write the names of all team members at the top of your poster.
- As a team, brainstorm a list of questions that Anna's friends might ask about her cancer. Have a recorder write all of the team's questions on a team poster.

Part C: Preparing for a Role Play (team work)

Your team members should share their work to prepare to play the role of Anna as she answers the questions that her classmates ask.

- Assign each team member a number. Give a list of student names and numbers to your teacher.
- Divide the questions on your team's list fairly. On your team poster, write the number of the student who will be responsible for playing the role of Anna if this question is asked.
- As a team, discuss how Anna could answer each of these questions openly and accurately so that her friends could understand what was happening to her.
- You may need to do additional research to find the answer to these questions. If so, refer to the fact sheet on Hodgkin's lymphoma or do Internet research.

Part D: Role Play

Your class will have a chance to ask "Anna" questions about her cancer.

- Your teacher will ask the class to select two questions from the other teams' posters that they would like Anna to answer.
- The team member assigned to that question will then play the role of Anna and answer the question.

Part 2: The Making of Cancer and A Cancer Turns Deadly (40-80 minutes)

This class activity introduces students to the many types of genes that may be involved in cancer. Student teams create a poster to explain the role of one of these genes. Student teams explain their poster to the class.

- Distribute one copy of the *Your World: Fighting Cancer with Biotechnology* magazine to each student. Refer students to pages 4-7.
- Distribute one copy of “Part 2: The Making of Cancer and A Cancer Turns Deadly” handout to each student.
- Read the first four paragraphs aloud to the class.
- Divide the class into 7 teams. Assign each team ONE of the following genes:
 1. Oncogenes
 2. Tumor suppressor genes
 3. Guardian genes
 4. DNA repair enzyme genes
 5. Telomeres and telomerase genes
 6. Angiogenesis factor genes
 7. Genes involved in invasion and metastasis
- Ask teams to read “Your Task” and highlight the key information that explains what they are expected to do.
- Discuss the amount of class time allotted for team work and when the poster is due.

Part 2: The Making of A Cancer and A Cancer Turns Deadly

(Pages 4-7 in *Your World: Fighting Cancer with Biotechnology*)

Some of Anna's friends were taking biology. They said that all their biology teacher had told them was that "cancer was uncontrolled cell division." They were curious about what happened to her cells that changed them into cancer cells.

Anna asked her doctor what caused her cells to become cancerous. Once he knew she was interested in knowing about this, he'd started giving her "cancer lessons" each time she went for an appointment. Anna never realized there were so many genes involved in cancer. Her doctor talked about at least seven different kinds of genes: oncogenes, tumor suppressor genes, guardian genes, DNA repair genes, telomeres, angiogenesis, and metastasis.

Anna's doctor's explanations were almost impossible to understand. He talked so fast and used bunches of words that she'd never heard before. Luckily she found two articles about the genes involved in cancer. Even these articles were not easy to understand. Anna kept reading and thinking about the information in the cancer articles. The pictures in the articles really helped but she had to figure out what parts of the picture went with each part of the reading. Finally the cancer information began to make sense.

Now Anna wanted to figure out how to explain this gene stuff to her friends. She decided that it would help if she used both pictures and words to describe how changes in these genes caused cells to become cancerous.

Your Task:

Work as a team to make a poster that Anna could use to explain the action of the gene assigned to your team. This poster should include a labeled graphic, or series of graphics, to show how each of these gene is involved in causing cancer. To make your poster, your team should:

- Read about the gene in the article provide by your teacher
- Brainstorm a list of ideas for information that Anna could use to explain how the gene is involved in cancer.
- Select the important ideas from your list that should be included in the poster.
- Organize the selected ideas into a logical sequence or into a graphic organizer that can be used to explain how these genes cause cancer.
- Make a labeled graphic (or series of graphics) to illustrate these important ideas about how the gene causes cancer.

During the next class, your teacher will randomly select one member of your team to explain your team's poster to your classmates.

Part 3: Designing Drugs to Defeat Cancer (20 minutes)

In this homework or class activity, students apply their understanding of the genes involved in cancer by explaining different ways that chemotherapy drugs could stop cancer growth.

- Distribute one copy of the *Your World: Fighting Cancer with Biotechnology* magazine to each student. Refer students to pages 4-7.
- Distribute one copy of “Part 3: Designing Drugs to Defeat Cancer”.
- Read the first paragraph aloud to the class.
- Ask students to work individually or in teams to use the information on pages 4-7 to explain four different ways that cancer chemotherapy drugs could act to stop the growth of cancer.

Part 3: Designing Drugs to Defeat Cancer

*(Pages 4-7 in *Your World: Fighting Cancer with Biotechnology*)*

Anna's last round of chemotherapy had really been rough. The doctor had told her that her chemotherapy treatment was a mixture of drugs that worked by stopping her cancer in different ways. Sometimes she wondered if her "chemo" was really working. She needed a sense of hope right now. She wanted to understand what those chemotherapy drugs were doing to kill her cancer or stop it from growing?

Read pages 4 through 7 and look at the illustrations. Use the information to explain **four** different ways that cancer chemotherapy drugs could act to stop the growth of cancer.

Part 4: Reducing Cancer Risks (40-80 minutes)

This homework or class activity makes students aware of how their behavior, heredity, and environment affect their risk for developing cancer. The class creates a poster campaign to encourage community members to take actions that reduce their cancer risks.

This activity could be completed in 40-80 minutes, depending on the amount of research and the number of scientific facts the teacher expects students to include. To encourage a variety of posters, teachers may assign specific topics (tobacco, sun, food and fitness, environmental carcinogens, or prevention and detection programs) to groups of students. Provide Internet access so that students can begin by accessing information at http://www.cancer.org/docroot/PED/ped_1.asp?sitearea=PED or provide print copies of the information at this site.

Ideally, students could brainstorm potential community locations for their posters and seek permission to display their posters at these locations. If not, these posters could be displayed in the classroom or other sites in the school. As an alternative, you may wish to invite students to create public service announcements for local radio or TV stations.

- Distribute one copy of the *Your World: Fighting Cancer with Biotechnology* magazine to each student. Refer students to pages 8-9.
- Ask students to work individually to read “Cancer and the Environment: Sun and Smokes”.
- Distribute one copy of “Part 4: Reducing Cancer Risks” handout.
- Read the first five paragraphs of “Part 4: Reducing Cancer Risks” aloud in class.
- Explain that avoiding exposure to sunlight and tobacco aren’t the only things that can be done to reduce cancer risks. There are other things listed on the “Part 4: Reducing Cancer Risks” handout that can be involved in reducing cancer risks: food and fitness, environmental carcinogens, or prevention and detection programs.
- Divide class into 5 groups. Assign each group to a different category: tobacco, sun, food/fitness, carcinogens, or prevention/detection.
- Provide computer access for student research.
- Ask students to work individually (or in teams) to create posters to contribute to the Reducing Cancer Risks poster campaign.
- Discuss the amount of class time allotted for team work and when the poster is due.
- If possible allow class time to plan for placing the posters in locations where community members can benefit from the students’ work.

Part 4: Reducing Cancer Risks

(Pages 8-9 in *Your World: Fighting Cancer with Biotechnology*)

Anna knows that the doctor can't tell her how she got the gene mutations that led to her cancer, but she also knows that some of her friends are increasing their risk of getting cancer by behaviors such as smoking and tanning.

Because Anna is worried about her friends, she decides to start a cancer prevention poster campaign to encourage her friends to **choose behaviors that reduce their risk of getting cancer** or to **avoid behaviors that increase their cancer risk**.

Your Task:

Anna has asked your class to create a poster campaign that will be displayed in your community to raise awareness of various:

- Causes of cancer, including genetics, behavior, and the environment.
- Ways to reduce the risk of developing cancer.

This is your chance to combine scientific facts with artistic creation to create a poster that encourages community members to take actions to prevent cancer. Any media may be used to create the posters, for example: paint, pencil, collage, photography, or digital images.

What you eat and drink, how you live, where you work; all these factors can affect your risk for cancer. Find out more about these risks and what you can do to minimize them.

For information on how people can reduce their risk for cancer, see:

http://www.cancer.org/docroot/PED/ped_1.asp?sitearea=PED

Team 1. Tobacco and Cancer

Smoking is the most preventable cause of death in our society. Learn about the health issues, get quitting tips, and find out about recent legislation.

Team 2. Sun Safety

The sun's UV rays cause the vast majority of skin cancers including melanoma, which can be life-threatening. Learn who's at high risk and how to protect yourself.

Team 3. Food and Fitness

Your diet can affect your risk for cancer. Get recommendations, recipes, and more.

Team 4. Environmental Carcinogens

Learn about the cancer risks posed by your surroundings and what you can do about them.

Team 5. Prevention and Detection Programs

Find out about cancer prevention and detection programs sponsored by your American Cancer Society.

Part 5: Cancer and Heredity: Colon Cancer's Jump Start

In this homework activity or class activity, students answer questions to explore the relationships among cancer, heredity, and age.

- Distribute one copy of the *Your World: Fighting Cancer with Biotechnology* magazine to each student. Refer students to the article on pages 10-11.
- Distribute one copy of "Part 5: Cancer and Heredity" handout.
- Ask students to read the article and use the information to answer the questions on the handout.

Part 5: Cancer and Heredity: Colon Cancer's Jump Start

(Pages 10-11 in *Your World: Fighting Cancer with Biotechnology*)

Anna's grandmother had colon cancer. Her mother has just had a precancerous colon polyp removed. Anna wonders if cancer is hereditary. She has some questions about this.

1. Why does it usually take 50 years or more for colon cancer to develop?
2. Why do some people get colon cancer when they are younger?
3. Why do some cancers, like colon cancer, seem to run in families?
4. If people have a colon cancer gene, what can they do to reduce their chances of developing colon cancer?
5. How might vaccines be used, in the future, to cure colon cancer?
6. Is there any way that Anna or her sister can be tested to see if they have colon cancer genes?
7. If Anna survives this lymphoma, what are the chances that she will face colon cancer when she gets older?

Part 6: Cancer Drugs: Leukemia and a Magic Bullet

In this homework or class activity, students answer questions about leukemia treatments and the rational drug design process.

- Distribute one copy of the *Your World: Fighting Cancer with Biotechnology* magazine to each student. Refer students to the article on pages 12-13.
- Distribute one copy of “Part 6: Cancer Drugs” handout.
- Ask students to read the article and use the information to answer the questions on the handout.

Part 6: Cancer Drugs: Leukemia and a Magic Bullet

(Pages 12-13 in *Your World: Fighting Cancer with Biotechnology*)

Read the article about a young boy with leukemia. Answer the questions below.

1. Explain why leukemia can be deadly.
2. What are clinical trials?
3. Why would the boy's parents lobby to have their son participate in testing of an experimental drug that might not be safe or effective?
4. Explain how doctors applied their understanding of chromosomes and genes and rational drug design to cure the young boy's CML (Chronic Myelogenous Leukemia).
5. How might a new system of classifying cancers based on the active genes in cancer cells lead to faster diagnosis, more effective treatment, and more cures?

Part 7: Detecting a Cancer Risk Factor

In this homework or class activity, students answer questions about predictive testing for a gene associated with an increased risk for breast cancer.

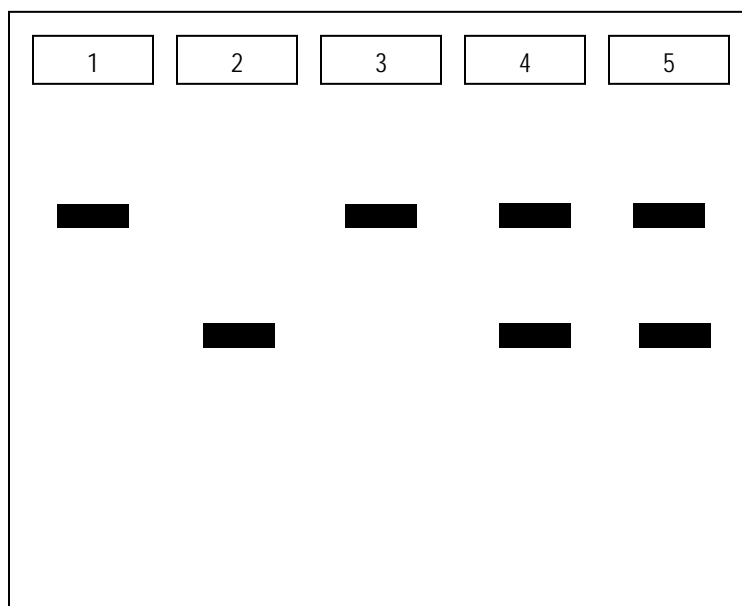
- Distribute one copy of the *Your World: Fighting Cancer with Biotechnology* magazine to each student. Refer students to the article on page 15.
- Distribute one copy of “Part 7: Detecting a Cancer Risk” handout.
- Ask students to read the article and use the information to answer the questions on the handout.

Part 7: Detecting a Cancer Risk Factor

(Page 15 in *Your World: Fighting Cancer with Biotechnology*)

Read "Detecting a Cancer Risk Factor", a case study about three sisters with a family history of breast cancer.

After Samantha was diagnosed with breast cancer, the sisters decided to be tested for the BRCA-1 gene. A laboratory technician used the Cancer Prediction Kit to test the sisters' DNA. Here is a diagram of the patterns of the bands that resulted.



Lane:
 1 - Normal Gene
 2 - BRCA-1 Gene
 3 - Mary's DNA
 4 - Samantha's DNA
 5 - Fran's DNA

1. Why did the sisters decide to have breast cancer gene testing done?
2. Which (if any) of the sisters carry the BRCA-1 mutation? How can you tell?
3. Which is the larger DNA fragment, the normal fragment or the BRCA-1 fragment? How can you tell?
4. Does it take one or two BRCA-1 mutations to increase a person's risk of breast cancer? How can you tell?
5. What chance does each sister have of passing on the mutation to a child?
6. Do you think the sisters were wise to have genetic testing done? Why or why not?
7. What are the sister's options if they learn they have the BRCA-1 mutation?
8. Do you think that the sisters should have their all of their children tested for the mutation? Why or why not?