

Cancer: A Mistake in the Recipe



a lesson plan from
CancerEd

Grades K-2

Subject: Science

Crossovers: ELA

Topic: What is Cancer?

Links to Other Lessons: Cells & Cell Division.

Description: A chocolate chip cookie recipe that is copied incorrectly is used to help children understand why errors in a cell's recipe book (DNA) cause cells to work incorrectly (not perform their normal job, divide at inappropriate times).

Time Required: 10-15 minutes

Background Information (for Teacher): *What is Cancer?* Backgrounder

Unlike many of the illnesses that children are familiar with (such as the common cold or flu), cancer is not caused by a bacteria or virus and cannot be “caught”. Rather, cancer (uncontrolled cell division) occurs when changes (mutations) occur in a cell's genetic material (DNA). This lesson uses the analogy of a cookie recipe to explain how cancer can develop. A recipe is an “instruction manual” for making food. DNA is the “instruction manual” in our cells, providing information that determines what a cell will look like and what jobs it will perform. When you copy a recipe, it is important to copy it correctly. If mistakes are made, the cookies won't look or taste the way they should. The same is true for cells: If mistakes are made when DNA is copied, the cell's instruction manual will be changed. In some cases, these changes will alter the way a cell looks or acts. Cancer cells are cells that have acquired changes (mutations) in their DNA that cause them to behave differently than healthy cells – they divide in an uncontrolled manner, which may lead to the formation of tumors. The number of mistakes that occur when DNA is copied (during cell division) is quite low and many of the resulting changes (mutations) in the DNA's instruction manual are not harmful. However, it is important to limit the number of changes that occur by reducing exposure to chemicals (such as those found in cigarette smoke) and radiation (such as UV light), which are known to cause DNA mutations.

Prerequisite Knowledge (for Students): Students should have a basic understanding of cells and cell division. The lesson plan Cells & Cell Division would serve as a good introduction to these concepts.

Learning Objectives

Students will...

- Understand that each cell contains a recipe book (or instruction manual) called DNA that provides information about cell structure (how the cell should look) and cell function (what the cell should do).
- Explain how mistakes (mutations) in DNA can cause cells to work incorrectly.

Standards Addressed: See end of document

Supplementary Materials: none

Classroom Materials: 3 pieces of poster board (or 3 large easel pad pages)

Preparation & Setup: Using one of the poster boards/easel pad pages, write out the original (correct) chocolate chip cookie recipe. You may want to add pictures of some of the ingredients.

Alternate Setups: none

Lesson Opener: Ask students to examine the original recipe and determine what type of treat they could make if they followed the recipe (chocolate chip cookies). Tell the students that this is the recipe for your “Famous Chocolate Chip Cookies.” Your friend loves your cookies and has asked for the recipe. Ask the students what you will need to do in order to share the recipe with your friend (make a copy the recipe on another poster board/easel pad page).

Development

Activity Description:

Chocolate Chip Cookies: A Mistake in the Recipe

- Have a student volunteer hold the original recipe while you begin to copy the recipe onto a new poster board, saying each ingredient out loud as you write it.
- As you move down the ingredient list, make some copying errors (write down some incorrect ingredients). For example, instead of writing 2 cups of flour, you might write 2 cup of ketchup, and instead of writing 2 cups chocolate chips, you might write 2 cups chopped pickles. (The incorrect ingredients should be clearly recognizable as mistakes in the recipe).
- Let the students recognize the mistakes as you write and read each ingredient out loud.
- Encourage students to discuss what has happened and what the result will be. (The recipe was copied incorrectly, the person following the recipe will NOT make tasty chocolate chip cookies)

Cancer Cells: A Mistake in the Recipe (DNA)

- Explain to students that cells contain a recipe book called DNA. This recipe book provides information about how a cell will look and how a cell will act. You may want to draw or show pictures of a cell and DNA (see *Figure 1 below*)
- Explain that each time a new cell is made, (through cell division), the DNA is copied. Sometimes, a mistake, called a **mutation**, is made during copying (*Figure 2*)
- Ask students to discuss what might happen if a cell's recipe book (DNA) has a mistake in it. (*the cell may not look how it should and it may not act how it should*).
- Explain that some DNA mistakes cause cells to divide too quickly and divide when they should not. These are characteristics of **cancer cells**. (*Figure 3*)
- Ask students to think about the chocolate chip cookie recipe again. How did the mistake occur in the recipe? (*it was copied incorrectly*). Ask students to think of other things or events that might cause the recipe to be changed or damaged. (*something is spilled on the recipe causing the ink to run, part of the recipe is ripped off, a child scribbles on the recipe with a marker, the recipe is left in the pocket of an apron and the apron is washed, etc.*)
- Explain that the cell's recipe book (DNA) can also be changed or damaged by different things (some of which are preventable!)
 - Mistake made while copying the DNA
 - Exposure to cancer-causing chemicals (such as those found in cigarette smoke)
 - Exposure to too much UV light (sunlight)

Closure: Ask students to explain how Ketchup-Pickle Cookies are similar to cancer cells. (*both are the result of recipes that contain mistakes*)

Review key concepts with students:

- DNA is a cell's recipe book (or instruction manual).
 - Mistakes in a cell's recipe book can prevent cells from acting the way that they should. Cancer cells divide too quickly, divide when they should not, and do not do their normal jobs.
 - We can lower our cancer risk by protecting ourselves from things that cause mistakes (mutations) in our cell's recipe book (DNA).
-
-

Assessment:

- Evaluate student understanding by discussing the lesson with students a few weeks after the demonstration.

- Assess student understanding of key concepts as students teach the same lesson to another class.
- Ask students to explain the demonstration to their parents/guardians as a homework assignment.

Further Exploration: Another concept that you may want to teach: *Not all mutations cause cancer (or other harmful outcomes)*

Mutation is the name given to any change that occurs in the DNA. While some of these changes have negative effects, others have no effect, and in some cases changes are beneficial (ex. a mutation may help organisms adapt to a changing environment)

Lesson extension:

- Ask students to consider and discuss the following questions:
 - Will all changes to the cookie recipe cause the cookies to taste bad?
 - Can you think of some ingredient changes that would not change the taste of the cookie very much? (Use wheat flour instead of white flour; use M&Ms rather than chocolate chips)
 - Can you think of some ingredient changes that would improve the taste of the cookie? (Add dried cranberries; use white chocolate chips instead of semi-sweet chocolate chips; add nuts)
- Explain that changes to a cell's recipe book (DNA) are not always bad either. Some changes do not affect the way that the cell looks or acts, and in rare cases, a change may improve a cell's ability to do its job.

Additional Resources:

DNA Structure for Kids- <https://www.youtube.com/watch?v=8qFACgy7Ufw>

A short video by Krista Duggan that describes the basic structure and function of DNA.

How to Explain DNA to Kids- <http://hubpages.com/education/explaining-dna-to-a-six-year-old>

An article written by Rhys Baker that explains DNA in basic terms, using several analogies.

What is DNA?- <http://learn.genetics.utah.edu/content/molecules/dna/>

This animation from the University of Utah's Genetic Science Learning Center helps students to visualize the location and size of DNA.

Questions or Comments?

Please contact us at: info@CancerEd.org

Standards Addressed

Next Generation Science Standards K-2	
Practices	<p><i>Practice 1: Asking Questions and Defining Problems</i></p> <ul style="list-style-type: none"> Ask questions based on observations to find more information about the natural world <p><i>Practice 2: Developing and Using Models</i></p> <ul style="list-style-type: none"> Distinguish between a model and the actual object, process, and/or events the model represents <p><i>Practice 8: Obtaining, Evaluating, and Communicating Information</i></p> <ul style="list-style-type: none"> Communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas
Core Ideas	<p><i>PS1.A: Matter and Its Interactions</i></p> <ul style="list-style-type: none"> A great variety of objects can be built up from a small set of pieces (bodies are made up of cells) <p><i>ETS1.A: Defining and Delimiting an Engineering Problem</i></p> <ul style="list-style-type: none"> Asking questions, making observations, and gathering information are helpful in thinking about problems. <p><i>ETS1.B: Developing Possible Solutions</i></p> <ul style="list-style-type: none"> Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
Cross Cutting Concepts	<p><i>System and System Models</i></p> <ul style="list-style-type: none"> Systems in the natural and designed world have parts that work together <p><i>Structure and Function</i></p> <ul style="list-style-type: none"> The shape and stability of structures of natural and designed objects are related to their function(s).
Common Core State Standards	
ELA/Literacy	<ul style="list-style-type: none"> <i>SL K.1:</i> Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups <i>SL 1.1:</i> Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups <i>SL 2.1:</i> Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups