NATIONAL GEOGRAPHIC

RESOURCE LIBRARY
ACTIVITY : 40 MINS

Nanotechnology Kills Cancer Cells

Students examine a diagram illustrating how cancer works and explore an animation that shows how nanotechnology can be used to improve cancer treatment. Students also learn about the work of a cancer technology researcher.

GRADES

7 - 12+

SUBJECTS

Biology

CONTENTS

3 Links, 1 Video

OVERVIEW

Students examine a diagram illustrating how cancer works and explore an animation that shows how nanotechnology can be used to improve cancer treatment. Students also learn about the work of a cancer technology researcher.

For the complete activity with media resources, visit:
http://www.nationalgeographic.org/activity/nanotechnology-kills-cancer-cells/

Program

MYSTERIES OF THE UNSEEN WORLD

DIRECTIONS

1. Activate students' prior knowledge

Ask students to discuss what they know about cancer. Explain that cancer is a term used for diseases in which abnormal cells divide without control and are able to invade other tissues.

2. Examine and discuss a diagram showing normal vs. cancer cell division.

Access the What Is Cancer? website and project the diagram of how cancer works. Describe or ask students to describe from the diagram how normal cell division is different from the process of cell division that takes place in the development of cancer.

3. Give students an overview of what they will be learning about cancer and nanotechnology.

Ask students to think about how doctors get rid of cancer cells. Explain that they use many methods, including removal of tissue, radiation treatment, and chemotherapy. Provide students with definitions for methods with which they are unfamiliar. Ask students to discuss problems associated with current cancer treatments. For example, chemotherapy damages healthy cells, not just cancer cells. Removal of tissue can impact other areas near the cancer site. Help students recognize the value of being able to target cancer cells only.

Ask students if anyone knows what nanotechnology is. Explain that nanotechnology is the manipulation of matter on an atomic and molecular scale. Tell students that scientists are using nanotechnology to improve cancer treatment. Some scientists are creating nanoparticles, very small particles that can be absorbed into a cell to destroy it.

Build student engagement in this topic by watching the short clip "Nanotech and Medicine" from the film *Mysteries of the Unseen World*.

4. Have students explore an animation to learn how nanotechnology can be used to fight cancer.

Show students the Nanotechnology Animations: Nanoshells animation. As you go through the animation, make sure students understand the activity that is taking place and have them list all terms they are unfamiliar with. After completing the animation, have students look up

unfamiliar terms and create clear definitions of them.

Ask students to draw a schematic in their science notebooks or on paper and include a summary of what happened in the animation along with their definitions for unfamiliar terms. Ask for student volunteers to show their diagrams and describe what occurs. Drawings should include the key parts: cells, nanoparticles, and energy or "light" seen in the schematic. Ask: *What did the nanoshells do to the cancer cells*? Make sure students understand that the nanoshells were absorbed into the cancer cells, then heated with external energy and destroyed with the heat.

5. Have students learn about career aspects of cancer nanotechnology research.

Ask students to read the interview of Dr. Naomi Halas, "Working with Nanoshells." After students finish reading, ask them how Dr. Halas is using nanotechnology to kill cancer cells. Make sure students recognize that Dr. Halas is making nanoshells that are absorbed by cancer cells, and she then uses infrared light to heat up the cells until they are destroyed.

Remind students that Dr. Halas is a professor of electrical and computer engineering. Ask: *How can Dr. Halas's research focus on cancer, which is typically addressed in biology and medicine?* Make sure students' discussion of this question includes how she likely teams with others—in the biology and medicine fields—to do her research.

Informal Assessment

Ask students to respond to the prompt, "How are scientists using nanotechnology in the fight against cancer?" *(Scientists are using nanoparticles to destroy cancer cells. Cells absorb the nanoparticles, and then infrared light is used to heat up the particles and destroy the cell.)*

Extending the Learning

- Divide students into pairs or small groups, and have them brainstorm other areas of medicine that may use nanotechnology as a tool for fighting disease. For example, students may be interested in research on treatment for spinal cord injury. Ask each group to decide on a topic and then research online to find out if scientists are doing research in their chosen area. Key words that will help with their search are: *cancer, nanotechnology,*

nanoparticles, nanotubes, and *nanoshells*. For example, if they type in "nano AND 'spinal cord injury,'" that will bring up articles on nanotechnology applications in spinal cord injury.

- Have students brainstorm possible ethical or social issues in using nanotechnology in medicine. Develop a list of the issues generated and have students conduct research on the issues.

OBJECTIVES

Subjects & Disciplines

Biology

Learning Objectives

Students will:

- explain one way that scientists are using nanotechnology to fight cancer
- describe the career of a researcher focused on nanotech and cancer treatment

Teaching Approach

- Learning-for-use

Teaching Methods

- Discussions
- Multimedia instruction

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Learning and Innovation Skills

- Communication and Collaboration

National Standards, Principles, and Practices

NATIONAL SCIENCE EDUCATION STANDARDS

- **(5-8) Standard A-1:**

Abilities necessary to do scientific inquiry

- **(5-8) Standard B-1:**

Properties and changes of properties in matter

- **(5-8) Standard C-1:**

Structure and function in living systems

- **(5-8) Standard E-1:**

Abilities of technological design

- **(5-8) Standard G-1:**

Science as a human endeavor

- **(9-12) Standard A-2:**

Understandings about scientific inquiry

- **(9-12) Standard B-2:**

Structure and properties of matter

- **(9-12) Standard C-1:**

The cell

- **(9-12) Standard E-2:**

Understandings about science and technology

- **(9-12) Standard G-1:**

Science as a human endeavor

Preparation

What You'll Need

REQUIRED TECHNOLOGY

- Internet Access: Required

GROUPING

- Heterogeneous grouping

Background Information

Scientists are using nanoparticles to kill cancer cells. Several different treatment techniques are under development. In one treatment the cell absorbs nanoparticles, and then infrared light is used to heat up the particles to kill the cell. This new technology promises to provide better, more targeted solutions to cancer treatment—destroying cancer tumors with minimal damage to healthy tissue and organs. Nanotechnology also offers promise in the detection and elimination of cancer cells before they form tumors.

Prior Knowledge

["Basic understanding of cell biology"]

Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
cancer	*noun*	growth of abnormal cells in the body.
chemotherapy	*noun*	treatment of a disease (usually cancer) using drugs or other chemical agents toxic to the diseased cells and tissue.
nanoparticle	*noun*	material that has an average particle size of 1-100 nanometers.
nanotechnology	*noun*	development and study of technological function and devices on a scale of individual atoms and molecules.
radiation therapy	*noun*	Use of radiation sources to treat or relieve diseases, usually cancer.

For Further Exploration

Articles & Profiles

- Nano's Big Future

Websites

- What is Cancer?
- National Cancer Institutes
- Nanooze

FUNDER

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