

Title: Skin Cancer and Nanoscience Case Study: Mitosis, Cell Cycle, DNA Replication

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Grade Level/Subject: 9-12 Life Science Class

Curriculum Standard (AAAS Benchmarks):

The Nature of Science

a. Scientific Inquiry

- Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare different theories.
- Hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of the data (both new and previously available).
- Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible for practical or ethical reasons, they try to observe as wide a range of natural occurrences as possible to be able to discern patterns.
- There are different traditions in science about what is investigated and how, but they all have in common certain basic beliefs about the value of evidence, logic, and good arguments. And there is agreement that progress in all fields of science depends on intelligence, hard work, imagination, and even chance.
- Scientists in any one research group tend to see things alike, so even groups of scientists may have trouble being entirely objective about their methods and findings. For that reason, scientific teams are expected to seek out the possible sources of bias in the design of their investigations and in their data analysis. Checking each other's results and explanations helps, but that is no guarantee against bias.

The Nature of Technology

c. Issues in Technology

- Social and economic forces strongly influence which technologies will be developed and used. Which will prevail is affected by many factors, such as personal values, consumer acceptance, patent laws, the availability of risk capital, the federal budget, local and national regulations, media attention, economic competition, and tax incentives.

The Living Environment

c. Cells

- Within every cell are specialized parts for the transport of materials, energy transfer, protein building, waste disposal, information feedback, and even movement. In addition, most cells in multicellular organisms perform some special functions that others do not.
- The genetic information encoded in DNA molecules provides instructions for assembling protein molecules. The code used is virtually the same for all life forms. Before a cell divides, the instructions are duplicated so that each of the two new cells gets all the necessary information for carrying on.
- Complex interactions among the different kinds of molecules in the cell cause distinct cycles of activities, such as growth and division. Cell behavior can also be affected by molecules from other parts of the organism or even other organisms.
- Gene mutation in a cell can result in uncontrolled cell division, called cancer. Exposure of cells to certain chemicals and radiation increases mutations and thus increases the chance of cancer.

The Designed World

f. Health Technology

- Biotechnology has contributed to health improvement in many ways, but its cost and application have led to a variety of controversial social and ethical issues.

Overview: Students will participate in a case study of cancer and nano-particle sunscreen

Learning Objectives: Students will learn concepts of DNA Replication, Mitosis, Cell Division and the Cell Cycle, Cancer, and Nano-particle sunscreens.

Time Allotted: - 3 weeks (45-50 minute class periods)

Resources/Materials:

- Faces of Cancer Cards (NIH Activity)
- Cancer as a Multi-Step Process Cards (NIH Activity)
- Evaluating Claims about Cancer Cards (NIH Activity)
- UV Beads –<http://www.stevespanglerscience.com/product/1350> or <http://www.teachersource.com/catalog/index.html>
- Sun Blockers (sunscreens, sunglasses, cloth)
- Plastic Bags
- UV or Black Light

Prerequisite Knowledge:

Students should already have knowledge of the following terms and ideas:

- Scaling and Perspective including the Nanoscale
- The cell and major organelles

Main Activities:

- Faces of Cancer (NIH Activity)
- Cancer as a Multi-Step Process (NIH Activity)
- DNA Replication Lab
- Mitosis Lab
- UV Bead Lab

Evaluation:

- Evaluating Claims about Cancer (NIH Activity)