CANCER: THE EMPEROR OF ALL MALADIES

WHAT IS CANCER: LESSON PLAN

THEME OF THE LESSON:
We all carry cancer cells, but what is the mystery that causes some of us to develop cancer and others not? Is it environmental? Is it genetic? What is cancer exactly?

BACKGROUND INFORMATION:
Cancer is a genetic disease that causes the uncontrolled, unregulated growth of cells. This growth causes tumors and can spread cancer cells to other parts of the body through blood and lymph systems. Cancer is not a single disease, but a group of more than 100 diseases. Cancer has the ability to evolve and survive in spite of medicines used to defeat it. Cancer exists in all of us - in our cells. There is no single cause that creates cancer; genetics, chemicals, viruses and chance can all cause cancer. Treatment of cancer has evolved as scientists have learned more about the disease itself. It was once believed that there was no treatment for cancer. Treatments have evolved from surgery - to radiation - to drugs - to immunotherapy. Although many die from cancer, cancer treatments have advanced, decreasing cancer mortality by 20% in the last two decades. Cancer is as old as human life itself, and cancer will probably not be cured, but it may become a manageable, treatable disease.

VIEWING CLIPS:
These clips from the documentary help to explain cancer, the causes, the treatment and the future of cancer treatment. Read the list of cancer statistics aloud before viewing the clips.

Cancer Statistics:
1 in 2 men and 1 in 3 women will experience cancer in their lifetimes.

Cancer afflicts 1.7 million Americans each year—and kills 600,000 of them.

40% of cancer cases have no known cause at all.

Cancer mortality has been slowly declining -- down 20% over the last two decades.

If society were to implement what's known about prevention, cancer deaths could be reduced by 50%.

Pre-Viewing Questions:
Raise your hand if you know someone who has or has had cancer.

Where does cancer come from?

Who gets cancer?

How is cancer treated?

Post-Viewing Questions
How is a cancer cell different than a normal cell?

How has cancer treatment evolved as scientists have learned more about cancer?

What steps can an individual take to prevent cancer?

Why has it been so difficult to find a cure for cancer?

What does Richard Klausner mean when he says cancer is like evolution in a bottle?

CLIP 1 - What is cancer
EP1 01:02:25 – 01:07:08
Cancer is a worldwide scourge, the fastest growing disease on earth.

CLIP 2 - Causes of cancer
EP3 01:47:31 – 01:48:29
After smoking and obesity the causes of cancer remain elusive and varied.

CLIP 3 - Why is cancer so difficult to cure
EP3 01:18:55 - 01:19:37
Cancer cells are constantly mutating and become resistant to drugs

CLIP 4 - Cancer treatment today
EP3 02:05:25 – 02:09:10
Targeted therapies have made a significant difference in the fight against cancer.

CLIP 5 - The future of cancer treatment
EP3 02:49:25 – 2:51:09
The future of cancer treatment is constantly evolving and new discoveries give reason for hope.

CLIP 6 - Evolution in a Bottle
EP3 02:09:49 – 02:11:40
Doctors will soon be able to map all genes and pathways of the human body

EXTENSION ACTIVITIES:
Have students work in small groups to review the cancer vocabulary. First, have them fill out a sheet with their own definitions. Next, review the terms as a class and fill in the correct definitions.

CANCER Vocabulary:

Cancer	a genetic disease that causes the uncontrolled, unregulated growth of cells.
Carcinogen	any agent, chemical, physical or biological, that causes cancer.
Carcinogenesis	the process by which normal cells are transformed into cancer cells.
Chemotherapy	treatment with a drug or drugs to destroy cancer cells.
Gene	the basic physical and functional unit of heredity.
Immunotherapy	treatments that use the body's immune system to fight cancer.

Leukemia	a cancer of the blood or blood-forming organs.
Metastasis	the distant spread of cancer from its primary site to other places in the body.
Mutation	any change in the DNA sequence of a cell.
Oncogene	gene that is a mutated (changed) form of a gene involved in normal cell growth. Oncogenes may cause the growth of cancer cells.
Oncology	a branch of medicine that specializes in the diagnosis and treatment of cancer.
Radiotherapy	the use of radiation treatment to kill cancer cells or stop them from dividing.
Remission	complete or partial disappearance of the signs and symptoms of cancer in response to treatment.
Drug Resistance	the ability of cells to resist the effects of drugs used to kill or weaken them
Systemic	affecting the entire body.
Virus	a simple microorganism that infects cells and may cause disease.

ADDITIONAL RESOURCES:

American Cancer Society
http://www.cancer.org

National Cancer Institute at the National Institutes of Health
http://www.cancer.gov

Cancer Treatment Centers of America - video animation - What is Cancer?
http://www.cancercenter.com/video/what-is-cancer/anatomy-of-cancer/

Cold Spring Harbor Laboratory - multimedia guide to cancer biology.
http://www.insidecancer.org

Information from the American Society of Clinical Oncologists. Guides for more than 120 types of cancer.
http://www.cancer.net/cancer-types

Cancer Research UK - Simple graphics and explanations of cancer.
http://www.cancerresearchuk.org/about-cancer/what-is-cancer

National Cancer Institute – Visuals Online - schematic of regular cells vs. cancer cells.
https://visualsonline.cancer.gov/details.cfm?imageid=2512

EDUCATIONAL STANDARDS:

Benchmarks for Science Literacy

3A/H1 (Grades: 9-12): Technological problems and advances often create a demand for new scientific knowledge, and new technologies make it possible for scientists to extend their research in new ways or to undertake entirely new lines of research. The very availability of new technology itself often sparks scientific advances.

5B/H1 (Grades: 9-12): Some new gene combinations make little difference, some can produce organisms with new and perhaps enhanced capabilities, and some can be deleterious.

5B/H4 (Grades: 9-12): Genes are segments of DNA molecules. Inserting, deleting, or substituting segments of DNA molecules can alter genes. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment.

5B/H6a (Grades: 9-12): The many body cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions.

5B/H6b (Grades: 9-12): Different parts of the genetic instructions are used in different types of cells, influenced by the cell's environment and past history.

5C/H6 (Grades: 9-12): gene mutation in a cell can result in uncontrolled division called cancer. Exposure of cells to certain chemicals and radiation increases mutations and thus the chance of cancer.

6E/H2 (Grades: 9-12): Faulty genes can cause body parts or systems to work poorly. Some genetic diseases appear only when an individual has inherited a certain faulty gene from both parents.

Next Generation Science Standards

Disciplinary Core Idea:
Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2),(HS-LS3-3)

Crosscutting Concepts:
Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS3-1),(HS-LS3-2)