Unit 4 Cancer

Content Area: **Science**
Course(s):
Time Period: **Semester 1**
Length: **5 weeks**
Status: **Published**

Enduring Understandings

- Cancer is relevant to young people and is not a disease of old age and how personal choices can affect their likelihood of developing cancer.
- The body is composed of a community of cells that can be affected by a number of factors and how cancer progression is a product of cellular evolution.
- The body is a system in which single organs may be affected by cancer and that cancer can spread to other body organs and/or systems.
- Cellular behavior is controlled by protein-protein interactions that determine one of three major cell fates: growth, differentiation, and death.

Essential Questions

- Why should we care about cancer?
- What lifestyle choices do I make that could predispose me to developing cancer later in life?
- How has our understanding of cancer changed over time?
- What do we know now about what causes cancer?
- How do carcinogens act to mutate DNA and how do we identify them?
- What type of normal cell is most vulnerable to becoming a cancer cell?
- How do cells normally act as part of a community and become isolated in cancer?
- How do cancer cells evolve?
- How does the immune system protect us from cancer?
- How will cancer be treated in the 21st century?

Knowledge and Skills

Knowledge:

- Cell mutation causes
- Historical figures in cancer research
- Carcinogen
- Ames test
- Hill's postulates
- Causation versus correlation
- cancer risk factors
- Survival rate
- Incidence rate
- mortality rate
- Cell replication
- Epithelial cells
- gene expression
- cell signals
- driver and checkpoint proteins
- apoptosis
- cell differentiation
- DNA mutation
- tumors and tumor progression
- Introns and exons
- Human genome
- DNA mutations
- normal vs chronic inflammation
- monoclonal tumor
- chemotherapy
- transformation
- types of tumors
- metastasis
- angiogenesis
- immunotherapy
- immune system
- cancer treatment options
- identifying cancer
- limitations to cancer screenings
- remission and relapse

Skills:

- Use computational and board game models to understand the role that regulated mitosis plays in maintaining an organism

- Evaluate the flaws and strengths of cancer diagnostics and treatments at an individual as well as population level.
- Explain how carcinogens act to mutate DNA
- Explain how population statistics can be used to calculate risk factors for cancer
- Analyze the survival rates for different types of cancer
- Explain how misconceptions can arise from reports
- Utilize research findings to evaluate how one attributes a potential risk factors as the cause of cancer
- Describe how ideas of cancer have evolved from a disease of fluids to a disease of cells.
- Explain how drivers and checkpoint proteins can lose control of the cell cycle, leading to unregulated cell growth
- Describe the function of the main components in a cell-signaling cascade
- Explain how gene expression is controlled by transcription factors
- Model apoptosis, explaining its role in equilibrium that exists for cells
- Apply knowledge of variations in gene expression in a case study
- Model wound healing
- Explain why most cancers originate from epithelial cells
- Predict the kinds of mutations that lead to deregulated mitosis and cancer
- Explain the role of secondary factors in converting normal inflammation into chronic inflammation
- Explain the function of telomerase
- Interpret data showing that chemotherapy can select for drug resistant tumor cells
- Analyze a case study on how tumor heterogeneity affects our availability to treat tumors
- Identify regions of divergence in genomic sequences from different species
- Compare genome sequences between different species to look for overlap
- Explain how DNA mutations turn normal cells into cancer cells
- Calculate the estimated number of cells transformed per second in the body.
- Explain the distinction between benign and malignant epithelial tumors.
- Explain how tumors are graded on the basis of extent of metastasis
- Explain why certain sites like the bone, brain, liver and lungs, are preferential sites for metastases
- Describe the mechanisms tumor cells use to hide from or evade the immune system
- Explain how the immune system can have both negative and positive effects on tumors.
- Describe the different options available for detecting and diagnosing tumors
- Explain why different methods of cancer detection are employed
- Describe the strengths and weaknesses of surgery, radiation and chemotherapy as cancer treatments
- Explain why eradicating cancer is challenging
- Case Studies:
    - Barbara's dilemma-radiation therapy
    - Fighting brain cancer with polio virus
    - Human papillomavirus and cancer
    - Smoking and cancer

Transfer Goals

- Apply their knowledge to analyze cancer case studies, developing potential treatment plans and exploring patient outcomes
- Integrate current research and emerging technologies in cancer treatment and prevention, considering their potential impact on future practices.
- Reflect on how cancer affects individuals and families, including personal connections and societal implications, fostering empathy and a deeper understanding.

Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing

Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing