| SUBJECT: Medical Interventions | GRADE: 10-12 |
|---|---|
| **Unit Title: How to Fight Infection** | **Time Frame: Marking Period** |

**UNIT OVERVIEW**

Students explore interventions involved in detecting, fighting, and preventing an infectious disease as they investigate a potential outbreak at a fictitious college. Sue Smith, a freshman in college, is not feeling well. She thinks she just has a cold, but further investigation will reveal something far more serious: bacterial meningitis.

Students use various techniques and technologies to diagnose Sue and determine the source of the disease on campus. They analyze clues found in the history and physical exam of each possible patient, identify pathogens present in body fluids through DNA sequence analysis, and test for the infectious agent using the antibody-based, enzyme-linked, immunosorbent assay (ELISA).

Students are introduced to the field of bioinformatics as they explore genetic databases to identify known gene sequences. They also review principles of human immunity as they learn how antibodies can be used to identify the presence of a disease agent. At the conclusion of the investigation, students outline a plan to stop a potential outbreak on campus and discuss interventions such as antibiotic therapy and vaccination, topics explored in greater detail in subsequent lessons.

| LRG SKILLS AND DISPOSITIONS | STEELS STANDARDS |
|---|---|
| S1C - Collaboration & Teamwork<br>S4C – Critical Thinking & Problem Solving<br>K2 - Healthy Living, Wellness, and Self-Awareness | 3.1.9-12.B - Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.<br>3.1.9-12.C - Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. |
| **COMPETENCIES** | **LEARNING TARGETS** |
| I can identify and apply medical interventions. | ● I can plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. C<br>● I can identify evidence that helps scientists determine the source of a potential outbreak of an infectious disease. C<br>● I can develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. B<br>● I can explain how medical technology, such as bioinformatics, has changed disease detection. B |

| SUBJECT: Medical Interventions | GRADE: 10-12 |
|---|---|
| **Unit Title: Genetic Testing and Screening** | **Time Frame: Marking Period** |

**UNIT OVERVIEW**

In Unit 2, students examine the available types of genetic testing and screening and discuss ethical implications of these tests. Students will focus on prenatal testing, newborn testing, and carrier screening; however, ethical use of genetic testing to screen for disease risk is also addressed. Students will explore genetic risk for chronic diseases such as cancer in more detail in Unit 3.
Playing the part of genetic counselors, students analyze a patient case concerning issues of genetic testing and provide appropriate recommendations. Next, students explore molecular techniques to complete a genetic test by amplifying a DNA segment using the polymerase chain reaction (PCR). Students then have a chance to see the connection between phenotype and genotype as they test their own genes. Finally, students investigate the interventions that exist to help protect and monitor a growing fetus. Students also research the value of proper prenatal care and interventions that protect and monitor the mother and growing fetus, then relate their findings to outcomes in both mother and child.

| LRG SKILLS AND DISPOSITIONS | STEELS STANDARDS |
|---|---|
| S1C - Collaboration & Teamwork<br>S4C – Critical Thinking & Problem Solving<br>K4DLT1C1 - Digital Literacy & Technology Proficiency | 3.1.9-12.P - Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. |
| **COMPETENCIES** | **LEARNING TARGETS** |
| I can explain how genetic counselors assist patients with decisions related to reproduction or personal disease risk. | ● I can ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. P<br>● I can explain the relationship between phenotype and genotype? P<br>● I can show which medical interventions and lifestyle modifications can help a pregnant woman have a healthy pregnancy? P<br>● I can debate the ethical implications of genetic testing? P |

| SUBJECT: Medical Interventions | GRADE: 10-12 |
|---|---|
| **Unit Title: How to Conquer Cancer** | **Time Frame: Marking Period** |

**UNIT OVERVIEW**

In this unit, students are introduced to Mike Smith, the 16-year-old son in the Smith family. For the last couple of months, Mike has experienced pain in his upper arm that may be indicative of cancer. Through the exploration of Mike's case, students explore diagnostic techniques used to diagnose Mike's particular cancer, including diagnostic imaging and examination of cancerous tissue.
Students look at the physiology of cancer and investigate the genes involved with cancer. Students examine the technology researchers use to get a better understanding of the differences between gene expression in cancer cells versus healthy cells. Students learn ways that this technology is used to potentially develop personalized medicine for treating cancer.

| LRG SKILLS AND DISPOSITIONS | STEELS STANDARDS |
|---|---|
| S1C - Collaboration & Teamwork<br>S4C – Critical Thinking & Problem Solving | 3.1.9-12.Q - Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.<br>3.1.9-12.B - Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. |
| **COMPETENCIES** | **LEARNING TARGETS** |
| I can explain the development of cancer by relating to the cell cycle. | ● I can make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. Q<br>● I can identify factors such as age, personal lifestyle choices, or environment influence a person's risk for developing cancer? Q<br>● I can show how imaging technology has changed medicine? Q<br>● I can develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. B<br>● I can analyze information that gene expression patterns tell scientists? B |

| SUBJECT: Medical Interventions | GRADE: 10-12 |
|---|---|
| **Unit Title: How to Prevail When Organs Fail** | **Time Frame: Marking Period** |

**UNIT OVERVIEW**

Students learn how to produce and purify a protein in a laboratory setting to understand how human insulin is produced to treat people with diabetes. Instead of creating insulin, students use the process of bacterial transformation to manufacture a green fluorescent protein (GFP) that is easily visible and can be traced in the laboratory. Then they learn techniques used to isolate a specific protein from a mixture, in this case, column chromatography.
Although students complete these three laboratory experiments using GFP, the processes can be adapted to the production of insulin. Students will relate their molecular work to the case of Diana Jones. Without insulin, she would have died long ago. As the unit progresses, students research and design other medical interventions to help Diana in her battle with diabetes and renal failure.

| LRG SKILLS AND DISPOSITIONS | STEELS STANDARDS |
|---|---|
| S1C - Collaboration & Teamwork<br>S4C – Critical Thinking & Problem Solving | 3.1.9-12.A - Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.<br>3.1.9-12.B - Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms |
| **COMPETENCIES** | **LEARNING TARGETS** |
| I can describe how organ failure relates to specific medical interventions. | ● I can develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. A<br>● I can explain how genetic engineering can be used to produce proteins such as insulinA<br>● I can construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. A<br>● I can show how the sequence of amino acids relates to the overall shape of a protein. B |

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| | • I can perform techniques that can be used to separate proteins in a mixture. B |