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| **TEXAS CTE LESSON PLAN**  [www.txcte.org](http://www.txcte.org) | |
| **Lesson Identification and TEKS Addressed** | |
| **Career Cluster** | Health Sciences |
| **Course Name** | World Health Research |
| **Lesson/Unit Title** | Immunity and Diseases |
| **TEKS Student Expectations** | **130.226. (c) Knowledge and skills**  (4) The student describes the engineering technologies developed to address clinical needs. The student is expected to:   1. describe technologies that support the prevention and treatment of infectious diseases; and 2. explain the implication of vaccines on the immune system. |
| **Basic Direct Teach Lesson**  (Includes Special Education Modifications/Accommodations and  one English Language Proficiency Standards (ELPS) Strategy) | |
| **Instructional Objectives** | The student will be able to:   * Define immunity as it applies to the human body. * Explain ways in which people acquire immunity. * Identify the organs of the immune system. * Analyze the body’s three lines of defense. * Distinguish between the function of different types of white blood cells. * Summarize how hormones affect the immune system. * Define “tumor necrosis factor.” * Analyze immunity and vaccinations. |
| **Rationale** | Understanding the immune system is vital for comprehending how our bodies respond to diseases and injuries. |
| **Duration of Lesson** | 4 – 5 hours |
| **Word Wall/Key Vocabulary**  *(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* | The key vocabulary for this lesson plan is in a separate document in the lesson plan attachments section. |
| **Materials/Specialized Equipment Needed** | * Immunity and Disease Terms handout * Instructional PowerPoint: Immunity and Disease * CheckPoint Test Key * Teacher Instructions for Investigation Activity * Student Instructions for Investigation handout * Group Investigation Cards * Evaluation Rubric * Student computers |
| **Anticipatory Set**  (May include pre-assessment for prior knowledge) | Discuss the following:  Zoologist Ilya Metchnikoff first suggested the idea of cells being directly involved in the defense of the body in 1884. His famous experiment involved pushing the thorn from a rose stem into a starfish larva and observing how phagocytic cells rapidly migrated and clustered around the thorn. |
| **Direct Instruction \*** | I. Immunity literally means “free from burden”  A. In medicine, when we speak of immunity, we are referring to the body’s ability to recognize and defend itself against foreign agents  II. How we acquire immunity  A. Natural passive immunity (maternal)  1. Occurs when antibodies travel across the placenta from the maternal blood to the fetal blood (the symbol for antibodies is “Y”)  2. Antibodies are also found in the colostrum (the liquid produced in the breasts for a baby’s first meal)  3. Antibodies received through passive immunity only last several weeks  B. Active Immunity  1. Natural active immunity – occurs when a person is exposed to harmful microbes (infectious diseases)  2. Artificial active immunity  a. Active immunity is artificially triggered  b. Occurs when a person is intentionally given a small quantity of an infectious disease (a vaccine)  III. The immune system is our body’s defense against foreign agents such as bacteria and viruses  IV. The organs of the immune system are positioned throughout the body. (these organs are also called lymphoid organs because they are home to lymphocytes—types of white blood cells)  A. Primary organs (where lymphocytes develop)  1. Thymus  a. Located in the chest between the sternum and heart  b. The thymus is large during infancy, but atrophies as a child grows  c. This is where the immune system’s T-cells mature  2. Bone marrow  a. New blood cells form in marrow then enter the bloodstream  b. Some white blood cells mature elsewhere in the body  c. Bone marrow produces all blood cells from stem cells  i. Called “stem cells” because they branch off and can become many different types of cells  ii. Stem cells change into actual, specific types of white blood cells  B. Secondary organs (where immune responses occur—our body’s call to action during infections)  1. Spleen  a. Located under the left side of the diaphragm (tucked under and protected by the ribs)  b. Filters out foreign organisms that infect the bloodstream  c. Also filters out old red blood cells from the bloodstream and recycles them  d. Serves as a blood reservoir  2. Lymph nodes  a. Small, bean-shaped structures strung along a series of vessels (lymphatic vessels which carry lymph fluid)  b. Lymph nodes store cells that fight infection and diseases  c. They act as filters, collecting and killing pathogens and/or cancer cells that travel through the lymphatic system  d. They are clustered in the neck, armpits, abdomen, and groin  C. Lymph nodes (where lymphocytes and macrophages are packed)  1. Lymphocytes  a. T-cells – white blood cells that mature in the thymus, and then migrate to other tissues  i. T-cells respond directly to antigens (foreign agents such as pathogens or toxins)  ii. Their response involves the destruction of target cells (e.g., virus-infected cells or cancer cells)  iii. 80% of blood cells are T-cells  b. B-cells – named for the bone marrow where they are produced  i. B-cells produce antibodies that incapacitate antigens  2. Macrophages  a. White blood cells (WBC) known as “big eaters”  b. Eat foreign material in the body  c. Some macrophages are stationed at areas of the body where foreign material commonly enters  d. Other macrophages patrol the body  3. All lymphocytes exit the lymph nodes through outgoing lymph vessels  4. Once in the bloodstream, lymphocytes are transported to tissues throughout the body – they patrol body for foreign antigens then return to the lymphatic system to begin the cycle all over again  5. Lymphocyte and fluid exchange occurs between blood and lymph vessels  6. Enables the lymphatic system to monitor the body for invading microbes  7. The lymphatic system is sometimes considered part of the circulatory system because it transports lymph through the vessels and empties it into the venous blood  V. How the body protects itself when exposed to foreign agents  A. Markers of “self”  1. The body has the ability to distinguish between “self” and “non-self”  2. Every cell in the body carries distinctive surface proteins that distinguish it as self  3. Foreign cells (bacteria, viruses, etc.) are recognized by the body as non-self and fall under attack by the immune system  4. Normally your immune cells don’t attack your own body tissues because they carry the same pattern of self-markers, and therefore, coexist peaceably with any cells they recognize as self  B. The body has built-in defense mechanisms which fight off non-self cells or tissues  1. Nonspecific defense mechanisms  a. Act against all harmful agents and provide nonspecific resistances (skin barrier, body’s inflammatory response)  b. Do not distinguish one infectious microbe from another  2. Specific defense mechanisms  a. Only act against certain agents  b. The backup defense system that has the ability to recognize and target organisms which don’t belong in the body (viruses, bacteria, etc.)  VI. The body’s three lines of defense  A. The first line of defense (nonspecific defense mechanisms) – the physical and chemical barriers that keep foreign agents at bay  1. Skin (keratin resists the digestive enzymes of invading bacteria; sweat and body oil lower the pH of skin to between 3 and 5, which is a hostile environment for most pathogens; sweat and sebum contain antiseptic molecules, primarily lysozyme which breaks down bacterial cell walls)  2. Ciliated mucous membranes and mucus (trap invading pathogens and foreign debris that can then be swept away by cilia)  3. Nasal passages and sinuses (make nitrous oxide that are toxic to a wide range of infectious microbes)  4. Tears and saliva (contain lysozyme, an antiseptic enzyme that attacks and breaks down cell the walls of bacteria)  5. The stomach’s hydrochloric acid and good gut bacteria (helps crowd out bad bacteria)  B. The second line of defense (also nonspecific defense mechanisms that do not react to specific intruders) – cells that initiate the inflammatory response (redness, fever, swelling) spring into action if foreign agents succeed in passing the first line of defense and enter body  1. Phagocytes – ingest and destroy foreign particles  a. Neutrophils – the “foot soldiers” of white blood cells  i. Make up about 60 – 70% of all WBCs  ii. Tend to self-destruct as they destroy invaders  iii. A person makes about 100 billion every day  b. Monocytes – develop into macrophages (the largest phagocyte)  i. Only about 5% of the WBCs  ii. Voracious eaters at infection sites, readily engulfing invading organisms and cellular debris  iii. Macrophages can also become involved in "intelligence gathering," collecting various bits and pieces of an enemy and displaying remains like macabre trophies of war  c. Eosinophils – have limited phagocytic activity  i. Make up only 1.5% of WBCs  ii. Can destroy larger parasites such as worm larvae (latch onto the surface of a parasite and release destructive enzymes)  d. Basophils – release histamines, which are part of the inflammatory response  i. Histamine increases the permeability of capillaries to white blood cells so they can fight foreign invaders in the infected tissues  e. Natural Killer (NK) cells – move throughout blood and lymph  i. Attack the body’s own cells, either those infected by viruses or cancerous cells  ii. Attack the membranes of target cells causing them to lyse (break open)  f. Complement system – a group of antimicrobial proteins found in plasma that work with (complement) antibodies  i. Activate when they come into contact with foreign agents  ii. Insert themselves into the membranes of pathogens, causing the pathogens to swell and lyse  C. The third line of defense (specific defense mechanisms) – the immune response  1. Comes into action when nonspecific lines of defense don’t stop foreign agents and an infection becomes widespread  2. Millions of Y-shaped proteins called antibodies are produced by white blood cells in response to foreign invaders (antigens)  a. Antibodies are also referred to as immunoglobulins and/or gamma globulins  b. Each antibody responds to a specific antigen (bacteria, virus, etc.)  3. The structure of antibodies  a. The structures are very similar, but the small regions at the tip of the protein are variable  b. Each variant tip can bind to a different antigen target  VII. Antigens  A. Anything that antagonizes or stimulates the immune system to produce an immune response, including  1. Pathogens  2. Foreign substances or agents (a splinter, etc.)  3. Tissues or cells from another person (except an identical twin)  4. Explains why transplanted organs and tissues are sometimes “rejected”  B. Antigens carry marker molecules that identify them as foreign  VIII. Hormones  A. Several hormones are generated by the components of the immune system  B. These hormones are known as lymphokines, which enhance the function of leukocytes  C. Certain hormones, such as steroids and corticosteroids, suppress the immune system  IX. Tumor Necrosis Factor (TNF)  A. An immune cell protein produced by macrophages  B. Kills cells that appear abnormal  C. Inhibits the growth of tumor cells but causes inflammation  D. Promotes the creation of new blood vessels (important to healing)  X. Interferon  A. Proteins produced by the immune system in response to an attack by a virus  B. Helps to protect other healthy cells from the attack. When the immune system mistakes “self” for “non-self”  XI. Sometimes the immune system launches chronic attacks against the body’s own cells or tissues  A. These attacks are called autoimmune diseases  B. Examples of autoimmune diseases  1. Rheumatoid arthritis  2. Systemic lupus erythematous  3. Myasthenia gravis  4. Diabetes I  XII. Allergens  A. In some cases the immune system responds to harmless foreign agents  1. Dust, ragweed, and certain foods  B. The result is an allergic reaction  1. The antigens that cause it are called allergens |
| **Guided Practice \*** | Student groups will investigate an immunity-related topic, then create and present a PowerPoint presentation over their research. |
| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | None |
| **Lesson Closure** | None |
| **Summative/End of Lesson Assessment \*** | * Successful completion of CheckPoint test * Evaluation Rubric   **Accommodations for Learning Differences**  For reinforcement, the student will develop flash cards for the key terms. |
| **References/Resources/**  **Teacher Preparation** |  |
| **Additional Required Components** | |
| **English Language Proficiency Standards (ELPS) Strategies** |  |
| **College and Career Readiness Connection[[1]](#footnote-1)** | **Science Standards**  III. Foundation Skills: Scientific Applications of Communication  B. Scientific Reading  1. Read technical and scientific articles to gain understanding of interpretations, apparatuses, techniques or procedures, and data.  3. Recognize scientific and technical vocabulary in the field of study and use this vocabulary to enhance clarity of communication.  VI. Biology  F. Systems and Homeostasis  1. Know that organisms possess various structures and processes (feedback loops) that maintain steady internal conditions.  **Cross-Disciplinary Standards**  I. Key Cognitive Skills  A. Intellectual curiosity  1. Engage in scholarly inquiry and dialogue.  I. Key Cognitive Skills  B. Reasoning  4. Support or modify claims based on the results of an inquiry.  I. Key Cognitive Skills  C. Problem Solving  3. Collect evidence and data systematically and directly relate to solving a problem.  I. Key Cognitive Skills  E. Work Habits  2. Work collaboratively.  II. Foundational Skills  C. Research across the curriculum  2. Explore a research topic.  4. Evaluate the validity and reliability of sources.  5. Synthesize and organize information effectively.  6. Design and present an effective product.  7. Integrate source material II. C. 8. Present final product.  II. Foundational Skills  E. Technology  1. Use technology to gather information.  2. Use technology to organize, manage, and analyze information.  3. Use technology to communicate and display findings in a clear and coherent manner. |
| **Recommended Strategies** | |
| **Reading Strategies** |  |
| **Quotes** |  |
| **Multimedia/Visual Strategy**  **Presentation Slides + One Additional Technology Connection** |  |
| **Graphic Organizers/Handout** |  |
| **Writing Strategies**  **Journal Entries + 1 Additional Writing Strategy** |  |
| **Communication**  **90 Second Speech Topics** |  |
| **Other Essential Lesson Components** | |
| **Enrichment Activity**  (e.g., homework assignment) | Student will view the following online videos and develop a multimedia presentation:   * Disease Defense: The Immune System (4 min.) * Disease Defense: Immunity and Vaccination (3 min.) * Autoimmune Inflammatory Disease (23 min.) |
| **Family/Community Connection** |  |
| **CTSO connection(s)** | SkillsUSA  HOSA |
| **Service Learning Projects** |  |
| **Lesson Notes** |  |

1. Visit the Texas College and Career Readiness Standards at <http://www.thecb.state.tx.us/collegereadiness/CRS.pdf>, Texas Higher Education Coordinating Board (THECB), 2009. [↑](#footnote-ref-1)