

Naturally Acquired versus Artificially Acquired Immunity

Course

Pathophysiology

Unit III

Mechanisms of Pathology

Essential Question

How does the body develop resistance against disease-causing organisms?

TEKS

130.208 (c)

3 A,B,C,D

4 D,E

5 C

7 A

Prior Student Learning

Understanding of the Immune System

Estimated time

2 hours

Rationale

The ability to develop immunity to diseases is a key factor in maintaining health and wellness.

Objectives

Upon completion of this lesson, the student will be able to

- Differentiate between naturally and artificially acquired immunity
- Explain the difference between the active and passive forms of artificially acquired immunity
- Define the term vaccine and give several examples of vaccines

Engage

The Texas Department of Health immunization schedule

<http://www.dshs.state.tx.us/immunize/schedule/default.shtm>

Examine the Texas Department of Health's immunization schedule of required immunizations for students attending Texas public schools in Grades K-12. Review the diseases which students must receive immunizations. Brainstorm why immunizations are important. Discuss how vaccines work.

Key Points

I. Naturally Acquired Immunity

A. Active Immunity – immunity may be acquired by exposure to a disease

1. Antibodies

- a. Manufactured by the body – act against the infecting agent
- b. Formation can occur repeatedly each time a person encounters the infecting agent

2. Lasts many years and sometimes for life

B. Passive Immunity – immunity may be acquired naturally by a fetus through the passage of antibodies from the mother through the placenta or through breast milk to a nursing infant

1. Antibodies come from an outside source

2. Antibodies are temporary (antibodies will protect for up to 6 months or longer if the mother continues nursing)

II. Artificially Acquired Immunity

A. Vaccination or immunization – an agent is introduced into the body to stimulate antibody production

B. Vaccines

1. Live organisms – must be nonvirulent for humans or treated in the lab to weaken them so they are not as pathogenic to humans
2. Attenuated – an organism that has been weakened

3. Killed – vaccination with a toxoid occurs when the toxin produced by an organism is altered with heat or chemicals to render it harmless, but to still allow the body to make antibodies against it
4. Examples of Vaccines
 - a. Smallpox – the last natural case of smallpox occurred in 1977; in 1980 the World Health Organization declared the global eradication of smallpox and recommended that all countries cease vaccination. Because there are concerns that the smallpox virus could be used as a bioterrorism weapon, the CDC has developed a plan. The plan will coordinate CDC, state, and local public health activities should a smallpox outbreak occur, and it will help health officials define and control the outbreak. This plan includes indications for vaccination, contraindications for vaccination, risks, sites, personnel, facilities, etc.
 - b. Pertussis (Whooping Cough) – causes coughing spells so bad that it is hard for infants to eat, drink, or breathe; it can lead to pneumonia, seizures, brain damage, and death
 - c. Diphtheria – causes a thick covering on the back of the throat; can lead to breathing problems, paralysis, heart failure, and death
 - d. Tetanus (Lockjaw) – causes painful tightening of the muscles, usually all over the body, leading to “locking” of the jaw so the victim cannot open his or her mouth or swallow. Tetanus leads to death in about 1 out of 10 cases
 - e. Meningococcal disease – a serious illness caused by bacteria. It is the leading cause of bacterial meningitis in children 2–18 years old in the United States. Meningitis is an infection of the brain and spinal cord coverings.
 - f. Haemophilus influenzae type b (Hib) – a serious disease caused by bacteria. Hib is spread from person to person. If the bacteria remain in the nose and throat, the individual will not get sick. If it spreads to the lungs or blood stream, Hib can be serious. Before the Hib vaccine, Hib was the leading cause of bacterial meningitis among children under 5 years old in the United States. Meningitis is an infection of the brain and spinal cord coverings which can lead to lasting brain damage and deafness. Hib disease can also cause
 - i. Pneumonia
 - ii. Severe swelling in the throat, making it hard to breathe
 - iii. Infections of the blood, joints, bones, and covering of the heart
 - iv. Death
 - g. Influenza – caused by a virus that spreads from infected

persons to the noses or throats of others. The “influenza (flu) season” in the U.S. is from November through April each year. Influenza can cause fever, cough, chills, sore throat, headache, and muscle aches. People of any age can get influenza. Most people are ill with influenza for only a few days, but some get much sicker and need to be hospitalized. Influenza causes thousands of deaths each year, mostly among the elderly. Influenza viruses change often. Therefore, the influenza vaccine is updated each year to make sure it is as effective as possible. Protection develops about 2 weeks after getting the shot and may last up to a year

- h. Polio – caused by a virus. It enters the body through the mouth. It can cause paralysis and death. No “wild” polio has been reported in the United States for over 20 years. The disease is still common in some parts of the world
 - i. Measles – causes rash, cough, runny nose, eye irritation, and fever. It can lead to ear infection, pneumonia, seizures, brain damage, and death
 - j. Mumps – causes fever, headache, and swollen glands. It can lead to deafness, meningitis, painful swelling of the testicles or ovaries, and (rarely) death
 - k. Rubella (German measles) – causes rash, mild fever, and arthritis. If a woman gets rubella while she is pregnant, she could have a miscarriage or her baby could be born with serious birth defects
 - l. Anthrax – a serious disease that can affect both animals and humans
 - i. Caused by the bacteria *Bacillus Anthracis*
 - ii. Contracted from infected animals, wool, meat, or hides
 - iii. Most commonly causing skin disease, ulcers, fever, and fatigue
 - iv. 20 % of the cases are fatal
 - v. Inhaled anthrax is more serious
 - m. Hepatitis B (HBV) – a serious disease. The hepatitis B virus can cause a short term (acute) illness that leads to
 - i. Loss of appetite
 - ii. Fatigue
 - iii. Pain in the muscles, joints, and stomach
 - iv. Diarrhea and vomiting
 - v. Jaundice (yellow tint to the skin and/or eyes)
 - vi. Chicken Pox
5. Immunity may or may not be lifelong with vaccines. To help keep the antibody levels high enough to keep you protected you sometimes need to have “booster shots”

Activity

- I. Investigate the history of a particular type of vaccine and the ramifications if the vaccine were not invented. Present this to the class using your choice of media.
- II. Prepare a timeline showing the schedule of vaccinations across a human lifespan.
- III. Debate mandatory immunizations for school children using HOSA Biomedical Debate Guidelines (religious beliefs, cultures, etc.).

Materials

HOSA Event Guidelines – <http://www.hosa.org>

<http://www.dshs.state.tx.us/immunize/schedule/default.shtm>

Assessment

HOSA Event Guidelines – <http://www.hosa.org>

Immunization Rubric

Accommodations for Learning Differences

For reinforcement, the student will create a chart of the different types of vaccines available and give examples for each class.

For enrichment, the student will pick a destination for a trip to a third world country and research the required vaccinations. Determine the diseases the vaccinations will prevent and the percentage of occurrence.

National and State Education Standards

National Healthcare Foundations Standards

1. Academic Foundation

1.2 Diseases and Disorders

1.22 Recognize emerging diseases and disorders

1.23 Investigate biomedical therapies as they relate to the prevention, pathology and treatment of diseases

7. Safety Practices

7.21 Apply personal safety procedures based on OSHA CDC regulations.

9. Health Maintenance Practices

9.11 Apply behaviors that promote health and wellness

9.12 Describe strategies for the prevention of diseases including health screenings and examinations

TEKS

130.208(c)(3)(A) In all fields of science, analyze, evaluate and critique scientific explanations by using empirical evidence logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student

130.208(c)(3)(B) Communicate and apply scientific information extracted

from various sources such as current events, news reports, published journal articles and marketing materials

130.208(c)(3)(C) Draw inferences based on data related to promotional materials for products and services

130.208(c)(3)(D) Evaluate the impact of scientific research on society and the environment

130.208(c)(4)(D) Examine the body's compensating mechanisms occurring under various conditions

130.208(c)(4)(E) Analyze how the body attempts to maintain homeostasis when changes occur.

130.208(c)(5)(C) analyze the body's natural defense systems against infection such as barriers, the inflammatory response and the immune response

130.208(c)(7)(A) Evaluate public health issues related to asepsis, isolation, immunizations and quarantine

Texas College and Career Readiness Standards

Science Standards

A Cognitive skills in science

1. Utilize skepticism, logic, and professional ethics in science

E Effective Communication of scientific information

1. Use several modes of expression to describe or characterize natural patterns and phenomena. These modes of expression include narrative, numerical, graphical, pictorial, symbolic, and kinesthetic.

2. Use essential vocabulary of the discipline being studied

Cross Disciplinary Standards

A. Intellectual curiosity

1. Engage in scholarly inquiry and dialogue

2. Accept constructive criticisms and revise personal views when valid evidence warrants

B. Reasoning

1. Consider arguments and conclusions of self and others

2. Construct well reasoned arguments to explain phenomena, validate conjectures or support positions

3. Gather evidence to support arguments, findings or lines of reasoning

4. Support or modify claims based on the results of an inquiry

D. Academic behaviors

1. Self monitor learning needs and seek assistance when needed

2. Use study habits necessary to manage academic pursuits and requirements

3. Strive for accuracy and precision

4. Persevere to complete and master tasks

E Work Habits

IV. Work independently

V. Work collaboratively

II C.. Research across the curriculum

VI. Understand which topics or questions are to be investigated





VII. Explore a research topic

VIII. Refine research topic based on preliminary research and devise a timeline for completing work

- IX. Evaluate the validity and reliability of sources
- X. Synthesize and organize information effectively
- XI. Design and present an effective produce
- XII. Integrate source material
- XIII. Present final product

Immunization Presentation

Topic: _____

	Best 	Good 	Average 	Bad 	Points Awarded
Presentation/Demonstration <ul style="list-style-type: none"> Presented information clearly All members participated in the presentation with speaking parts 	25	20	15	10	
Display <ul style="list-style-type: none"> Pleasing to look at Easy to follow Legible 	20	16	12	8	
Stage Presence <ul style="list-style-type: none"> Voice quality (pitch & tempo) Posture Eye contact 	25	20	15	10	
Answered Questions <ul style="list-style-type: none"> Able to easily answer audience questions Gave well thought out responses 	25	20	15	10	
Effectively communicated the main idea	5	4	3	2	
Total Points – Possible/Awarded	100	80	60	40	

Comments: _____
