35.1 Infectious Disease

Lesson Objectives

Identify the causes of infectious disease.
Explain how infectious diseases are spread.

Lesson Summary

Causes of Infectious Disease  Changes to body physiology that disrupt normal body functions and are caused by microorganisms are called infectious diseases. This explanation, established by Louis Pasteur and Robert Koch, is called the germ theory of disease.

- Infectious diseases are caused by viruses, bacteria, fungi, protists, and parasitic worms. Disease-causing microorganisms are also called pathogens.
- Koch also developed a series of rules that help scientists identify which organism causes a specific disease. These rules are called Koch’s postulates.
- Many microorganisms are symbionts that are either harmless or beneficial. Pathogens cause disease by destroying cells, disrupting body functions, or releasing toxins that kill cells or interfere with their normal functions.

How Diseases Spread  Infectious diseases can be spread in several ways.

- Some infectious diseases are spread from person to person through coughing, sneezing, physical contact, or exchange of body fluids. Most infectious diseases are spread through indirect contact, such as pathogens that are carried through the air. These pathogens can be inhaled, or they can be picked up from surfaces.
- Some pathogens are spread by specific kinds of direct contact, such as sexual contact or drug use that involves shared syringes.
- Other infectious diseases are spread through contaminated water or food.
- Some infectious diseases spread from animals to humans. Such a disease is called a zoonosis. Often, the spread of zoonoses involves vectors, which are disease carriers that usually do not get sick from the pathogen.

Causes of Infectious Disease

1. What are infectious diseases, and what causes them?
   Infectious diseases are changes to body physiology that disrupt normal body functions. They are caused by microorganisms.

2. How did the germ theory of disease get its name?
   Microorganisms were once called germs; today the word “germ” has no scientific meaning.

3. What is another name that scientists use for a disease-causing agent?
   Pathogen
For Questions 4–12, match each type of disease with the type of disease-causing agent that causes it. Some types of disease-causing agents may be used more than once.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Type of Disease-Causing Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>African sleeping sickness</td>
<td>A. virus</td>
</tr>
<tr>
<td>athlete’s foot</td>
<td>B. bacterium</td>
</tr>
<tr>
<td>botulism</td>
<td>C. protist</td>
</tr>
<tr>
<td>chicken pox</td>
<td>D. parasitic worm</td>
</tr>
<tr>
<td>hookworm</td>
<td>E. fungus</td>
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<tr>
<td>influenza</td>
<td></td>
</tr>
<tr>
<td>malaria</td>
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<tr>
<td>trichinosis</td>
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<tr>
<td>tuberculosis</td>
<td></td>
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</tbody>
</table>

13. What are Koch’s postulates used for?

_They are used to scientifically identify the microorganism that causes a specific disease._

14. Complete the flowchart by numbering the steps to show the order in which a researcher applies Koch’s postulates.

15. Are microorganisms always harmful to the human body? Explain your answer, and give an example.

_No. Most microorganisms that live in the human body are symbionts, which are either harmless or even beneficial. For example, bacteria that live in the large intestine help with digestion and also produce vitamins._

16. List two ways that bacteria can produce illness.

A. _by destroying cells_

B. _by producing poisons that kill cells or interfere with their normal functions_
35.2 Defenses Against Infection

Lesson Objectives

- Describe the body’s nonspecific defenses against invading pathogens.
- Describe the function of the immune system’s specific defenses.
- List the body’s specific defenses against pathogens.

Lesson Summary

Nonspecific Defenses

The body has many nonspecific defenses, which defend against a wide range of pathogens.

- The first line of defense is skin. Skin keeps pathogens out of the body by forming a barrier that few pathogens can get through. Mucus, saliva, and tears contain an enzyme that can kill bacteria. Mucus can also trap pathogens.

- When pathogens do enter the body, the second line of defense goes to work. These nonspecific defenses include:
  - the inflammatory response, in which chemicals called histamines cause blood vessels near a wound to expand and phagocytes to move into the tissue to fight infection.
  - the production of proteins called interferons, which help block the replication of viruses.
  - the release of chemicals that produce a fever, an increase in normal body temperature, which may slow the growth of pathogens and speed up immune response.

Specific Defenses: The Immune System

The function of the immune system is to fight infection by inactivating foreign substances or cells that have entered the body. The specific immune response works in several ways, including:

- recognizing “self,” including cells and proteins that belong to the body.

- recognizing “nonself”, or antigens, molecules found on foreign substances. Antigens stimulate the immune system to produce cells called lymphocytes that recognize, attack, destroy, and “remember” specific pathogens.

- producing specific lymphocytes that recognize specific antigens. They work by attacking infected cells or producing antibodies, proteins which tag antigens for destruction by immune cells.

The Immune System in Action

The immune response works in two ways.

- In humoral immunity, white blood cells, called B lymphocytes (B cells), make antibodies that attack pathogens in the blood.

- In cell-mediated immunity, white blood cells, called T lymphocytes (T cells), find and destroy abnormal or infected cells.

- After a pathogen is destroyed, memory B cells and memory T cells stay in the body. These cells help create a faster immune response if the same pathogen enters the body again.
Nonspecific Defenses

For Questions 1–8, write the letter of the definition that best matches each term.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. skin</td>
<td>A. An increase in body temperature, which slows or stops pathogens</td>
</tr>
<tr>
<td>2. lysozyme</td>
<td>B. A secretion of the nose and throat that traps pathogens</td>
</tr>
<tr>
<td>3. inflammatory response</td>
<td>C. An enzyme found in tears and saliva that breaks down bacterial cell walls</td>
</tr>
<tr>
<td>4. histamines</td>
<td>D. Chemicals that increase blood flow to tissues</td>
</tr>
<tr>
<td>5. interferons</td>
<td>E. Combination of physical and chemical barriers that defend against pathogens</td>
</tr>
<tr>
<td>6. fever</td>
<td>F. Redness, pain, and swelling at the site of an injury</td>
</tr>
<tr>
<td>7. mucus</td>
<td>G. Proteins that fight viral growth</td>
</tr>
<tr>
<td>8. nonspecific defenses</td>
<td>H. The body’s most important nonspecific defense</td>
</tr>
</tbody>
</table>

Specific Defenses: The Immune System

For Questions 9–14, complete each statement by writing the correct word or words.

9. The _______ response is the body’s response to specific invaders.

10. A substance that triggers the immune response is known as a (n) _______.

11. The main role of _______ is to tag _______ for destruction by immune-system cells.

12. The main working cells of the immune system are two types of _______. Their specific types are determined by a person’s _______.

13. _______ discover antigens in body fluids.

14. _______ defend the body against pathogens that have infected body cells.

15. **THINK VISUALLY** In the space provided, draw an example of each type of lymphocyte indicated to show a basic difference between the two types of cells.