Chapter 37 Section 1: Protecting Against Disease

Key Vocabulary Terms

Adapted from Holt Biology 2008
Pathogen

A microorganism, another organism, a virus, or a protein that causes disease; an infectious agent.
Mucous Membrane

The layer of epithelial tissue that covers internal surfaces of the body and that secretes mucus.
Inflammation

A protective response of tissues affected by disease or injury; characterized by pain, swelling, redness, and heat
Histamine

A chemical that stimulates the autonomous nervous system, secretion of gastric juices, and dilation of capillaries

Adapted from Holt Biology 2008
Antigen

A substance that stimulates an immune response
Macrophage

An immune system cell that engulfs pathogens and other materials

Adapted from Holt Biology 2008
Neutrophil

A large leukocyte that contains a lobed nucleus and many cytoplasmic granules
Natural Killer Cells

A type of white blood cell that is present in individuals who have not been immunized and that kills a variety of cells.
Interferon

A protein that is produced by cells infected by a virus and that can protect uninfected cells from reproduction of the virus.
Chapter 37
Section 1:
Protecting Against Disease

Notes

Adapted from Holt Biology 2008
Content Objectives

• I will be able to identify the physical barriers that protect the human body.

• I will be able to identify three general defense mechanisms that the body uses to fight pathogens.

• I will be able to identify how the body responds to pathogens that have infected a cell?
Preventing Entry

Disease-causing microorganisms and viruses are called pathogens. The body has many ways to protect against pathogens.
Preventing Entry

Skin and mucous membranes form strong barriers that prevent pathogens from entering the body.
Preventing Entry

Skin is the first line of defense against pathogens.
Preventing Entry

Oil and sweat on the skin’s surface inhibit the growth of many pathogens.
Mucous membranes form a second barrier to pathogens. **Mucous membranes** are layers of epithelial tissue that produce a sticky, viscous fluid called *mucus*. Mucus traps pathogens before they can cause infections.
Mucous membranes cover internal body surfaces, such as the linings of the digestive tract, respiratory tract, and reproductive tract.
Cuts and abrasions allow pathogens to enter through the skin. Airborne pathogens can enter the body through the respiratory system.
How do physical barriers prevent pathogens from entering the body?
Skin physically prevents many pathogens from invading the body (unless there is a tear in the skin).
YOUR TURN

- With a partner complete
- Chapter 37 Section 1 Active Reading (Protecting against Disease).
- Take turns reading the questions aloud to each other, alternating questions.
- Read the paragraphs aloud, alternating paragraphs.

Adapted from Holt Biology 2008
YOUR TURN

- Discuss what you have read!

- From your discussion write the best possible response to the questions.

  - Be prepared to share with the class.
Nonspecific Immune Responses

When pathogens break through the body’s physical barriers, the body quickly responds with second-line defenses—fever, inflammation, and the activation of special proteins that kill or inhibit pathogens.
Nonspecific Immune Responses

As the body begins to fight against an invading pathogen, the body’s temperature may rise several degrees. Increased body temperature, or fever, is a common symptom of illness.
Nonspecific Immune Responses

Fever helps the body fight infection because higher temperatures are harmful to many bacterial pathogens.
An injury or local infection may stimulate inflammation. **Inflammation** is a protective response that results in the accumulation of chemicals and cells that attack and destroy pathogens in the area of injury or infection.
Infected or injured cells release chemicals such as **histamine**. Histamine dilates local blood vessels, increasing blood flow and causing swelling and redness.
Three types of white blood cells attack pathogens: macrophages, neutrophils, and natural killer cells.
White Blood Cells Involved in Inflammation

<table>
<thead>
<tr>
<th></th>
<th>Macrophage</th>
<th>Neutrophil</th>
<th>Natural Killer Cell</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target:</strong></td>
<td>pathogens, dead cells, and cellular debris</td>
<td>Target: pathogens</td>
<td>Target: cells infected with pathogens and cancer cells</td>
</tr>
<tr>
<td><strong>Method of action:</strong></td>
<td>ingests and kills pathogens</td>
<td>Method of action: ingests and kills pathogens</td>
<td>Method of action: punctures an infected cell membrane, and causes water to rush in and burst the cell</td>
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<tr>
<td><strong>Location:</strong></td>
<td>lymph and fluid between cells, concentrated in the spleen and lungs</td>
<td>Location: blood and fluid between cells and in the walls of capillaries</td>
<td>Location: lymph nodes and other tissues</td>
</tr>
</tbody>
</table>
Nonspecific Immune Responses

Some pathogens activate proteins that help the body’s general responses to infection.
Nonspecific Immune Responses

Complement proteins attack pathogens by punching holes in the cell membranes and causing the contents to leak out.
Nonspecific Immune Responses

Another group of proteins called interferons are released by cells infected with viruses.
Nonspecific Immune Responses

Interferons prevent viruses from making proteins and RNA.
Specific Immune Responses

The body’s third line of defense is called the specific immune response. This response involves specialized white blood cells.
Specific Immune Responses

When a pathogen infects a cell, the body produces immune cells that specialize in detecting and destroying that specific pathogen.
Specific Immune Responses

**Macrophages** are one type of white blood cell that destroys pathogens.
Specific Immune Responses

Pathogens have unique proteins on their surfaces called antigens that help the body identify the pathogen as foreign and trigger an immune response.
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Specific Immune Responses

After a macrophage destroys a pathogen, pieces of the pathogen that contain its antigens move to the surface of the macrophage, changing the cell surface markers on the macrophage.
Specific Immune Responses

This new antigen display on the surface of the macrophage alerts the immune system to an invader.
Specific Immune Responses

Every antigen has its own receptor which is located in the surface of an immune cell.
Specific Immune Responses

Antigen receptors bind to antigens that match their shape exactly.
Specific Immune Responses

The unique structure of antigen receptors allows the immune system to be specific to certain antigens.
Specific Immune Responses

The body produces a variety of immune cells, each of which has receptors for a different antigen.
Specific Immune Responses

When a displayed antigen binds to its antigen receptor on an immune cell, more immune cells are produced that have the same antigen receptor.
Specific Immune Responses

These new immune cells function to destroy body cells that are no longer normal and to remove extracellular pathogens that have not yet entered body cells.
How does the body recognize “nonself” invaders?
Viruses display antigens on their cell surfaces, which tells the body that the viral cells are different from “self” cells. How does the body recognize “nonself” invaders?
Summary

Skin and mucous membranes form strong barriers that prevent pathogens from entering the body.
Summary

When pathogens break through the body’s physical barriers, the body quickly responds with second-line defenses—fever, inflammation, and the activation of special proteins that kill or inhibit pathogens.
Summary

When a pathogen infects a cell, the body produces immune cells that specialize in detecting and destroying that specific pathogen.