



Bacteria, Viruses, and Humans

Section 20-3

Roles of Bacteria and Viruses

Key Idea: Bacteria play important roles in the **environment** and in **industry**. Both bacteria and viruses are important in research.

Bacteria and the Environment

- Bacteria play a vital role in all of Earth's ecosystems by producing oxygen, making nitrogen available, and decomposing organisms.
- Many form important symbiotic relationships.

Bacteria and Industry

- Bacteria are important in a variety of industries such as food production, chemical production, mining, and environmental cleanup.


Bacteria, Viruses, and Research

- Bacteria and viruses have been important in genetic research.

Koch's Postulates and Disease Transmission

Key Idea: The four main steps in Koch's postulates are:

- **Step 1** The pathogen must be found in an animal with the disease and not in a healthy animal.
- **Step 2** The pathogen must be isolated from the sick animal and grown in a laboratory culture.
- **Step 3** When the isolated pathogen is injected into a healthy animal, the animal must develop the disease.
- **Step 4** The pathogen should be taken from the second animal, grown in the lab, and shown to be the same as the original pathogen.

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- Koch's postulates is a four-step procedure developed by German physician Robert Koch as a technique for diagnosing the cause of an infection.
 - A pathogen is a disease-causing agent.

Koch's Postulates and Disease Transmission

- Diseases that can spread from person to person are considered contagious.
- Diseases can be transmitted through the air, in contaminated food or water, or on contaminated objects.

Bacterial Diseases

Key Idea: Bacteria can cause disease by producing toxins and by destroying body tissues.

A toxin is a poisonous chemical released or stored inside the bacteria until the bacteria die.

Bacterial Diseases

- The most common way that bacteria cause disease is by producing toxins.
- A second way that bacteria cause disease is by producing enzymes that break down the host's tissues into nutrients that the bacteria can use.

Antibiotic Resistance

Key Idea: Antibiotic resistance spreads when sensitive populations of **bacteria** are killed by **antibiotics**. As a result, resistant bacteria **thrive**.

- **An antibiotic is a** chemical that inhibit the growth of or kill microorganisms.
- **Resistance is** the ability of bacteria to tolerate antibiotics.

Development of Resistance

- Since the introduction of antibiotics, these drugs have reduced illness, suffering, and deaths from bacterial diseases.
- Mutations for antibiotic resistance arise naturally and often in bacteria.
- When the antibiotic is present, vulnerable bacteria are killed.
- Resistant bacteria survive and reproduce.
- Antibiotic-resistant bacteria become the dominant type in the population.

Consequences of Resistance

- Diseases that were once easy to treat with antibiotics are now more difficult to treat because of resistance to multiple antibiotics.
- Widespread use of antibiotics promotes the spread of antibiotic resistance.
- As bacteria become resistant, physicians must switch to using different antibiotics.
- As new antibiotics are used, bacteria will probably develop resistance to those as well.

Viral Diseases

Key Idea: Because viruses enter **host cells** to reproduce, it is difficult to develop a drug that kills the virus without harming the living host.

Viral Diseases

- Viruses cause disease in bacteria, plants, and animals.
- Viruses can be transmitted by any action that brings virus particles into contact with a host cell.
- Many viral diseases can be prevented through vaccination.
- A *vaccine* is a weakened form of a pathogen that prepares the immune system to recognize and destroy the pathogen.

Emerging Diseases

Key Idea: Emerging diseases are diseases that are newly recognized, that have spread to new areas or to a new host, or that have reemerged when a disease that was once considered under control begins to spread.

Emerging Diseases

- Diseases can spread to new areas or a new host when people come into contact with a pathogen in a different way than in the past.
- Environmental changes can cause diseases to emerge.
- Human behavior plays an important role in emerging disease.