Chapter 3 Microbiology

Key Terms

Bacilli
Bacteria
Bacteriology
Cocci
Contagious or communicable
Diplococci
Flagella or cilia
Fungi
General infection
HIV & AIDS
Immunity
Local infection
Microorganisms
Motile
Nonpathogenic
Pathogenic
Protozoa
Rickettsia
Saprophytes
Spirilla
Staphylococci
Streptococci
Viruses

Learning Objectives

After completing this chapter, you should be able to:

- List the types and classifications of bacteria.
- Understand how bacteria grow and reproduce.
- Understand the difference between pathogenic and nonpathogenic bacteria.
- Understand how contagious diseases are spread.
- Understand AIDS and how it is spread.

INTRODUCTION

There are many different types of **microorganisms** (meye-kroh-OR-gah-niz-ems), which are commonly referred to as microbes or germs. An understanding of how these germs grow and how they spread will help prevent both you and your client from contracting an infectious disease.

Bacteriology (bak-teer-ee-OL-o-jee) is the study of bacteria. *Bacteria* (bak-TEER-ee-ah) are the oldest, most abundant and simplest organisms on Earth. Bacteria are one-celled vegetable microorganisms that are present on and in everything you touch. They do not depend on other organisms to live and can live outside the human body. Although there are hundreds of different kinds of bacteria, they can all be classified as one of two types.

1. Nonpathogenic bacteria do not produce disease.

   All bacteria do not produce disease. Many are harmless, some are helpful, and others are essential for life on Earth. Helpful bacteria are used to produce yogurt, sauerkraut, pickles, and olives. Nitrogen-fixing bacteria convert nitrogen from the atmosphere into a form that can be used by plants. Other bacteria are necessary for the decomposition of organic matter, which improves the quality of soil for farming. **Saprophytes** (SAP-ro-fights) are **nonpathogenic** (non-path-o-JEN-ik) bacteria that live on dead matter and do not produce disease.

2. Pathogenic bacteria produce disease.

   All infectious disease begins when **pathogenic** (path-o-JEN-ik) germs enter the body. Most infectious diseases are caused by one of six types of pathogens. The most common are **bacteria** (bak-TEER-ee-a) and **viruses** (VY-rus-es). Hairstylists must practice proper disinfection and sanitation methods to protect themselves and their clients from the spread of disease in the salon.

CLASSIFICATIONS OF PATHOGENIC BACTERIA

Pathogenic bacteria cause tetanus, meningitis, scarlet fever, strep throat, tuberculosis, gonorrhea, syphilis, chlamydia, toxic shock syndrome, Legionnaires' disease, diphtheria, and food poisoning. The three main classes of pathogenic bacteria are determined by their distinctive shapes. (Fig. 3.1)

1. **Cocci** (KOK-si) are round-shaped organisms that appear alone or in groups. There are three groups of cocci: (Fig. 3.2)
   a) **Staphylococci** (staf-i-lo-KOK-si) grow in bunches or clusters. They are pus-forming and cause abscesses, pustules, and boils.
   b) **Streptococci** (strep-to-KOK-si) grow in chains. They are pus-forming and cause strep throat.
   c) **Diplococci** (dip-lo-KOK-si) grow in pairs and cause pneumonia.

Figure 3-1 *General forms of bacteria.*

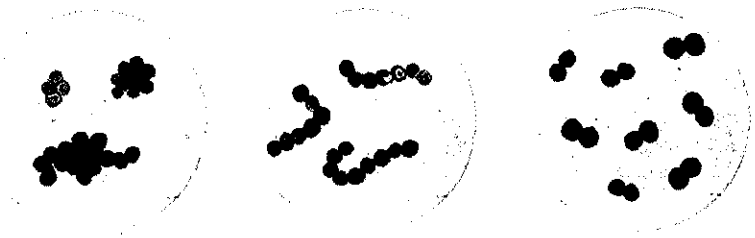

Figure 3-2 *Groupings of bacteria.*

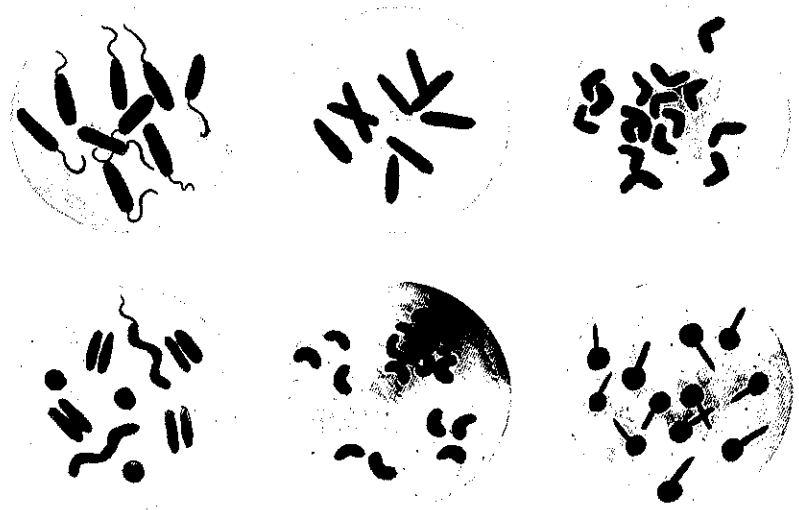

Figure 3-3 *Disease-producing bacteria.*

2. **Bacilli** (ba-SIL-I) are short rod-shaped organisms. They are the most common type of bacteria and cause tetanus, flu, typhoid fever, tuberculosis, and diphtheria. (Fig. 3.3)
3. **Spirilla** (sp-RIL-a) are spiraled organisms that cause syphilis and cholera.

MOVEMENT OF BACTERIA

Both bacilli and spirilla are **motile**, which means they have the ability to move by themselves. The whip-like motion of tiny hair-like projections, known as **flagella** (flah-JEL-a) or **cilia** (SIL-ee-a), propels bacteria through liquids. Cocci rarely show motility. They are spread through the air, in dust, and by contact with people and objects.

BACTERIAL GROWTH AND REPRODUCTION

The two distinct stages in the life cycle of bacteria are an active stage and an inactive stage.

1. **The Active or Vegetative Stage**

   Bacteria grow and reproduce during this stage. Warm, dark, damp places with sufficient food provide the most favorable conditions for rapid growth. Bacteria reproduce every one to three hours, by mitosis (see chapter 2). This rapid doubling of cells allows most bacteria to produce a population of billions in just one day.

2. **The Inactive or Spore-Forming Stage**

   In order to survive when conditions for growth are not favorable, some bacteria such as anthrax and tetanus become inactive and form spores resistant to heat and disinfectants. When favorable conditions return, the spores return to the active or vegetative stage, then grow and reproduce.

VIRUSES

Viruses (VY-rus-es) are much smaller than bacteria and do not have a cellular structure. Viruses depend on other organisms to live and reproduce, and unlike bacteria, viruses can't live outside of the body. Viruses are not killed or weakened by antibiotics as are bacteria. Viruses cause hepatitis, tuberculosis, measles, mumps, chicken pox, meningitis, rubella, influenza, warts, colds, herpes, shingles, genital warts, and AIDS.

The Human Immunodeficiency Virus (**HIV**) causes Acquired Immune Deficiency Syndrome (**AIDS**). HIV attacks white blood cells and destroys the body's ability to fight infection. The infections that strike people whose immune systems

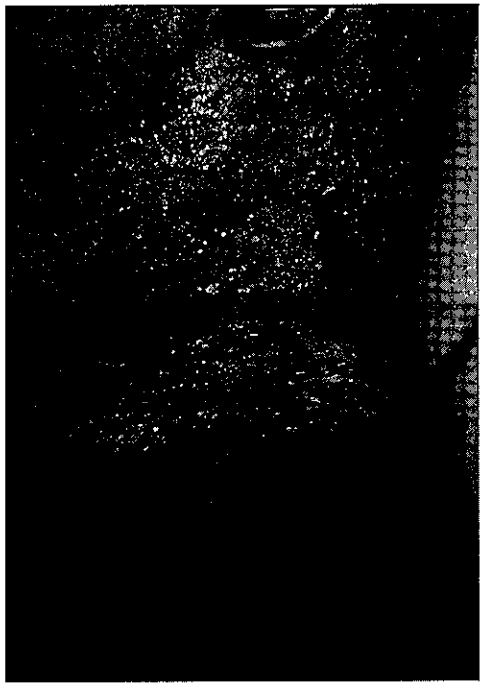

Figure 3-4 *Herpes Type II in an HIV-positive patient.*
(Courtesy Rube J. Pardo, M.D., Ph.D.)

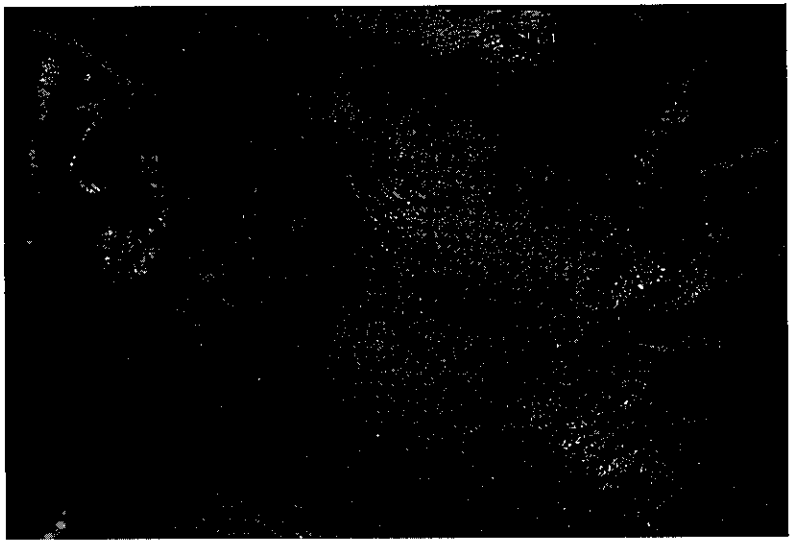

Figure 3-5 *Shingles on the neck and face of an HIV-positive patient.*
(Courtesy Rube J. Pardo, M.D., Ph. D.)

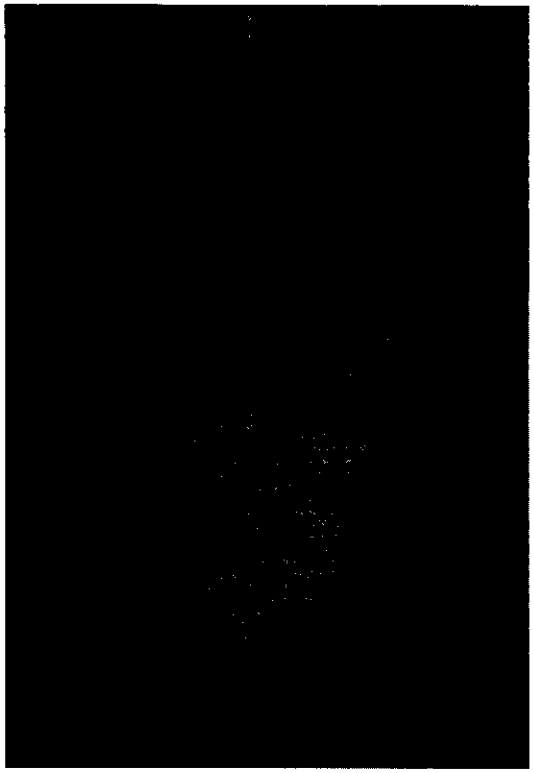

Figure 3-6 *Kaposi's sarcoma in an* AIDS (HIV-*positive) patient.*
(Courtesy Rube J. Pardo, M.D., Ph. D.)

are weakened by HIV include severe pneumonia and fungal infections of the mouth and esophagus. Those infected with HIV may also develop Kaposi's sarcoma and other unusual cancers.

In spite of what you may have heard, HIV cannot be spread through casual contact. HIV is only transmitted through exposure to infected blood, semen, or vaginal secretions. According to the American Red Cross, HIV is easily killed by alcohol, chlorine bleach, and other common disinfectants.

OTHER INFECTIOUS AGENTS

Fungi (FUN-ji) are plant parasites, such as molds, mildews, and yeasts that cause athlete's foot and ringworm.

Protozoa (PROH-toh-zoh-h) are animal-like organisms that cause malaria and dysentery.

Rickettsia cause typhus and Rocky Mountain spotted fever.

Animal parasites cause contagious diseases. The itch mite causes scabies and head lice cause pediculosis.

TYPES OF INFECTION

There are two types of infection.

1. A **local infection** is limited to a small, specific area and is indicated by a boil or pimple that contains pus.
2. A **general infection** is also called a *systemic infection* because the bloodstream carries the pathogens and toxins to all parts of the body.

Contagious (kon-TAY-jus) or **communicable** (ko-MYOO-ni-kah-bil) diseases are those that can be spread from one infected person to another. Infectious diseases are usually spread through contact by unclean hands, implements, and unsanitary salon conditions. Pathogens enter the body through open sores, breaks in the skin, and body openings such as the mouth, eyes, and nose.

IMMUNITY

Immunity (Im-MYOO-ni-tee) is the body's ability to destroy pathogens and resist disease. There are two types of immunity:

1. Natural immunity is a natural resistance to disease, which is partly inherited and the result of a healthy immune system.
2. Acquired immunity occurs after the body overcomes a disease or as a result of inoculation.

REVIEW QUESTIONS

1. What are bacteria?
2. List several diseases caused by bacteria.
3. What are viruses?
4. List several diseases caused by viruses.
5. What are pathogens?
6. How do bacteria multiply?
7. List and define the three forms of bacteria.
8. How do bacteria move about?
9. How do pathogens enter the body?

DISCUSSION QUESTIONS

1. What are microbes, microorganisms and germs?
2. How are most contagious diseases spread?
3. What can you do to prevent the spread of disease in the salon?
4. How can bacteria be destroyed?
5. How can viruses be destroyed?