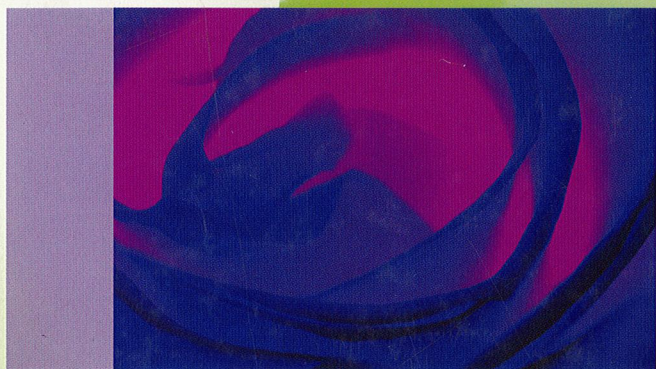


# **Health Science Career Exploration**



**Louise Simmers**



Three diseases of major concern to the health care worker are hepatitis B, hepatitis C, and acquired immune deficiency syndrome (AIDS).

**Hepatitis B**, or serum hepatitis, is caused by the HBV virus (figure 11-6B). It is transmitted by blood, serum, and other body secretions. It affects the liver and can lead to the destruction and scarring of liver cells. A vaccine has been developed to protect individuals from this disease. The vaccine is expensive and involves a series of three injections. Under federal law, employers must provide the vaccination at no cost to any health care worker with occupational exposure to blood or other body secretions that may carry the HBV virus. An individual does have the right to refuse the vaccination, but a written record must be kept proving that the vaccine was offered.

**Hepatitis C** is caused by the hepatitis C virus, or HCV. It is transmitted by blood and blood containing body fluids. Many individuals who contract the disease are asymptomatic (display no symptoms). Others have mild symptoms that are often diagnosed as influenza, or flu. In either case, HCV can cause serious liver damage. At present there is no preventive immunization, but a vaccine is being developed. Both HBV and

HCV are extremely difficult to destroy. These viruses can even remain active for several days in dried blood.

Health care workers must take every precaution to protect themselves from hepatitis viruses.

**Acquired immune deficiency syndrome** is caused by the human immunodeficiency virus (HIV). It suppresses the immune system. An individual with AIDS cannot fight off many cancers and infections that would not affect a healthy person. Presently there is no cure and no vaccine available. A variety of medications are used to treat the patient's symptoms and slow the progress of the disease. It is important for the health care worker to take precautions to prevent the spread of this disease.

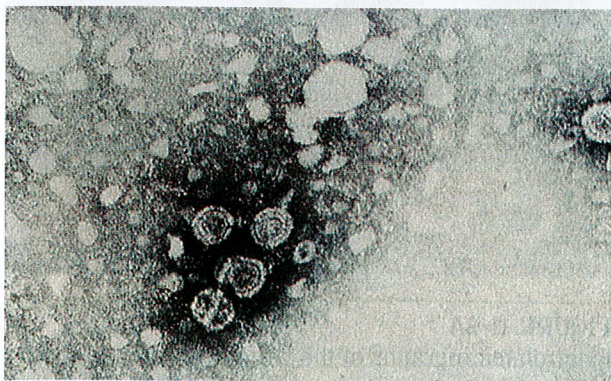
In order to grow and reproduce, microorganisms need certain things. The human body is the ideal supplier of all of the requirements of microorganisms. The basic requirements include:

- A warm environment: body temperature is ideal
- Darkness: preferred by most microorganisms; many are killed quickly by sunlight
- Source of food and moisture
- **Aerobic** organisms: require oxygen to live
- **Anaerobic** organisms: live and reproduce in the absence of oxygen

## TYPES OF INFECTION

Infections and diseases are classified as endogenous, exogenous, nosocomial, or opportunistic:

- **Endogenous:** means the infection or disease originates within the body. These include metabolic disorders, congenital (present at birth) abnormalities, tumors, and infections caused by microorganisms within the body.



**FIGURE 11-6B**

Electron micrograph of the hepatitis B virus. (Courtesy of the Centers for Disease Control and Prevention, Atlanta, GA)



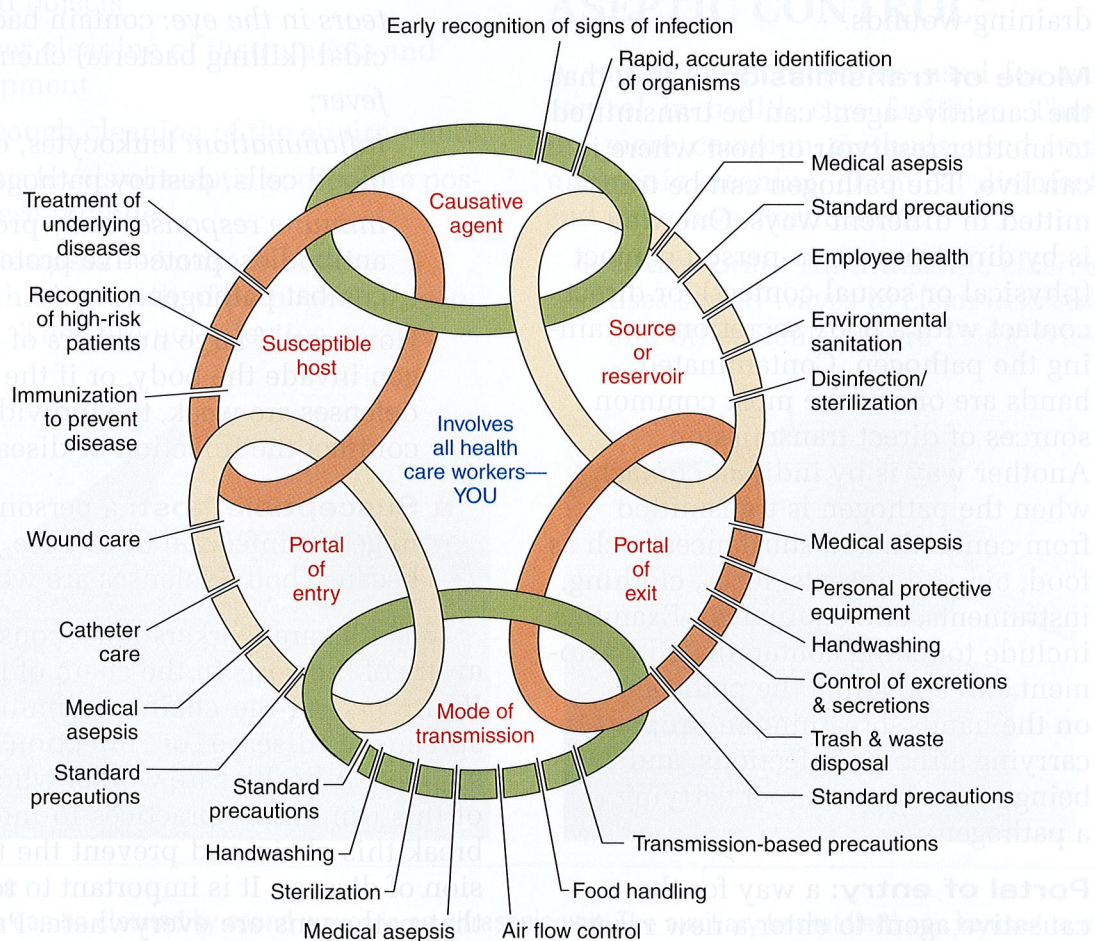
- **Exogenous:** means the infection or disease originates outside the body. Examples include pathogenic organisms that invade the body, radiation, chemical agents, trauma, electric shock, and temperature extremes.
- **Nosocomial:** an infection acquired by an individual in a health care facility such as a hospital or long-term care facility. Nosocomial infections are usually present in the facility. They are transmitted by health care workers to the patient. Many of the pathogens transmitted in this manner are antibiotic-resistant and can cause serious and even life-threatening infections in patients. Common examples are staphylococcus, pseudomonas, and enterococci. Infection-control programs are used in health care

facilities to prevent and deal with nosocomial infections.

- **Opportunistic:** infections that occur when the body's defenses are weak. These diseases do not usually occur in individuals with intact immune systems. Examples include the development of Kaposi's sarcoma (a rare type of cancer) or *Pneumocystis carinii* pneumonia in individuals with AIDS.

## CHAIN OF INFECTION

In order for disease to occur and spread from one individual to another, certain conditions must be met. These conditions are commonly called the **chain of infection** (figure 11-7). The parts of the chain include:



**FIGURE 11-7**  
The components in the chain of infection and the ways in which the chain can be broken.



■ **Causative agent:** a pathogen, such as a bacterium or virus that can cause a disease.

■ **Reservoir:** an area where the causative agent can live. Some common reservoirs include the human body, animals, the environment, and **fomites**, or objects contaminated with infectious material that contains the pathogens. Common fomites include doorknobs, bedpans, urinals, linens, instruments, and specimen containers.

■ **Portal of exit:** a way for the causative agent to escape from the reservoir in which it has been growing. In the human body, pathogens can leave the body through urine, feces, saliva, blood, tears, mucus discharge, sexual secretions, and draining wounds.

■ **Mode of transmission:** a way that the causative agent can be transmitted to another reservoir or host where it can live. The pathogen can be transmitted in different ways. One way is by direct person-to-person contact (physical or sexual contact), or direct contact with a body secretion containing the pathogen. Contaminated hands are one of the most common sources of direct transmission. Another way is by indirect contact, when the pathogen is transmitted from contaminated substances such as food, air, soil, insects, feces, clothing, instruments, and equipment. Examples include touching contaminated equipment and spreading the pathogen on the hands, breathing in droplets carrying airborne infections, and being bitten by an insect carrying a pathogen.

■ **Portal of entry:** a way for the causative agent to enter a new reservoir or host. Some ways pathogens

can enter the body are through breaks in the skin, breaks in the mucous membrane, the respiratory tract, the digestive tract, the genitourinary tract, and the circulatory system. If the defense mechanisms of the body are intact and the immune system is functioning, a human can frequently fight off the causative agent and not contract the disease. Body defenses include:

*mucous membrane:* lines the respiratory, digestive, and reproductive tracts and traps pathogens;

*cilia:* tiny, hairlike structures that line the respiratory tract and propel pathogens out of the body;

*coughing and sneezing;*

*hydrochloric acid:* destroys pathogens in the stomach;

*tears in the eye:* contain bactericidal (killing bacteria) chemicals;

*fever;*

*inflammation:* leukocytes, or white blood cells, destroy pathogens;

*immune response:* body produces antibodies, protective proteins that combat pathogens

However, if large numbers of a pathogen invade the body, or if the body defenses are weak, the individual can contract the infection or disease.

■ **Susceptible host:** a person likely to get an infection or disease, usually because body defenses are weak.

Health care workers must constantly be aware of the parts in the chain of infection. If any part of the chain is eliminated, the spread of disease or infection will be stopped. A health care worker who is aware of this can follow practices to interrupt or break this chain and prevent the transmission of disease. It is important to remember that pathogens are everywhere. Preventing their transmission is a continuous process.



## ASEPTIC TECHNIQUES

A major way to break the chain of infection is to use aseptic techniques while providing health care. **Asepsis** is defined as the absence of disease-producing microorganisms, or pathogens. **Sterile** means free from all organisms, both pathogenic and nonpathogenic, including spores and viruses. **Contaminated** means that organisms and pathogens are present. Any object or area that may contain pathogens is considered to be contaminated. Aseptic techniques are directed toward maintaining cleanliness and eliminating or preventing contamination. Common aseptic techniques include:

- Handwashing
- Good personal hygiene
- Use of disposable gloves when contacting body secretions or contaminated objects
- Proper cleaning of instruments and equipment
- Thorough cleaning of the environment

Various levels of aseptic control are possible. These include:

- **Antisepsis**—Antiseptics prevent or inhibit growth of pathogenic organisms. They are not effective against

spores and viruses. They can usually be used on the skin. Common examples include alcohol and betadine.

- **Disinfection**—This is a process that destroys or kills pathogenic organisms. It is not always effective against spores and viruses. Chemical disinfectants are used in this process. Disinfectants can irritate or damage the skin and are used mainly on objects, not people.
- **Sterilization**—This is a process that destroys all microorganisms, both pathogenic and nonpathogenic, including spores and viruses. Steam under pressure, gas, radiation, and chemicals can be used to sterilize objects.

## METHODS OF ASEPTIC CONTROL

A variety of methods are used for aseptic control in health care facilities. Three of the more common methods used include ultrasonic cleaning, chemical disinfection, and autoclave sterilization.

- **Ultrasonic:** An ultrasonic cleaner uses sound waves to clean instruments and other items (figure 11-8). When





**FIGURE 11-8**

Instruments can be cleaned by sound waves in an ultrasonic unit. The auxiliary basket (left) can be used to clean larger items. Glass beakers (right) can be used to clean smaller items.



## 11:3 OBSERVING STANDARD PRECAUTIONS

  In order to prevent the spread of pathogens and disease, the chain of infection must be broken. The standard precautions discussed in this chapter are an important way health care workers can break this chain.

## BLOODBORNE PATHOGENS STANDARD

One of the main ways that pathogens are spread is by blood and body fluids. Three pathogens of major concern are the hepatitis B virus (HBV), the hepatitis C virus (HCV), and the human immunodeficiency virus (HIV), which causes AIDS. Consequently, extreme care must be taken at all times when an area, object, or person is contaminated with blood or body fluids. In 1991, the Occupational Safety and Health Administration (OSHA) established *Bloodborne Pathogen Standards* that must be followed by all health care facilities. The employer faces civil penalties if the regulations are not implemented by the employer and followed by the employees. These regulations require all health care facility employers to:

- Develop a written exposure control plan, and update it annually, to minimize or eliminate employee exposure to bloodborne pathogens.
- Identify all employees who have occupational exposure to blood or potentially infectious materials such as semen, vaginal secretions, and other body fluids.
- Provide hepatitis B vaccine free of charge to all employees who have occupational exposure, and obtain a

written release form signed by any employee who does not want the vaccine.

- Provide **personal protective equipment (PPE)** such as gloves, gowns, lab coats, masks, and face shields in appropriate sizes and in accessible locations.
- Provide adequate handwashing facilities and supplies.
- Ensure that the worksite is maintained in a clean and sanitary condition, follow measures for immediate decontamination of any surface that comes in contact with blood or infectious materials, and dispose of infectious waste correctly.
- Enforce rules of no eating, drinking, smoking, applying cosmetics or lip balm, handling contact lenses, and mouth pipetting or suctioning in any area that can be potentially contaminated by blood or other body fluids.
- Provide appropriate containers that are color coded (fluorescent orange or orange-red) and labeled for contaminated sharps (needles, scalpels) and other infectious or biohazard wastes.
- Post signs at the entrance to work areas where there is occupational exposure to biohazardous materials.
- Provide a confidential medical evaluation and follow-up for any employee who has an exposure incident. Examples might include an accidental needlestick or the splashing of blood or body fluids on the skin, eyes, or mucous membranes.
- Provide training about the regulations and all potential biohazards to all employees at no cost during working hours, and provide additional education as needed when procedures or working conditions are changed or modified.