

A disease that is caused by a microorganism, such as a bacterium, virus, or protozoan, that is not normally found in the body and is capable of causing infection. Some, but not all, infectious diseases are contagious, meaning they can spread from person to person. Other infectious diseases can spread from animals or insects to humans, but not from person to person. HIV is both infectious and contagious. When health is not altered, the process is called a subclinical infection. Thus, a person may be infected but not have an infectious disease. This principle is illustrated by the use of vaccines for the prevention of infectious diseases. For example, a virus such as that which causes measles may be attenuated (weakened) and used as an immunizing agent. The immunization is designed to produce a measles infection in the recipient but generally causes no discernible alteration in the state of health. It produces immunity to measles without producing a clinical illness (an infectious disease). The most important barriers to invasion of the human host by infectious agents are the skin and mucous membranes (the tissues that line the nose, mouth, and upper respiratory tract). When these tissues have been broken or affected by earlier disease, invasion by infectious agents may occur. These infectious agents may produce a local infectious disease, such as boils, or may invade the bloodstream and be carried throughout the body, producing generalized bloodstream infection (septicemia) or localized infection at a distant site, such as meningitis (an infection of the coverings of the brain and spinal cord). Infectious agents swallowed in food and drink can attack the wall of the intestinal tract and cause local or general disease. The conjunctiva, which covers the front of the eye, may be penetrated by viruses that cause a local inflammation of the eye or that pass into the bloodstream and cause a severe general disease, such as smallpox. Infectious agents

can enter the body through the genital tract, causing the acute inflammatory reaction of gonorrhea in the genital and pelvic organs or spreading out to attack almost any organ of the body with the more chronic and destructive lesions of syphilis. Even before birth, viruses and other infectious agents can pass through the placenta and attack developing cells, so that an infant may be diseased or deformed at birth. From conception to death, humans are targets for attack by multitudes of other living organisms, all of them competing for a place in the common environment. The air people breathe, the soil they walk on, the waters and vegetation around them, the buildings they inhabit and work in, all can be populated with forms of life that are potentially dangerous. Domestic animals may harbour organisms that are a threat, and wildlife teems with agents of infection that can afflict humans with serious disease. However, the human body is not without defenses against these threats, for it is equipped with a comprehensive immune system that reacts quickly and specifically against disease organisms when they attack. Survival throughout the ages has depended largely on these reactions, which today are supplemented and strengthened through the use of medical drugs.

The agents of infection can be divided into different groups on the basis of their size, biochemical characteristics, or manner in which they interact with the human host. The groups of organisms that cause infectious diseases are categorized as bacteria, viruses, fungi, and parasites. Bacteria can survive within the body but outside individual cells. Some bacteria, classified as aerobes, require oxygen for growth, while others, such as those normally found in the small intestine of healthy persons, grow only in the absence of oxygen and, therefore, are called anaerobes. Most bacteria are surrounded by a capsule that appears to play an important role in their abil-

ity to produce disease. Also, a number of bacterial species give off toxins that in turn may damage tissues. Bacteria are generally large enough to be seen under a light microscope. Streptococci, the bacteria that cause scarlet fever, are about 0.75 micrometre (0.00003 inch) in diameter. The spirochetes, which cause syphilis, leptospirosis, and rat-bite fever, are 5 to 15 micrometres long. Bacterial infections can be treated with antibiotics. Bacterial infections are commonly caused by pneumococci, staphylococci, and streptococci, all of which are often commensals (that is, organisms living harmlessly on their hosts) in the upper respiratory tract but that can become virulent and cause serious conditions, such as pneumonia, septicemia (blood poisoning), and meningitis. The pneumococcus is the most common cause of lobar pneumonia, the disease in which one or more lobes, or segments, of the lung become solid and airless as a result of inflammation. Staphylococci affect the lungs either in the course of staphylococcal septicemia—when bacteria in the circulating blood cause scattered abscesses in the lungs—or as a complication of a viral infection, commonly influenza—when these organisms invade the damaged lung cells and cause a life-threatening form of pneumonia. Streptococcal pneumonia is the least common of the three and occurs usually as a complication of influenza or other lung disease.

Pneumococci often enter the bloodstream from inflamed lungs and cause septicemia, with continued

fever but no other special symptoms. Staphylococci produce a type of septicemia with high spiking fever; the bacteria can reach almost any organ of the body—including the brain, the bones, and especially the lungs—and destructive abscesses form in the infected areas. Streptococci also cause septicemia with fever, but the organisms tend to cause inflammation of surface lining cells rather than abscesses—for example, pleurisy (inflammation of the chest lining) rather than lung abscess, and peritonitis (inflammation of the membrane lining the abdomen) rather than liver abscess. In the course of either of the last two forms of septicemia, organisms may enter the nervous system and cause streptococcal or staphylococcal meningitis, but these are rare conditions. Pneumococci, on the other hand, often spread directly into the central nervous system, causing one of the common forms of meningitis. Staphylococci and streptococci are common causes of skin diseases. Boils and impetigo (in which the skin is covered with blisters, pustules, and yellow crusts) may be caused by either. Staphylococci also can cause a severe skin infection that strips the outer skin layers off the body and leaves the underlayers exposed, as in severe burns, a condition known as toxic epidermal necrolysis. Streptococcal organisms can cause a severe condition known as necrotizing fasciitis, commonly referred to as flesh-eating disease, which has a fatality rate between 25 and 75 percent. Streptococci can be the cause of the red cellulitis of the skin known as erysipelas.