

Study Outline Chapter 15

Introduction (p. 421)

- Pathogenicity is the ability of a pathogen to produce a disease by overcoming the defenses of the host.
- Virulence is the degree of pathogenicity.

Entry of a Microorganism into the Host (pp. 421- 425)

- The specific route by which a particular pathogen gains access to the body is called its portal of entry.

Portals of Entry (pp. 421- 423)

- Many microorganisms can penetrate mucous membranes of the conjunctiva and the respiratory, gastrointestinal, and genitourinary tracts.
- Microorganisms that are inhaled with droplets of moisture and dust particles gain access to the respiratory tract.
- The respiratory tract is the most common portal of entry.
- Microorganisms that gain access via the genitourinary tract can enter the body through mucous membranes.
- Microorganisms enter the gastrointestinal tract via food, water, and contaminated fingers.
- Most microorganisms cannot penetrate intact skin; they enter hair follicles and sweat ducts.
- Some fungi infect the skin itself.
- Some microorganisms can gain access to tissues by inoculation through the skin and mucous membranes in bites, injections, and other wounds. This route of penetration is called the parenteral route.

The Preferred Portal of Entry (p. 423)

- Many microorganisms can cause infections only when they gain access through their specific portal of entry.

Numbers of Invading Microbes (p. 423)

- Virulence can be expressed as LD50 (lethal dose for 50% of the inoculated hosts) or ID50 (infectious dose for 50% of the inoculated hosts).

Adherence (p. 423- 425)

- Surface projections on a pathogen called adhesins (ligands) adhere to complementary receptors on the host cells.
- Adhesins can be glycoproteins or lipoproteins and are frequently associated with fimbriae.
- Mannose is the most common receptor.

How Bacterial Pathogens Penetrate Host Defenses (pp. 425- 427)

Capsules (pp. 425- 426)

- Some pathogens have capsules that prevent them from being phagocytized.

Components of the Cell Wall (p. 426)

- Proteins in the cell wall can facilitate adherence or prevent a pathogen from being phagocytized.
- Some microbes can reproduce inside phagocytes.

Enzymes (p. 426)

- Leukocidins destroy neutrophils and macrophages.
- Hemolysins lyse red blood cells.
- Local infections can be protected in a fibrin clot caused by the bacterial enzyme coagulase.
- Bacteria can spread from a focal infection by means of kinases (which destroy blood clots), hyaluronidase (which destroys a mucopolysaccharide that holds cells together), and collagenase (which hydrolyzes connective tissue collagen).

Penetration into Host Cells (p. 427)

- *Salmonella* bacteria produce invasins, proteins that cause the actin of the host cell's cytoskeleton to form a basket to carry the bacteria into the cell.

How Bacterial Pathogens Damage Host Cells (pp. 427- 431)

Direct Damage (p. 427)

- Host cells can be destroyed when pathogens metabolize and multiply inside the host cells.

The Production of Toxins (pp. 427- 431)

- Poisonous substances produced by microorganisms are called toxins; toxemia refers to the presence of toxins in the blood. The ability to produce toxins is called toxigenicity.
- Exotoxins are produced by bacteria and released into the surrounding medium. Exotoxins, not the bacteria, produce the disease symptoms.
- Antibodies produced against exotoxins are called antitoxins.
- Cytotoxins include diphtheria toxin (which inhibits protein synthesis) and erythrogenic toxins (which damage capillaries).
- Neurotoxins include botulinum toxin (which prevents nerve transmission) and tetanus toxin (which prevents inhibitory nerve transmission).
- *Vibrio cholerae* toxin and staphylococcal enterotoxin are enterotoxins, which induce fluid and electrolyte loss from host cells.
- Endotoxins are lipopolysaccharides (LPS), the lipid A component of the cell wall of gram-negative bacteria.
- Bacterial cell death, antibiotics, and antibodies may cause the release of endotoxins.
- Endotoxins cause fever (by inducing the release of interleukin-1) and shock (because of a TNF-induced decrease in blood pressure).
- Endotoxins allow bacteria to cross the blood-brain barrier.
- The *Limulus* amoebocyte lysate (LAL) assay is used to detect endotoxins in drugs and on medical devices.

Plasmids, Lysogeny, and Pathogenicity (pp. 431- 432)

- Plasmids may carry genes for antibiotic resistance, toxins, capsules, and fimbriae.

- Lysogenic conversion can result in bacteria with virulence factors, such as toxins or capsules.

Pathogenic Properties of Nonbacterial Microorganisms (pp. 432- 436)

Viruses (pp. 432- 434)

- Viruses avoid the host's immune response by growing inside cells.
- Viruses gain access to host cells because they attachment sites for receptors on the host cell.
- Visible signs of viral infections are called cytopathic effects (CPE).
- Some viruses cause cytotoxic effects (cell death), and others cause noncytotoxic effects (damage but not death).
- Cytopathic effects include the stopping of mitosis, lysis, the formation of inclusion bodies, cell fusion, antigenic changes, chromosomal changes, and transformation.

Fungi, Protozoa, Helminths, and Algae (pp. 434-435)

- Symptoms of fungal infections can be caused by capsules, toxins, and allergic responses.
- Symptoms of protozoan and helminthic diseases can be caused by damage to host tissue or by the metabolic waste products of the parasite..
- Some protozoa change their surface antigens while growing in a host so that the host's antibodies don't kill the protozoa.
- Some algae produce neurotoxins that cause paralysis when ingested by humans.