Pathogenesis of Bacterial Infection

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Subjects in this lecture

- Introduction about bacteria infection
- Glossary
- Transmission of Infection
- Infection process
- Virulence factors of bacteria

Introduction

- The pathogenesis of bacterial infection includes initiation of the infectious process and the mechanisms that lead to the development of signs and symptoms of disease.
- Characteristics of bacteria that are pathogens include transmissibility, adherence to host cells, invasion of host cells and tissues, toxigenicity, and ability to evade the host's immune system.
- Disease occurs if the bacteria or immunologic reactions to their presence cause sufficient harm to the person.

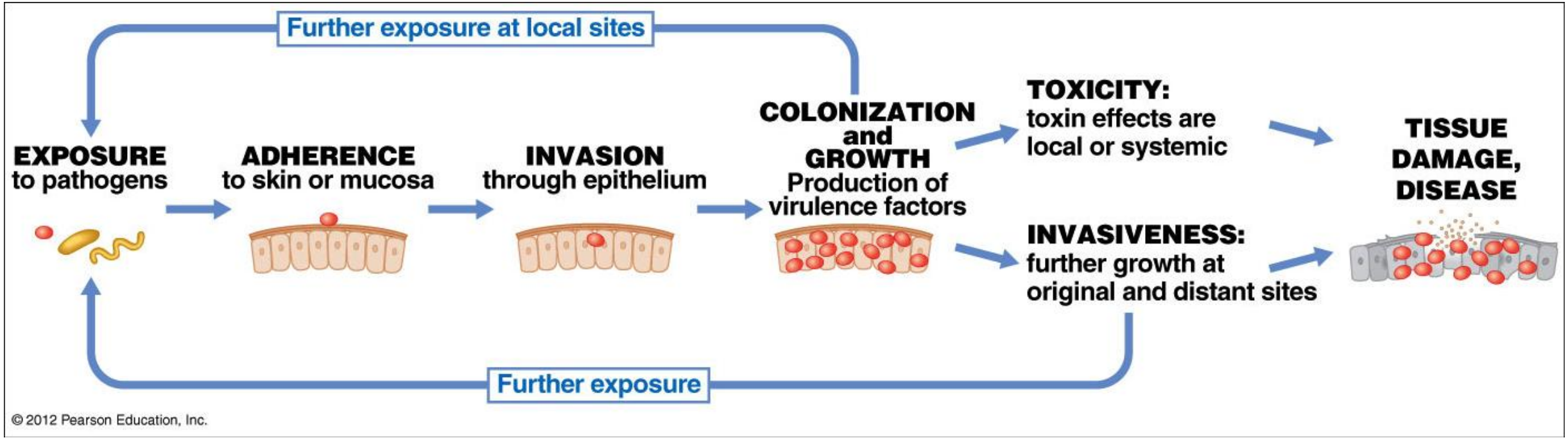
Glossary

- **Adherence (adhesion, attachment):** The process by which bacteria stick to the surfaces of host cells. Once bacteria have entered the body, adherence is a major initial step in the infection process. The terms adherence, adhesion, and attachment are often used interchangeably.
- **Carrier:** A person or animal with asymptomatic infection that can be transmitted to another susceptible person or animal.
- **Infection:** Multiplication of an infectious agent within the body. Multiplication of the bacteria that are part of the normal flora of the gastrointestinal tract, skin, etc, is generally not considered an infection; on the other hand, multiplication of pathogenic bacteria (eg, *Salmonella* species)—even if the person is asymptomatic—is deemed an infection.

- **Invasion:** The process whereby bacteria, animal parasites, fungi, and viruses enter host cells or tissues and spread in the body.
- **Nonpathogen:** A microorganism that does not cause disease; may be part of the normal flora.
- **Opportunistic pathogen:** An agent capable of causing disease only when the host's resistance is impaired (ie, when the patient is "immunocompromised").

- **Pathogen:** A microorganism capable of causing disease.
- **Pathogenicity:** The ability of an infectious agent to cause disease.
- **Toxigenicity:** The ability of a microorganism to produce a toxin that contributes to the development of disease.
- **Virulence:** The quantitative ability of an agent to cause disease. Virulent agents cause disease when introduced into the host in small numbers. Virulence involves adherence, invasion, and toxigenicity.

Pathogenesis steps



Transmission of Infection

- Bacteria (and other microorganisms) adapt to the environment, including animals and humans, where they normally reside and subsist.
- 1. Animal source
- 2. Inadvertent
- 3. Contamination
- 4. Person to person

- Some bacteria that commonly cause disease in humans exist primarily in animals and incidentally infect humans. For example, *Salmonella* and *Campylobacter* species typically infect animals and are transmitted in food products to humans.

- Other bacteria produce infection of humans that is inadvertent, a mistake in the normal life cycle of the organism; the organisms have not adapted to humans, and the disease they produce may be severe. For example,
- *Y pestis* (plague) has a well-established life cycle in rodents and rodent fleas, and transmission by the fleas to humans is inadvertent;
- *Bacillus anthracis* (anthrax) lives in the environment, occasionally infects animals, and is transmitted to humans by products such as raw hair from infected animals.
- The *Clostridium* species are ubiquitous in the environment and are transmitted to humans by ingestion (eg, *C perfringens* gastroenteritis and *C botulinum* [botulism]) or when wounds are contaminated by soil (eg, *C perfringens* [gas gangrene] and *C tetani* [tetanus]).

- The clinical manifestations of diseases (eg, diarrhea, cough, genital discharge) produced by microorganisms often promote transmission of the agents. Examples of clinical syndromes and how they enhance transmission of the causative bacteria are as follows:
- *Vibrio cholerae* can cause voluminous diarrhea which may contaminate salt and fresh water; drinking water or seafood such as oysters and crabs may be contaminated; ingestion of contaminated water or seafood can produce infection and disease.
- Similarly, contamination of food products with sewage containing *E coli* that cause diarrhea results in transmission of the bacteria.
- *M tuberculosis* (tuberculosis) naturally infects only humans; it produces respiratory disease with cough and production of aerosols, resulting in transmission of the bacteria from one person to another.

- Many bacteria are transmitted from one person to another on hands.
- A person with *S aureus* carriage in the anterior nares may rub his nose, pick up the staphylococci on the hands, and spread the bacteria to other parts of the body or to another person, where infection results.
- Many opportunistic pathogens that cause nosocomial infections are transmitted from one patient to another on the hands of hospital personnel. Hand washing is thus an important component of infection control.

- The most frequent **portals of entry of pathogenic bacteria** into the body are the sites where mucous membranes meet with the skin: respiratory (upper and lower airways), gastrointestinal (primarily mouth), genital, and urinary tracts. Abnormal areas of mucous membranes and skin (eg, cuts, burns, and other injuries) are also frequent sites of entry. Normal skin and mucous membranes provide the primary defense against infection. To cause disease, pathogens must overcome these barriers.