

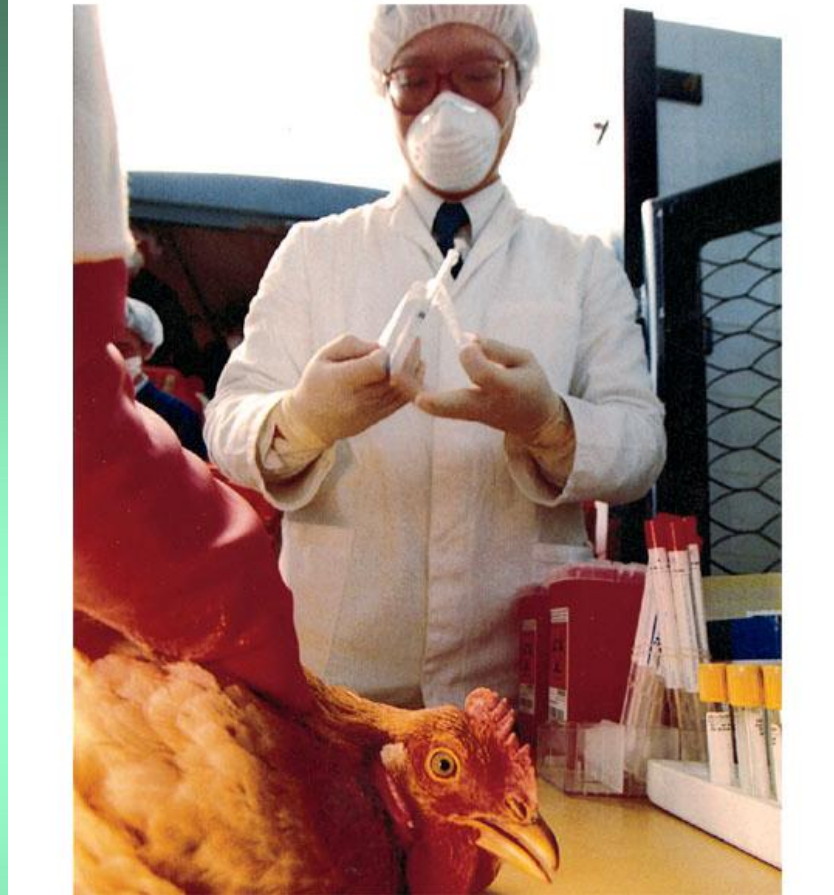
Foundations in Microbiology

Fifth Edition

Talaro

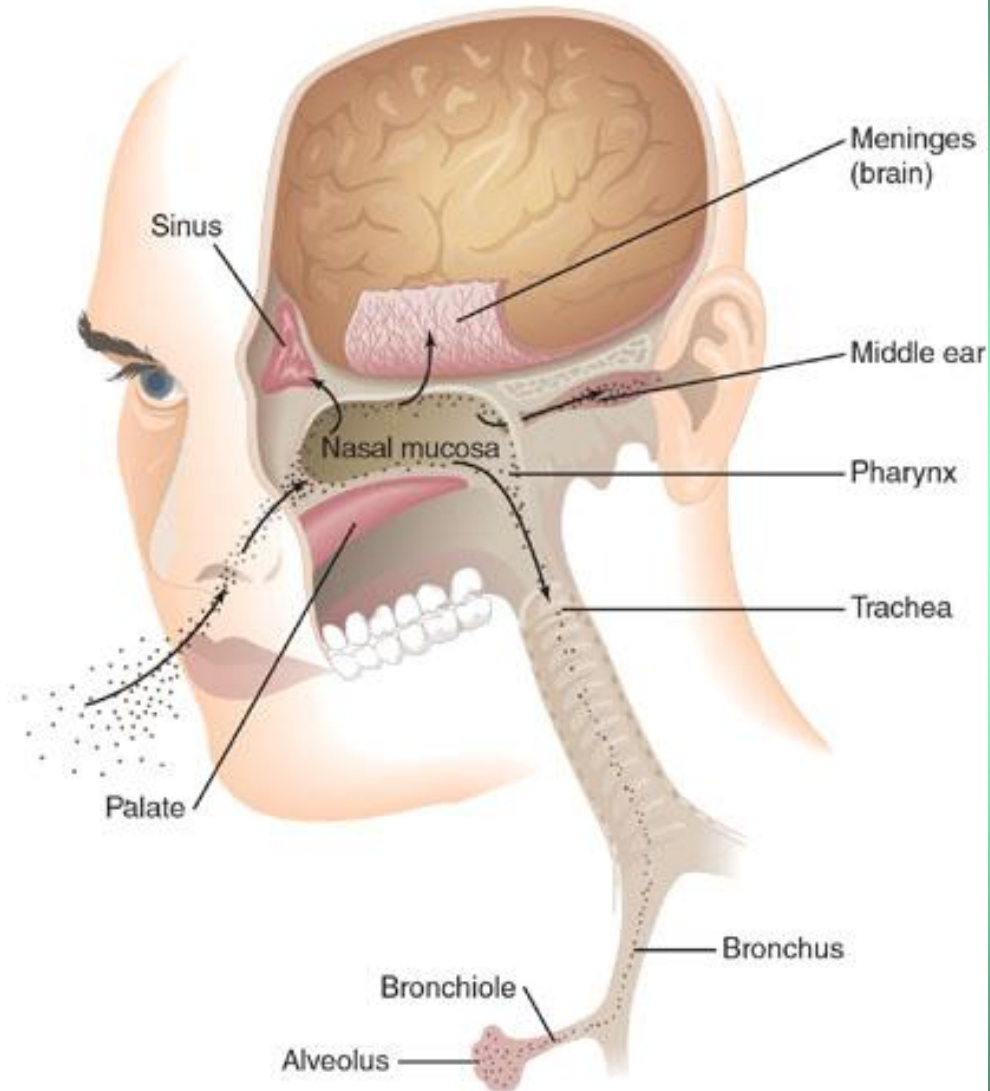
Chapter

13



Microbe-Human Interactions: Infection and Disease

Chapter 13



CONTACT
Microbes are picked up on exposed areas of the body

ADVERSE EFFECTS

Microbes cross lines of defense and enter sterile tissues

Microbes become established and grow in tissues
Carrier state occurs

Effect of microbes is injury or disruption of tissues

Morbidity occurs
Mortality occurs

INVASION

INFECTION

DISEASE

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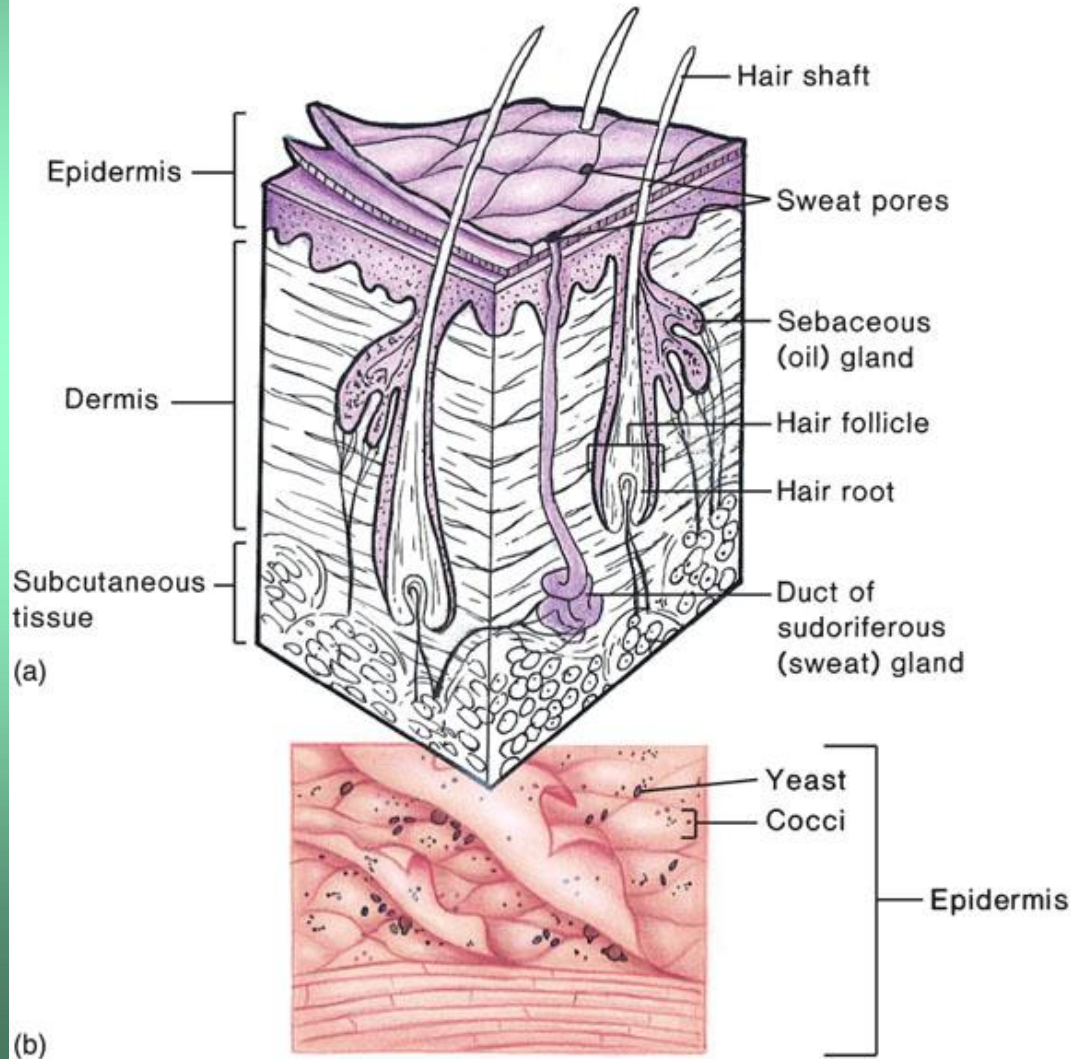
- **Infection**- a condition in which pathogenic microbes penetrate host defenses, enter tissues & multiply
- **Disease** – any deviation from health, disruption of a tissue or organ caused by microbes or their products

Resident flora

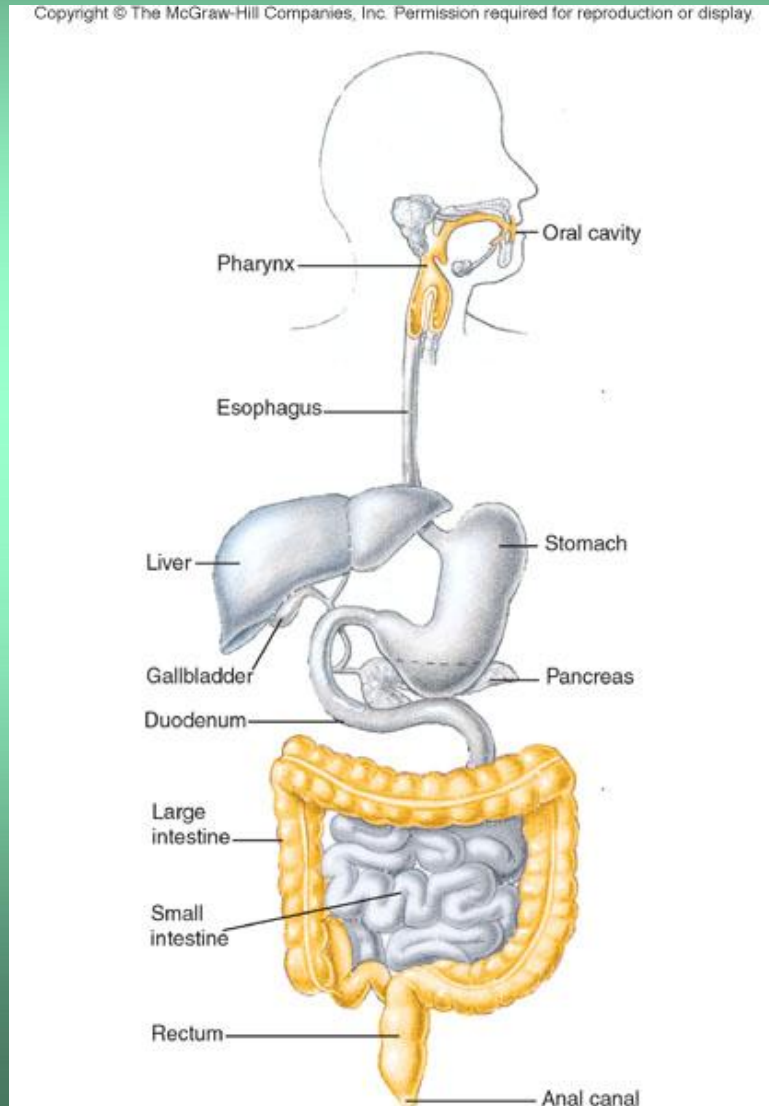
- includes bacteria, fungi, protozoa, viruses and arthropods
- most areas of the body in contact with the outside environment harbor resident microbes; large intestine has the highest numbers of bacteria
- internal organs & tissues & fluids are microbe-free
- bacterial flora benefit host by preventing overgrowth of harmful microbes

Landscape of the skin

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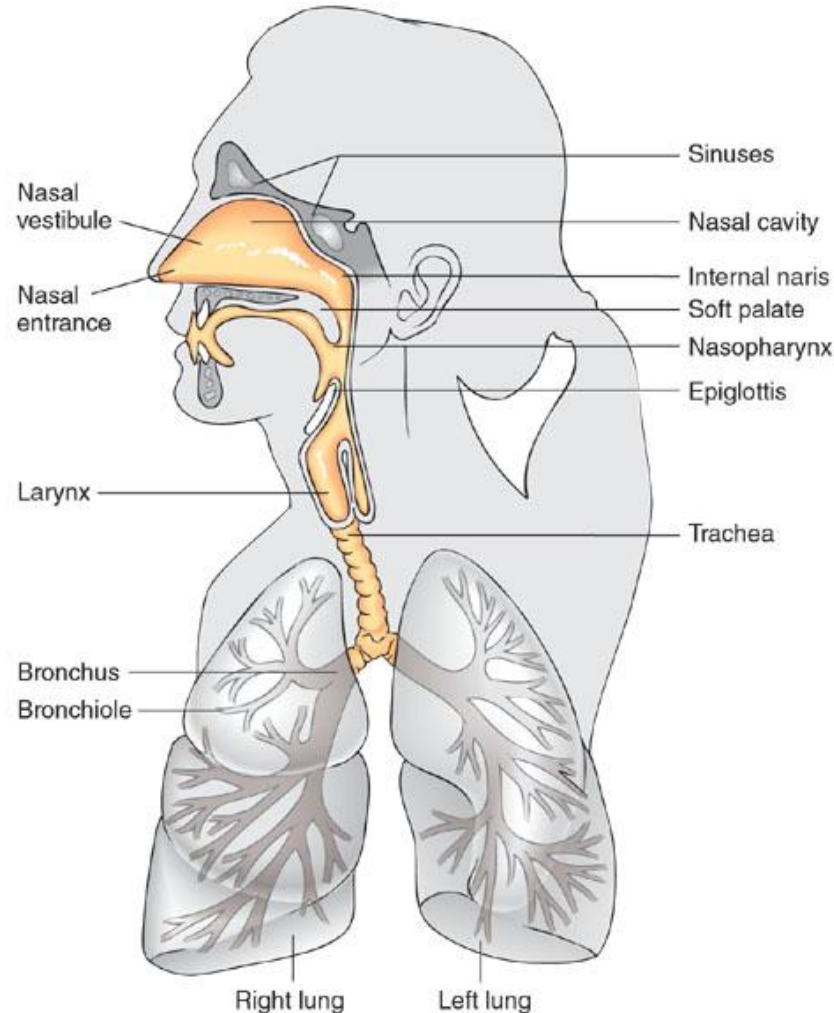


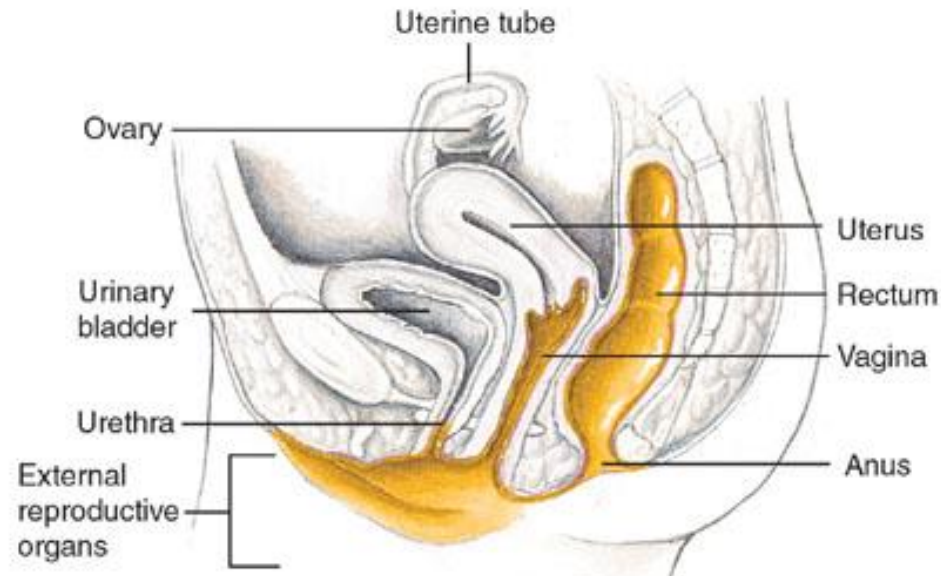
Distribution of flora



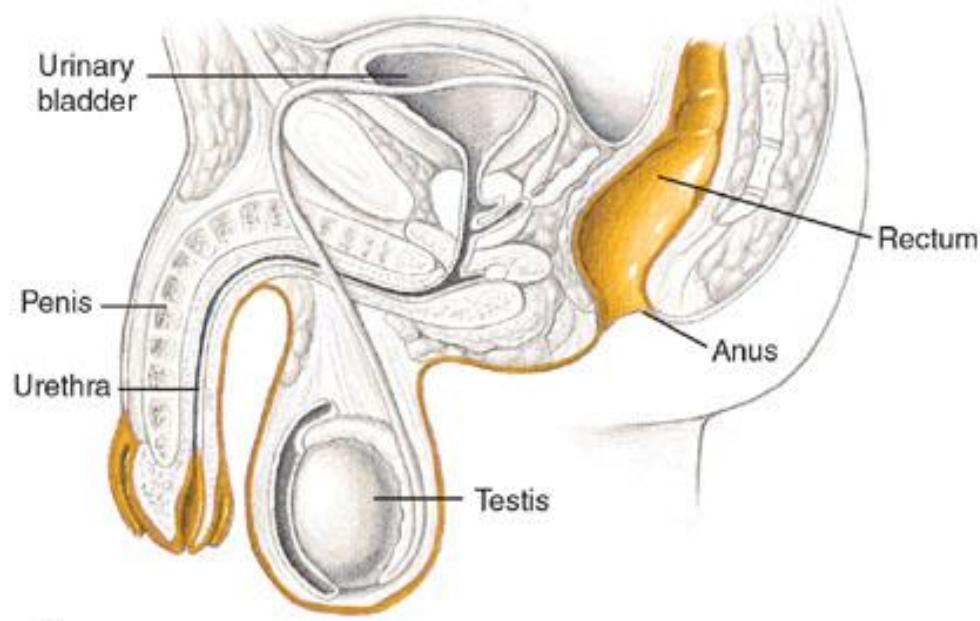
Colonized regions of the respiratory tract

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(a)

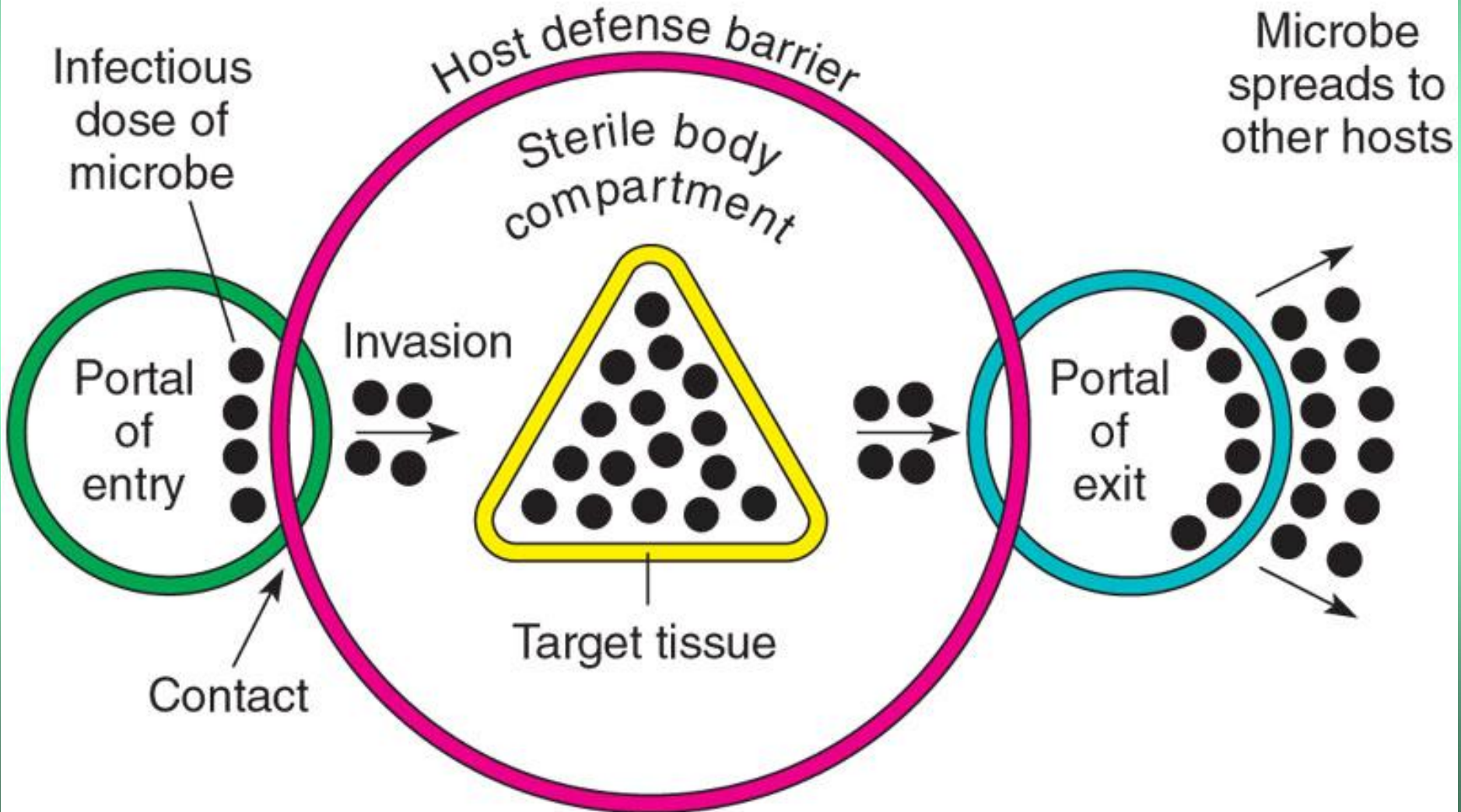


(b)

- **True pathogens** – capable of causing disease in healthy persons with normal immune defenses
 - Influenza virus, plague bacillus, malarial protozoan
- **Opportunistic pathogens** – cause disease when the host's defenses are compromised or when they grow in part of the body that is not natural to them
 - *Pseudomonas sp* & *Candida albicans*

Overview of infection

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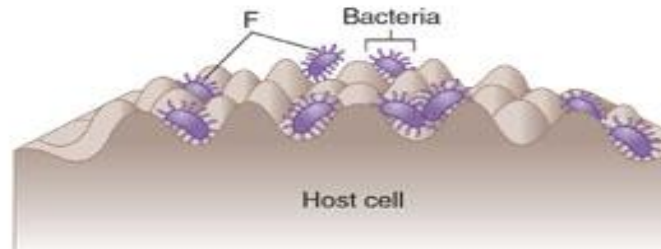


Portals of entry

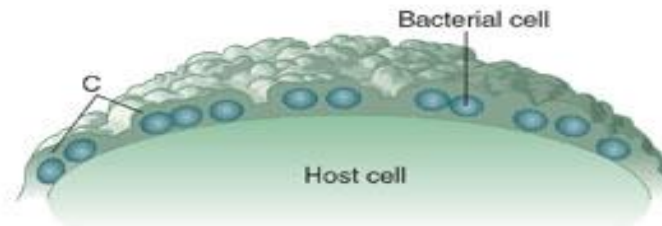
- skin
- gastrointestinal tract
- respiratory tract
- urogenital tract

Mechanisms of adhesion

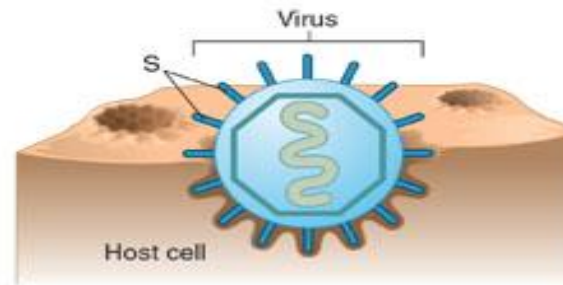
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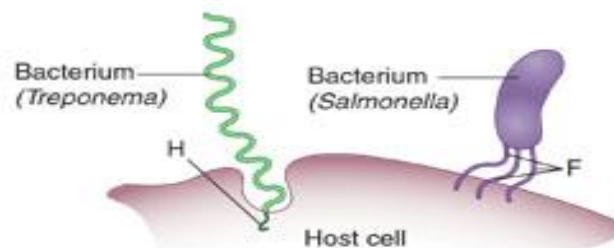
(a) Fimbriae



(b) Capsules



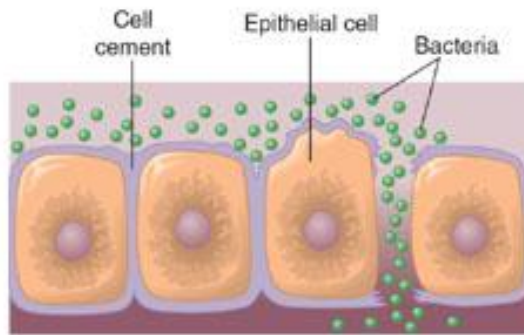
(c) Spikes



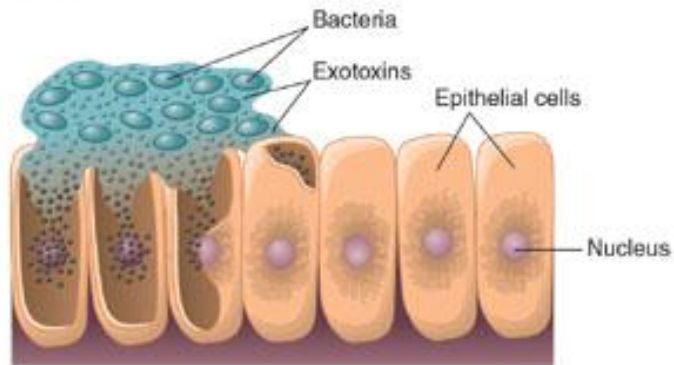
(d) Hooks or flagella

Virulence factors

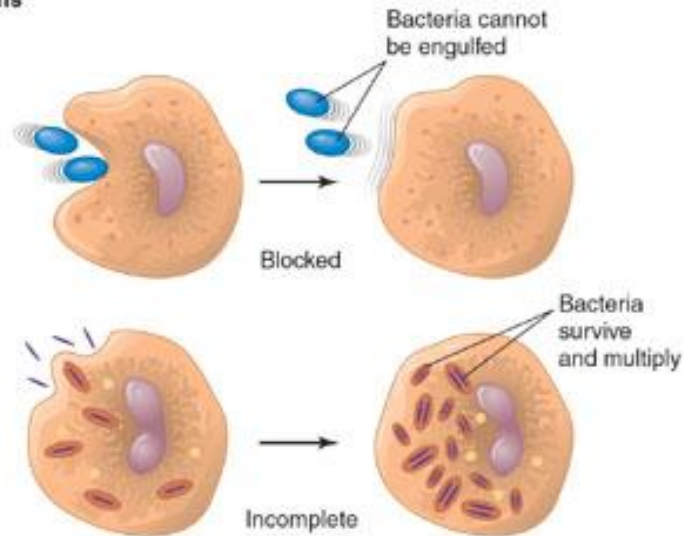
- **exoenzymes** – digest epithelial tissues & permit invasion of pathogens
- Toxigenicity – capacity to produce **toxins** at the site of multiplication
 - **endotoxins** – lipid A of LPS of gram-negative bacteria
 - **exotoxins** – proteins secreted by gram-positive and gram-negative bacteria
- **antiphagocytic factors** – help them to kill or avoid phagocytes, include leukocidins and capsules



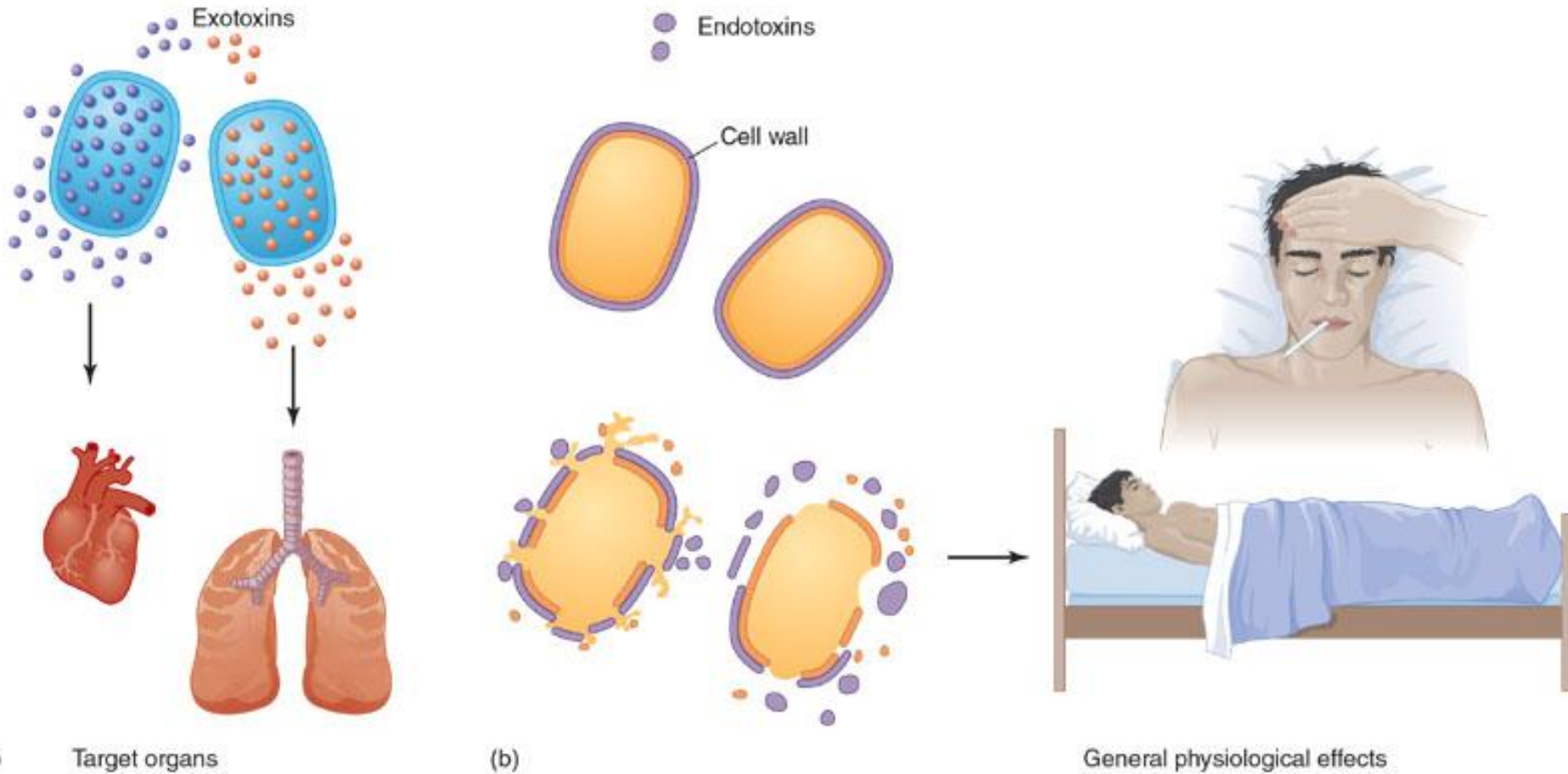
(a) Exoenzymes



(b) Toxins



(c) Phagocytosis

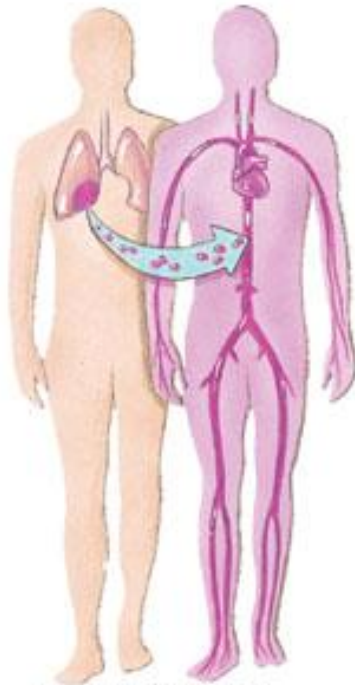


Patterns of infection

- **localized infection**– microbes enters body & remains confined to a specific tissue
- **systemic infection**– infection spreads to several sites and tissue fluids usually in the bloodstream
- **focal infection**– when infectious agent breaks loose from a local infection and is carried to other tissues

Localized infection (boil)

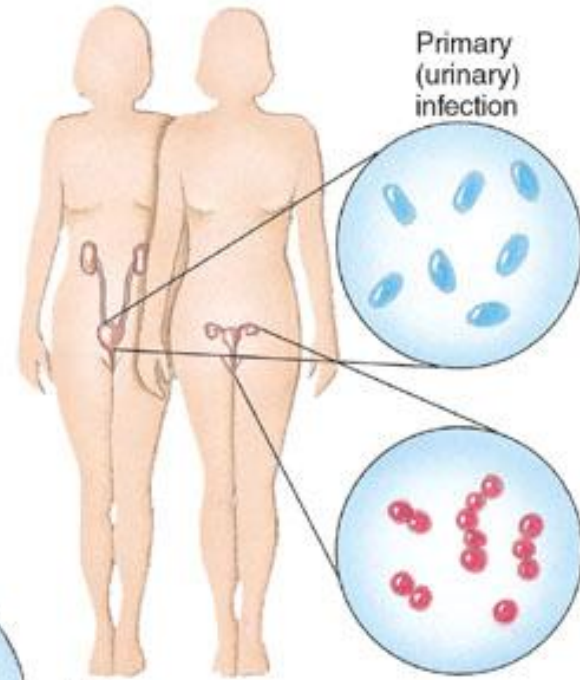
Systemic infection



(c) Focal infection



(d) Mixed infection



Primary (urinary) infection

(e)

Secondary (vaginal) infection

Various microbes

(a)

(b)

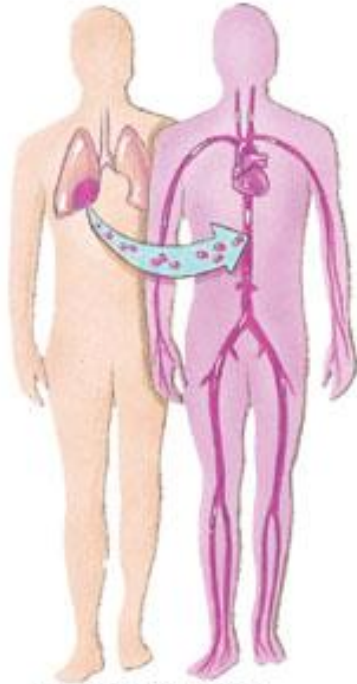
Patterns of infection

- **Mixed infection** – several microbes grow simultaneously at the infection site
- **Primary infection** – initial infection
- **Secondary infection** – another infection by a different microbe

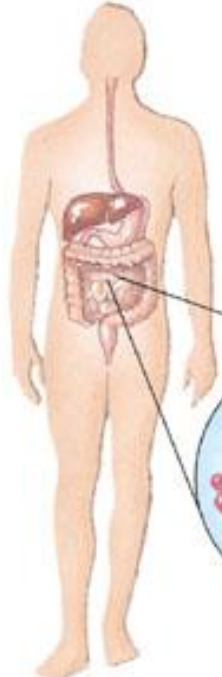
Localized infection (boil)



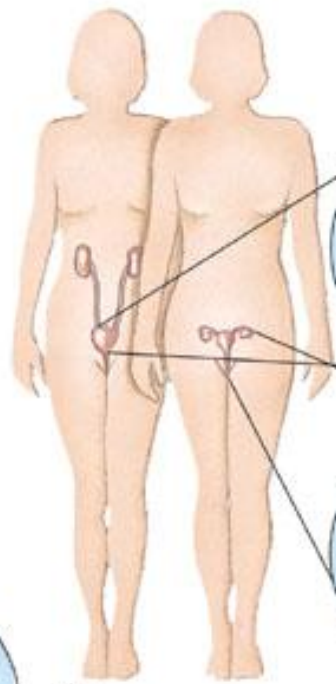
Systemic infection



(c) Focal infection



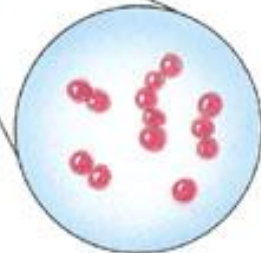
(d) Mixed infection



Primary (urinary) infection



(e)



Secondary (vaginal) infection

Various microbes

Portals of exit

- Respiratory, saliva
- Skin scales
- Fecal exit
- Urogenital tract
- Removal of blood

Epidemiology

- The study of the **frequency and distribution** of disease & health-related factors in human populations
- Surveillance –collecting, analyzing, & reporting data on rates of occurrence, mortality, morbidity and transmission of infections
- Reportable, notifiable diseases must be reported to authorities

- Centers for Disease Control and Prevention (CDC) in Atlanta, GA – principal government agency responsible for keeping track of infectious diseases nationwide
- <http://www.cdc.gov>

Patterns of disease occurrence

- **Endemic** – disease that exhibits a relatively steady frequency over a long period of time in a particular geographic locale
- **Sporadic** – when occasional cases are reported at irregular intervals
- **Epidemic** – when prevalence of a disease is increasing beyond what is expected
- **Pandemic** – epidemic across continents



(a) Endemic Occurrence



(b) Sporadic Occurrence



(c) Epidemic Occurrence



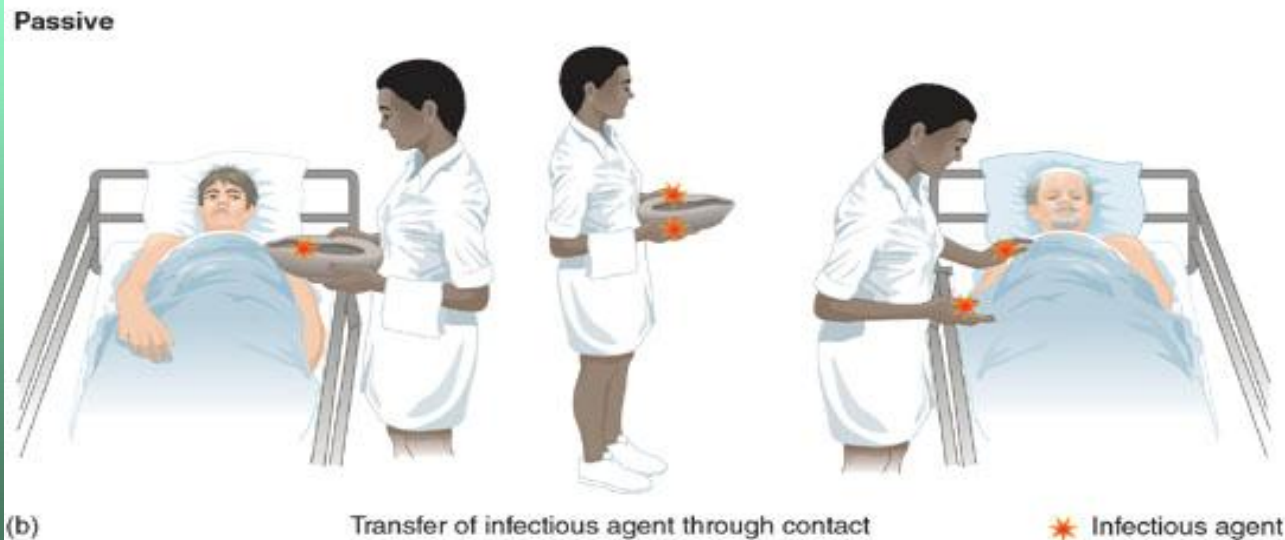
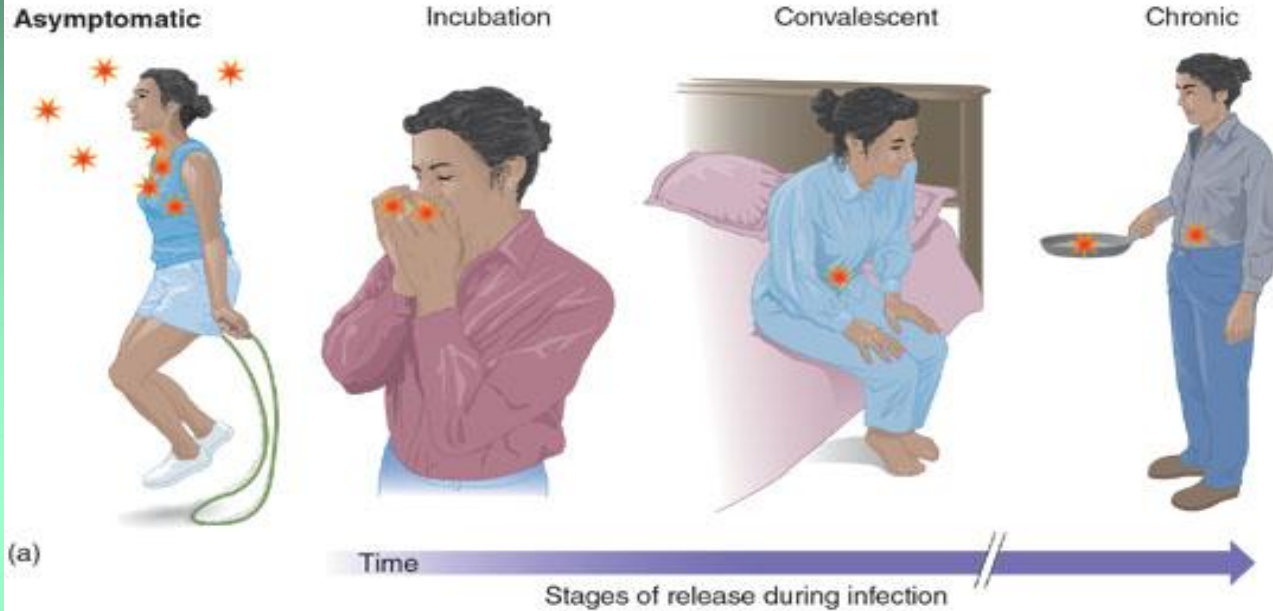
(d) Pandemic Occurrence

Reservoirs of infection

- Primary habitat in the natural world from which a pathogen originates
- Living reservoirs may or may not have symptoms
 - **Asymptomatic carriers**
 - **Passive carriers**
 - **Vectors** – live animal that transmits infectious disease
- Nonliving reservoirs – soil, water

Types of carriers

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Vectors

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(a) Biological vectors are infected.



(b) Mechanical vectors are not infected.

Patterns of transmission

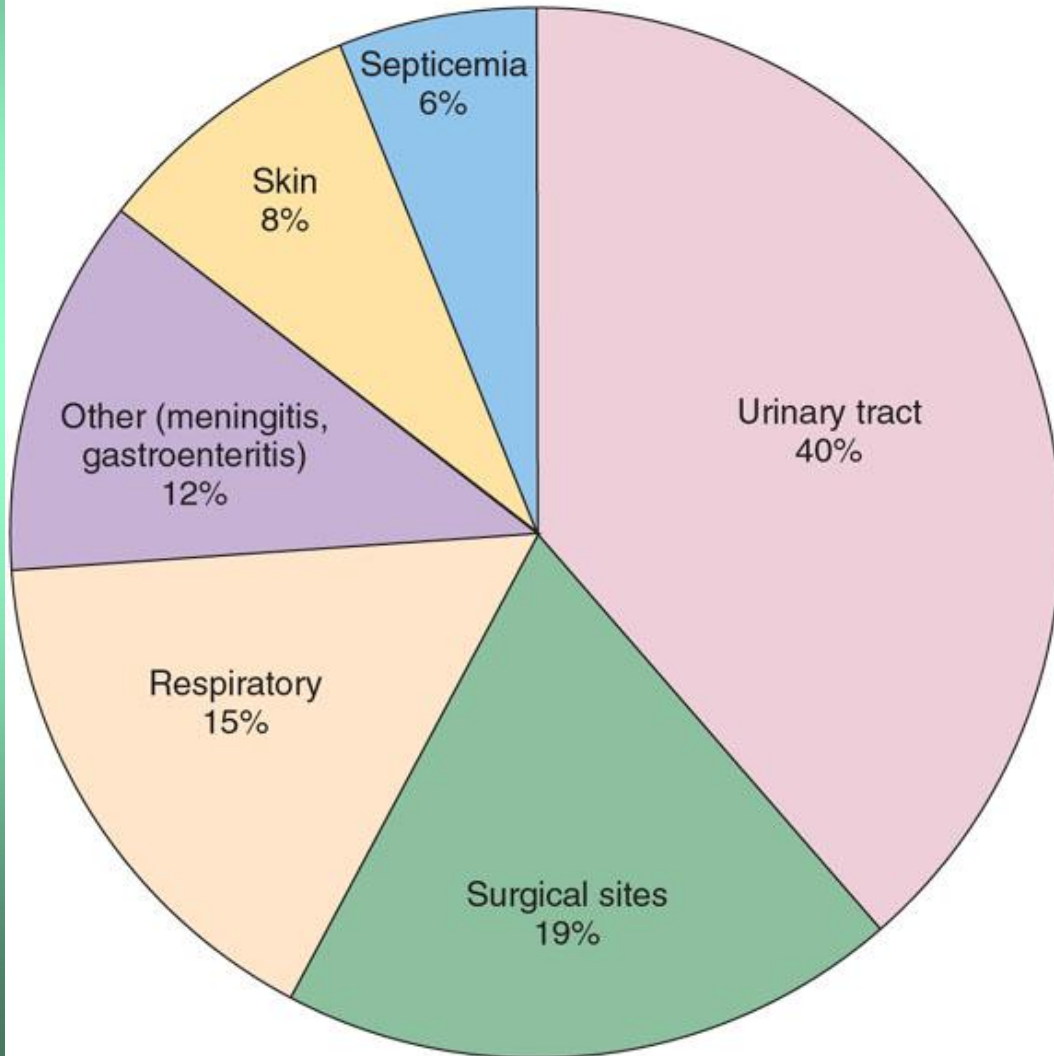
- Direct contact
- Indirect contact
 - Vehicle – inanimate material, food, water, biological products, fomites
 - Airborne – droplet nuclei, aerosols

Nosocomial infections

- Diseases that are acquired during a hospital stay
- Most commonly involve urinary tract, respiratory tract, & surgical incisions
- Most common organisms involved gram-negative intestinal flora, *E. coli*, *Pseudomonas*, *Staphylococcus*

Nosocomial infections

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Koch's postulates

1. Find evidence of a particular microbe in every case of a disease
2. Isolate that microbe from an infected subject and cultivate it artificially in the laboratory
3. Inoculate a susceptible healthy subject with the laboratory isolate and observe the resultant disease
4. Reisolate the agent from this subject

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