

# MICROBE-HUMAN INTERACTIONS INFECTION AND DISEASE

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# OBJECTIVES

- 1- TO IDENTIFY THE TYPES OF INFECTIONS.
- 2- AND HAVE KNOWLEDGE ABOUT THE PORTAL ENTRY OF EACH INFECTION AND THE RESIDENT NORMAL FLORA.
- 3- MECHANISMS AND PATTERN OF INFECTIONS WITH SINGLE AND SYMPTOMS .
- 4- OVERVIEW OF NOSOCOMIAL INFECTION.

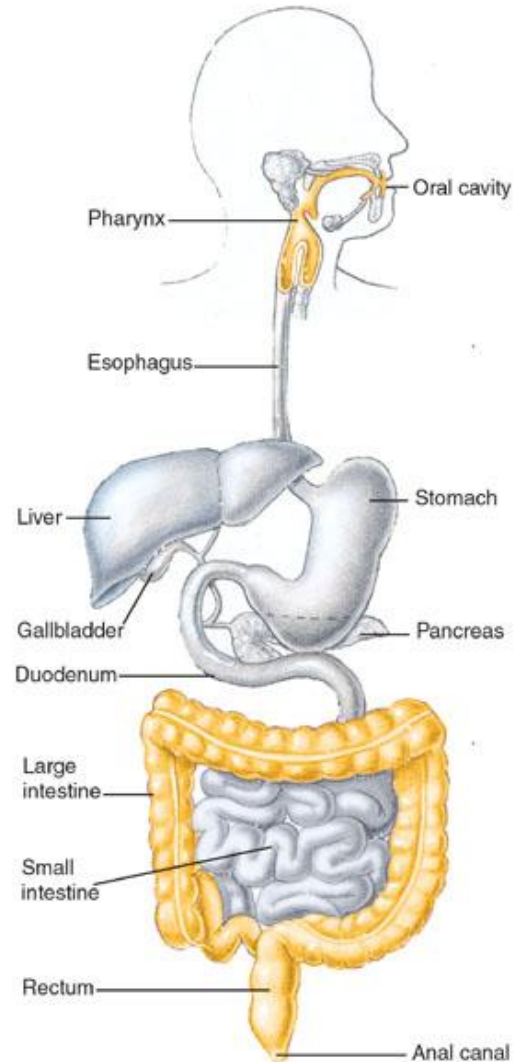
- **INFECTION**- A CONDITION IN WHICH PATHOGENIC MICROBES PENETRATE HOST DEFENSES, ENTER TISSUES & MULTIPLY
- **DISEASE** – ANY DEVIATION FROM HEALTH, DISRUPTION OF A TISSUE OR ORGAN CAUSED BY MICROBES OR THEIR PRODUCTS

# 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

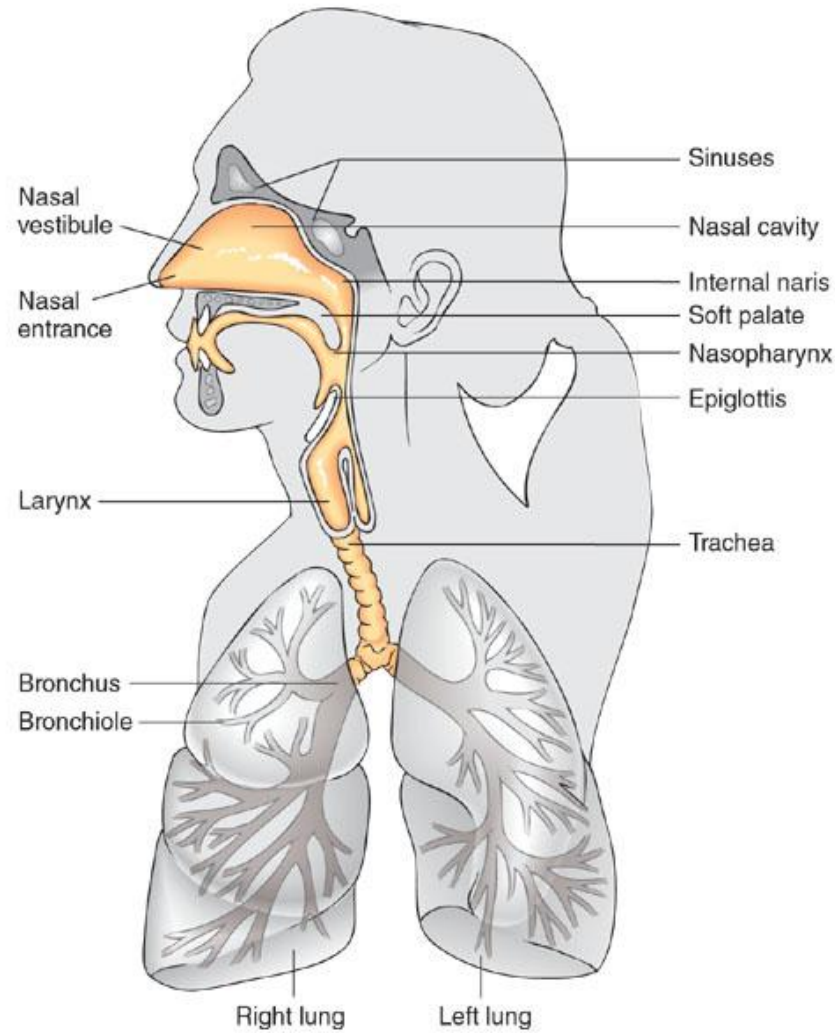
# DISTRIBUTION OF FLORA

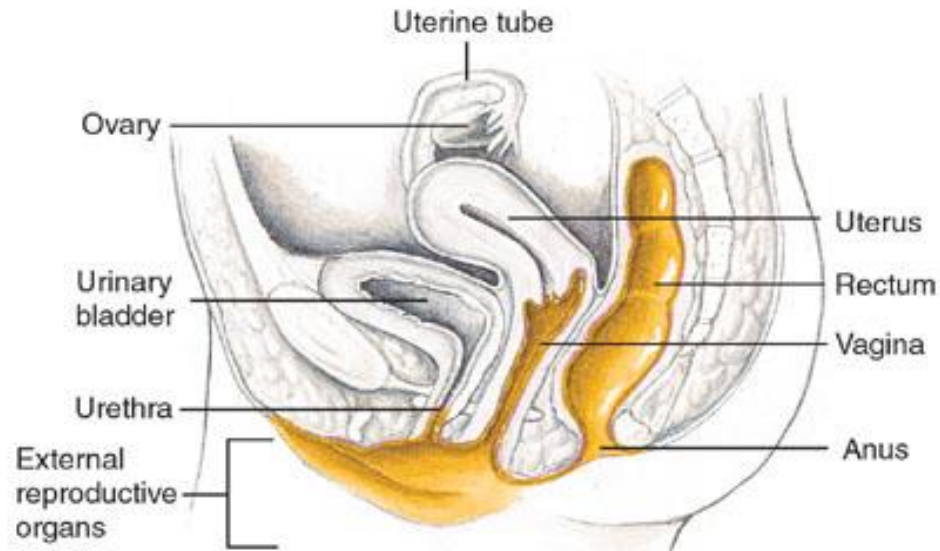
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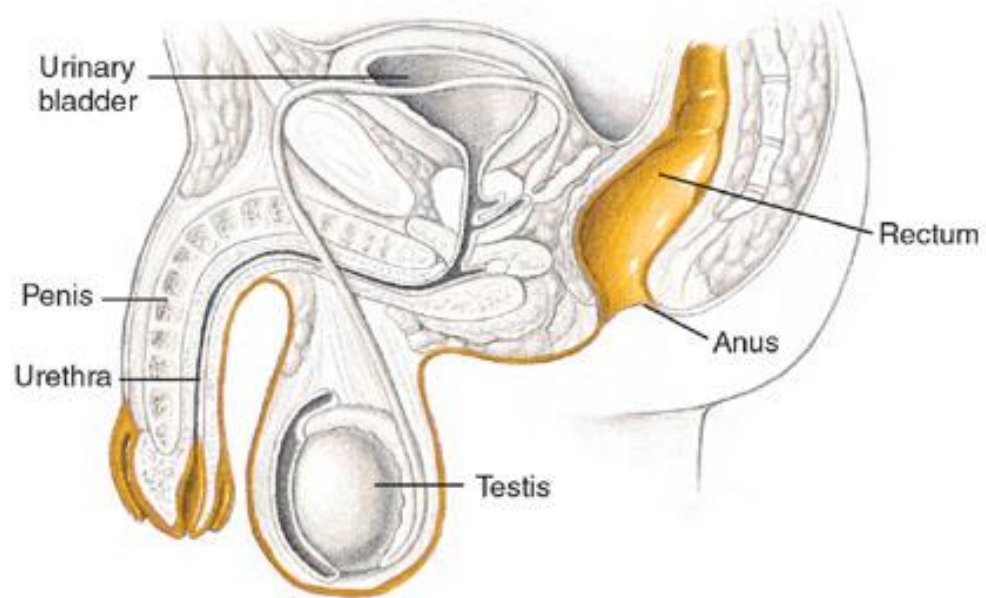
# COLONIZED REGIONS OF THE RESPIRATORY TRACT

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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

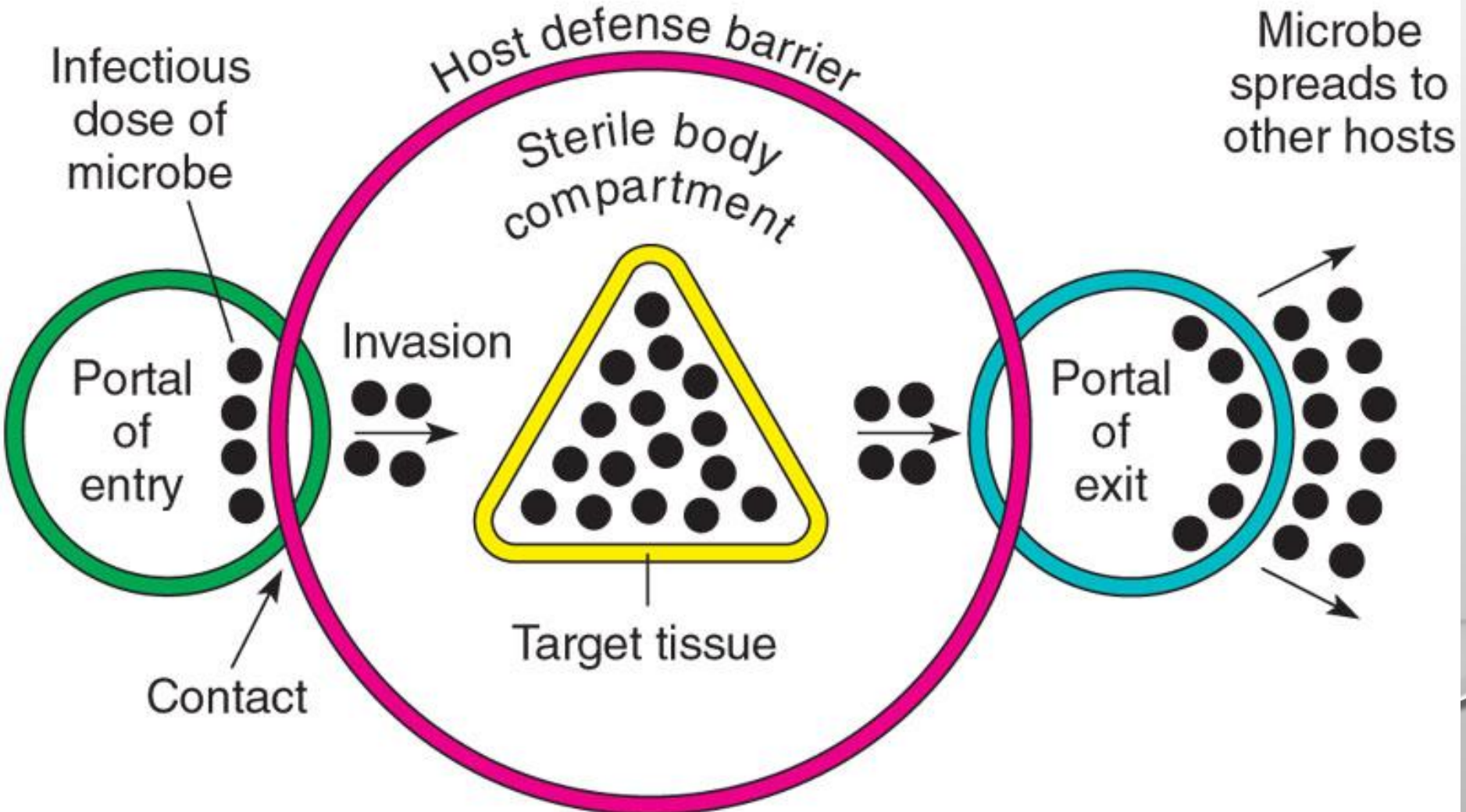
• **OPPORTUNISTIC PATHOGENS** – CAUSE DISEASE WHEN THE HOST'S DEFENSES ARE COMPROMISED OR WHEN THEY GROW IN PART OF THE BODY THAT IS NOT NATURAL TO THEM

- *PSEUDOMONAS SP & CANDIDA ALBICANS*



# OVERVIEW OF INFECTION

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# PORTALS OF ENTRY

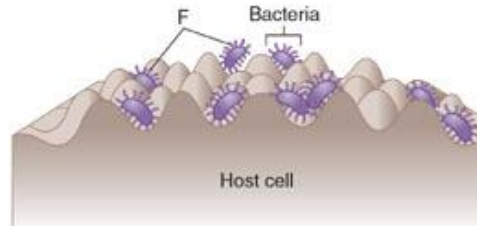
- SKIN
- GASTROINTESTINAL TRACT
- RESPIRATORY TRACT
- UROGENITAL TRACT

# INFECTIOUS DOSE (ID)

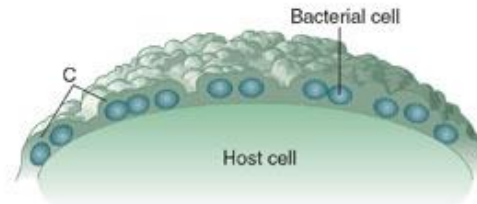
- MINIMUM NUMBER OF MICROBES REQUIRED FOR INFECTION TO PROCEED
- MICROBES WITH SMALL **IDS** HAVE GREATER VIRULENCE
  - 1 RICKETTSIAL CELL IN Q FEVER
  - 10 BACTERIA IN TB, GIARDIASIS
  - $10^9$  BACTERIA IN CHOLERA
- LACK OF ID WILL NOT RESULT IN INFECTION

# MECHANISMS OF ADHESION

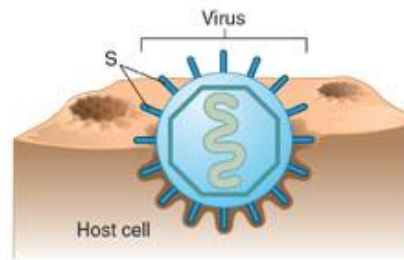
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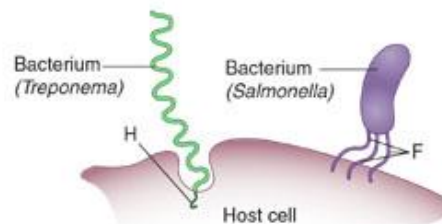
(a) Fimbriae



(b) Capsules



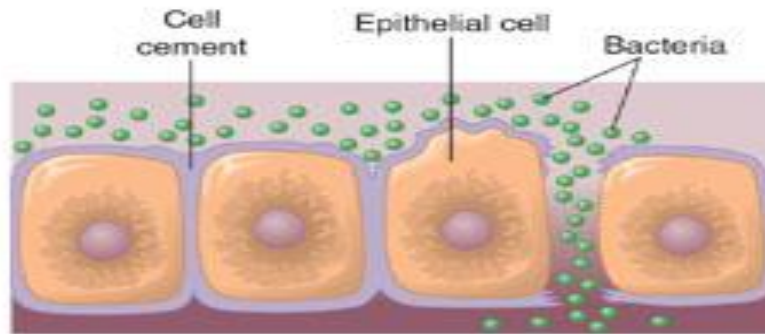
(c) Spikes



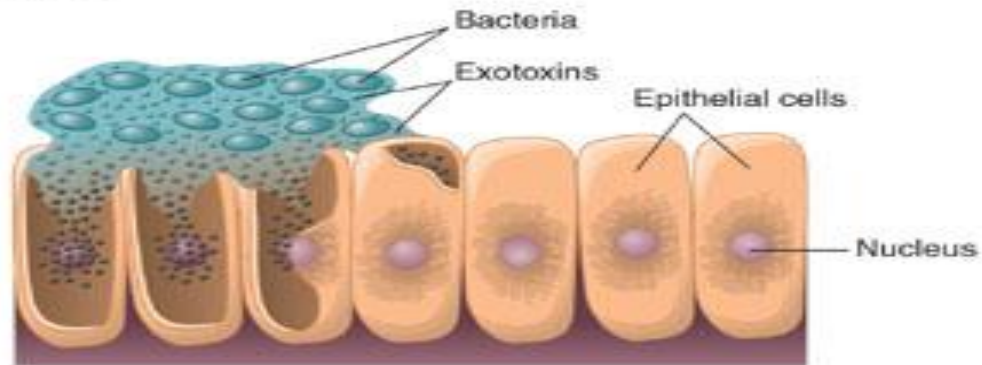
(d) Hooks or flagella

# VIRULENCE FACTORS

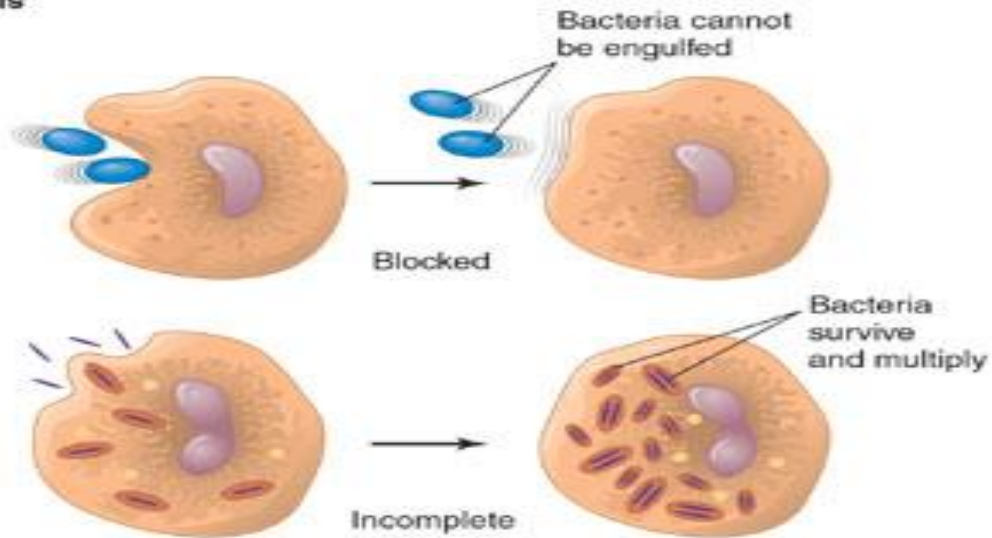
- **EXOENZYMES** – DIGEST EPITHELIAL TISSUES & PERMIT INVASION OF PATHOGENS
- **TOXIGENICITY** – CAPACITY TO PRODUCE TOXINS AT THE SITE OF MULTIPLICATION
  - **ENDOTOXINS** – LIPID A OF LPS OF GRAM-NEGATIVE BACTERIA
  - **EXOTOXINS** – PROTEINS SECRETED BY GRAM-POSITIVE AND GRAM-NEGATIVE BACTERIA
- **ANTIPHAGOCYTTIC FACTORS** – HELP THEM TO KILL<sup>13</sup> OR AVOID PHAGOCYTES, INCLUDE LEUKOCIDINS



(a) Exoenzymes

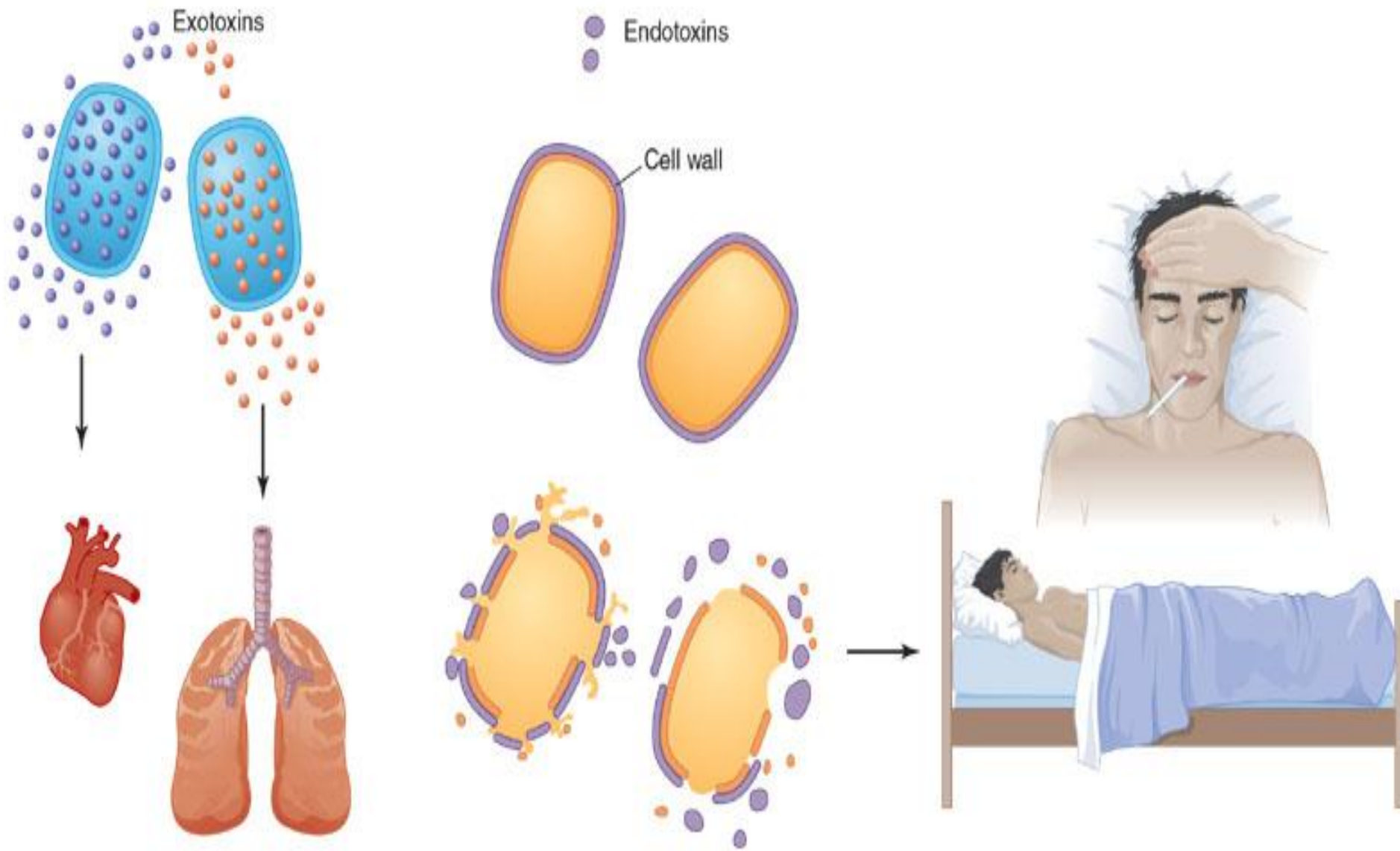


(b) Toxins



(c) Phagocytosis





Exotoxins

Endotoxins

Cell wall

(a) Target organs

(b)

General physiological effects



# 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

# 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)



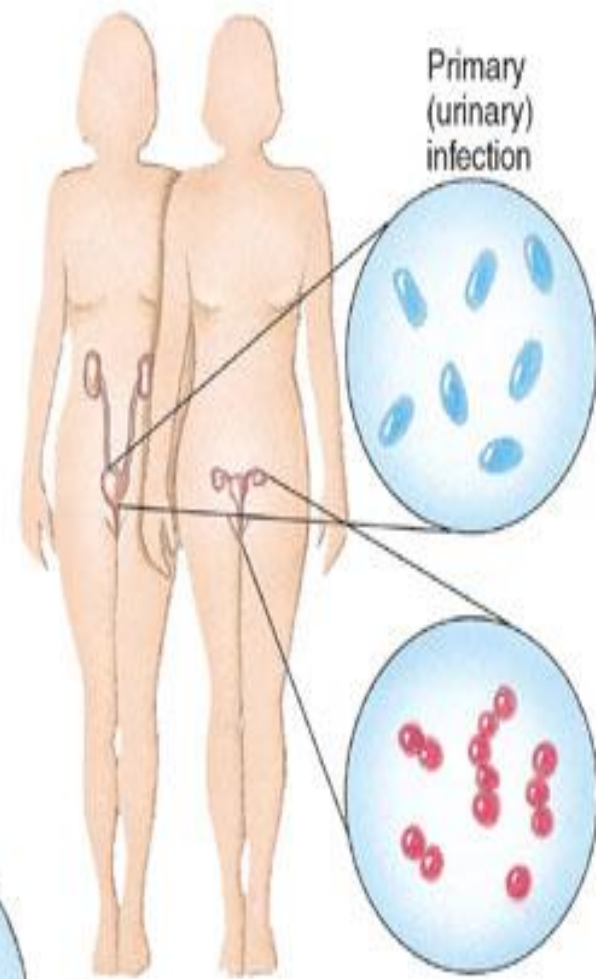
Systemic infection



(c) Focal infection



(d) Mixed infection



Primary (urinary) infection

(e)

Secondary (vaginal) infection

Various microbes

- **SIGN** – OBJECTIVE EVIDENCE OF DISEASE AS NOTED BY AN OBSERVER
- **SYMPTOM** – SUBJECTIVE EVIDENCE OF DISEASE AS SENSED BY THE PATIENT

**TABLE 13.8**

**Common Signs and Symptoms of Infectious Diseases**

**Signs**

Fever  
Septicemia  
Microbes in tissue fluids  
Chest sounds  
Skin eruptions  
Leukocytosis  
Leukopenia  
Swollen lymph nodes  
Abscesses  
Tachycardia (increased heart rate)  
Antibodies in serum

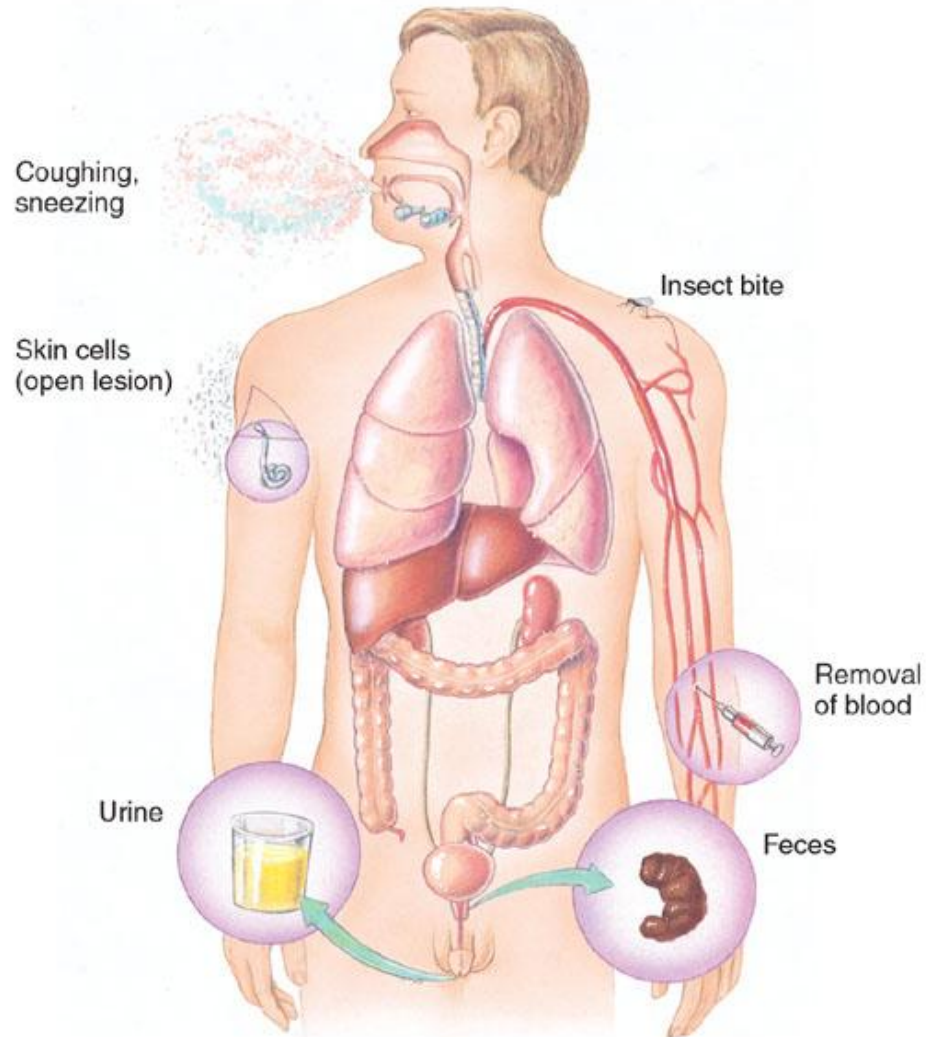
**Symptoms**

Chills  
Pain, ache, soreness, irritation  
Nausea  
Malaise, fatigue  
Chest tightness  
Itching  
Headache  
Nausea  
Abdominal cramps  
Anorexia (lack of appetite)  
Sore throat



# PORTALS OF EXIT

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# PORTALS OF EXIT

- RESPIRATORY, SALIVA
- SKIN SCALES
- FECAL EXIT
- UROGENITAL TRACT
- REMOVAL OF BLOOD



- **SEQUELAE** – LONG-TERM OR PERMANENT DAMAGE TO TISSUES OR ORGANS

# TYPES OF CARRIERS

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**Asymptomatic**



**Incubation**



**Convalescent**



**Chronic**

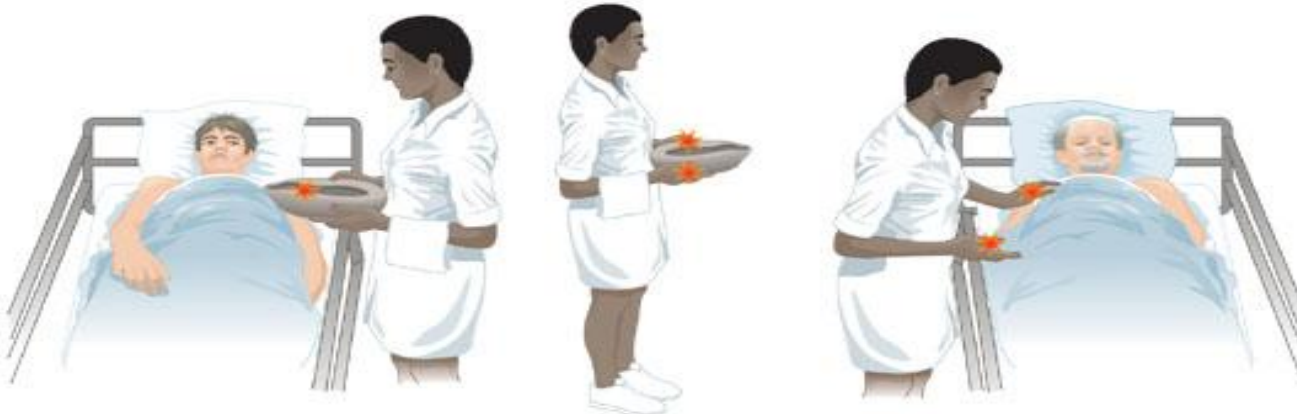


(a)

Time

Stages of release during infection

**Passive**



(b)

Transfer of infectious agent through contact

★ Infectious agent

# PATTERNS OF TRANSMISSION

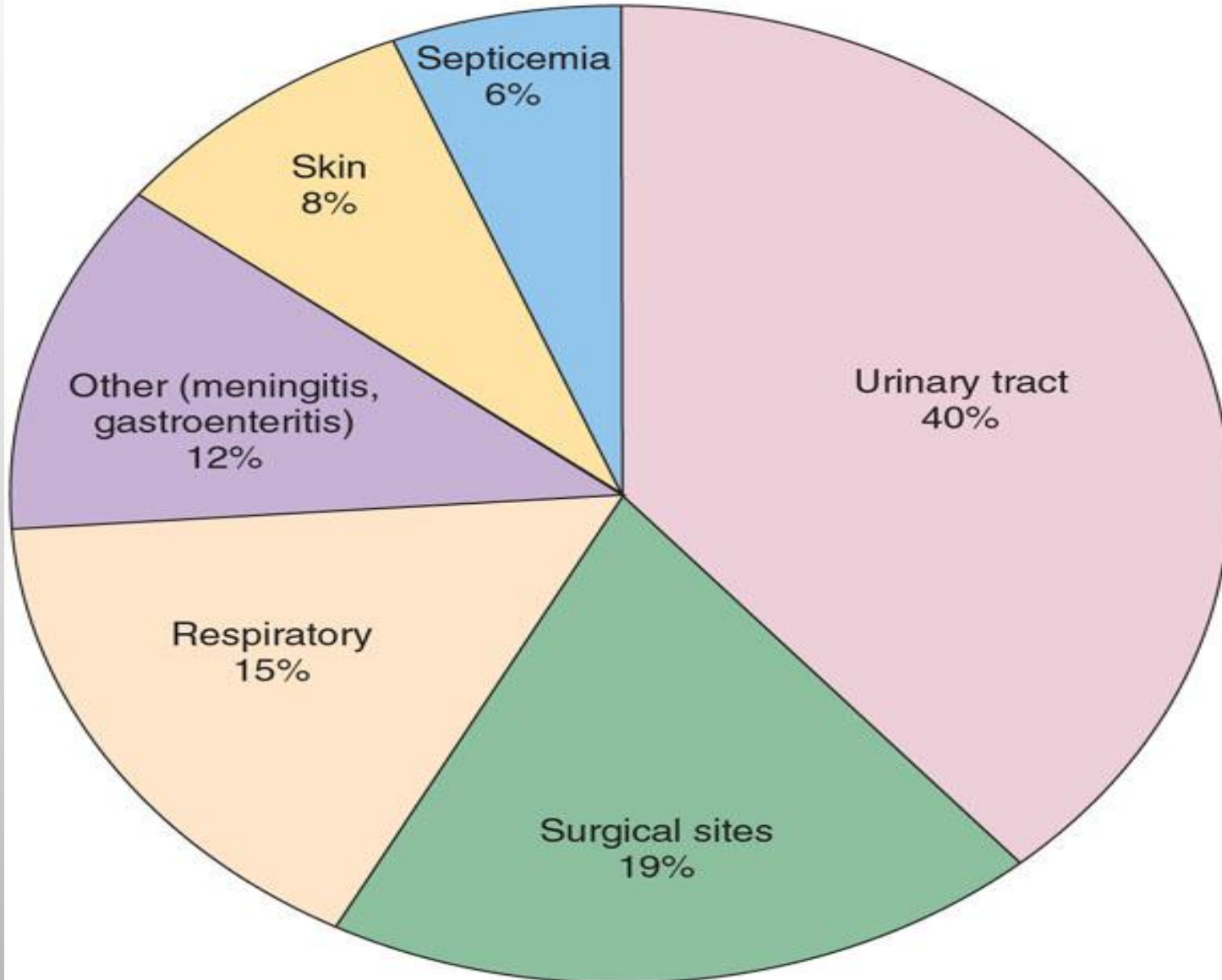
- DIRECT CONTACT
- INDIRECT CONTACT
  - **VEHICLE** – INANIMATE MATERIAL, FOOD, WATER, BIOLOGICAL PRODUCTS, FOMITES
  - **AIRBORNE** – DROPLET NUCLEI, AEROSOLS

# 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