

Lecture 1.

Pathogenic Microbiology Introduction

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Definitions

- Pathology – the scientific study of disease
 - 1-Etiology – cause of disease
 - Etiologic agent – virus, fungi, bacteria, protozoa
 - 2-Pathogenesis – the manner in which a disease develops
 - 3-structural and functional changes brought about by disease and with their final effects on the body

Definitions

- Infection – the invasion or colonization of the body by a pathogenic microorganism
 - May exist in absence of disease
- Pathogen – disease causing microorganism
- Disease – occurs when an infection results in any change from a state of health
 - An abnormal state in which part or all of the body is not properly adjusted or incapable of performing its normal function

Microbiota

- In utero free of microorganisms
- Vaginal lactobacilli proliferate prior to parturition
- Lactobacilli colonize and predominate intestine of newborn
- More bacteria introduced with breathing and feeding start
 - *E. coli* colonize lower intestine
 - Other microorganisms

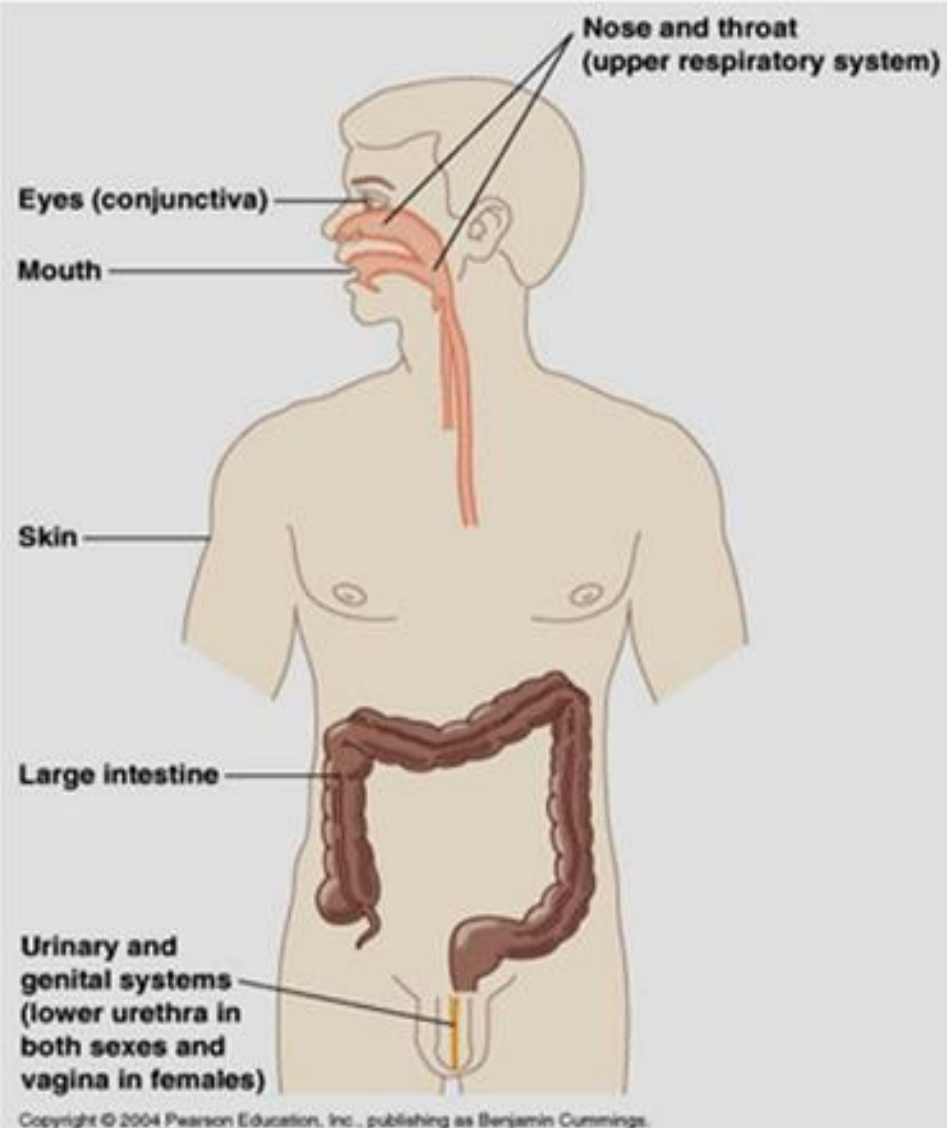
Microbiota

- Normal microbiota (Normal flora) – microorganisms that establish more or less permanent residence (colonizes) but that do not produce disease under normal conditions
 - 1×10^{14} bacterial cells in body
- Transient microbiota – may be present for several days or months and disappear

Microbiota

■ Locations of microbiota

- Eyes
- Nose and throat
- Mouth
- Skin
- Large intestine
- Urinary and genital systems
 - Vagina
 - Urethra



Microbiota

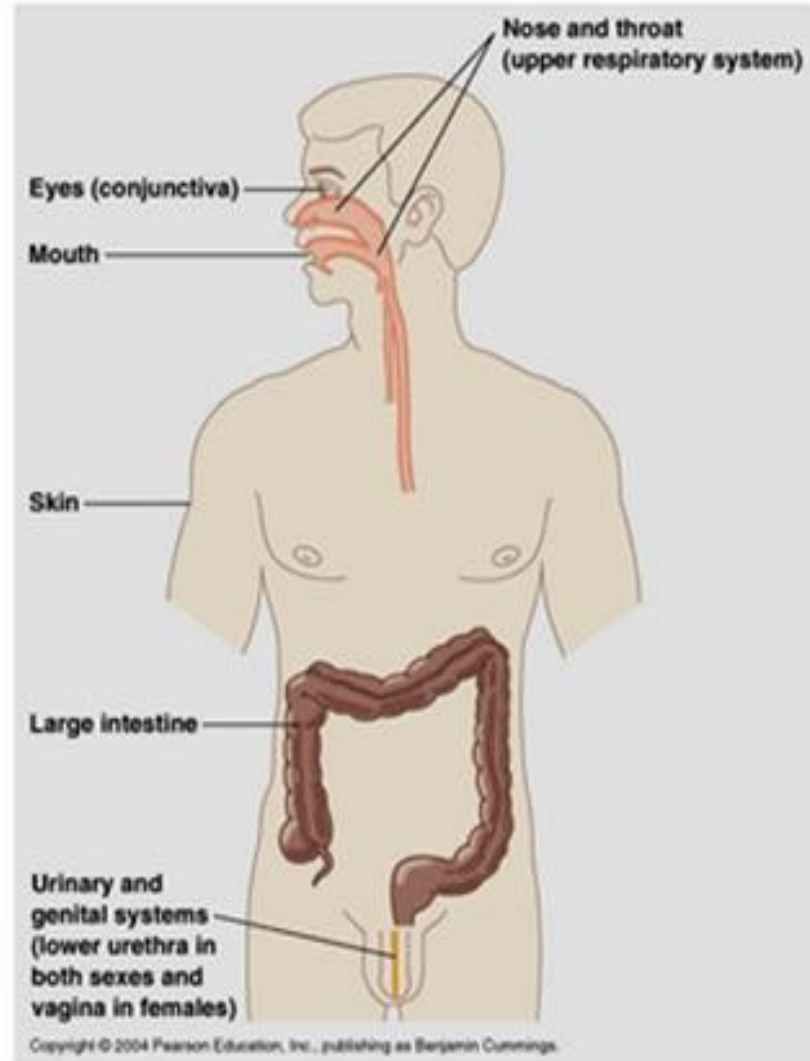


Microbiota

■ Normal flora region by region

□ Skin

- *Staphylococcus epidermidis*
- *Staphylococcus aureus*
- *Candida spp.*
- *Pityrosporum spp.*

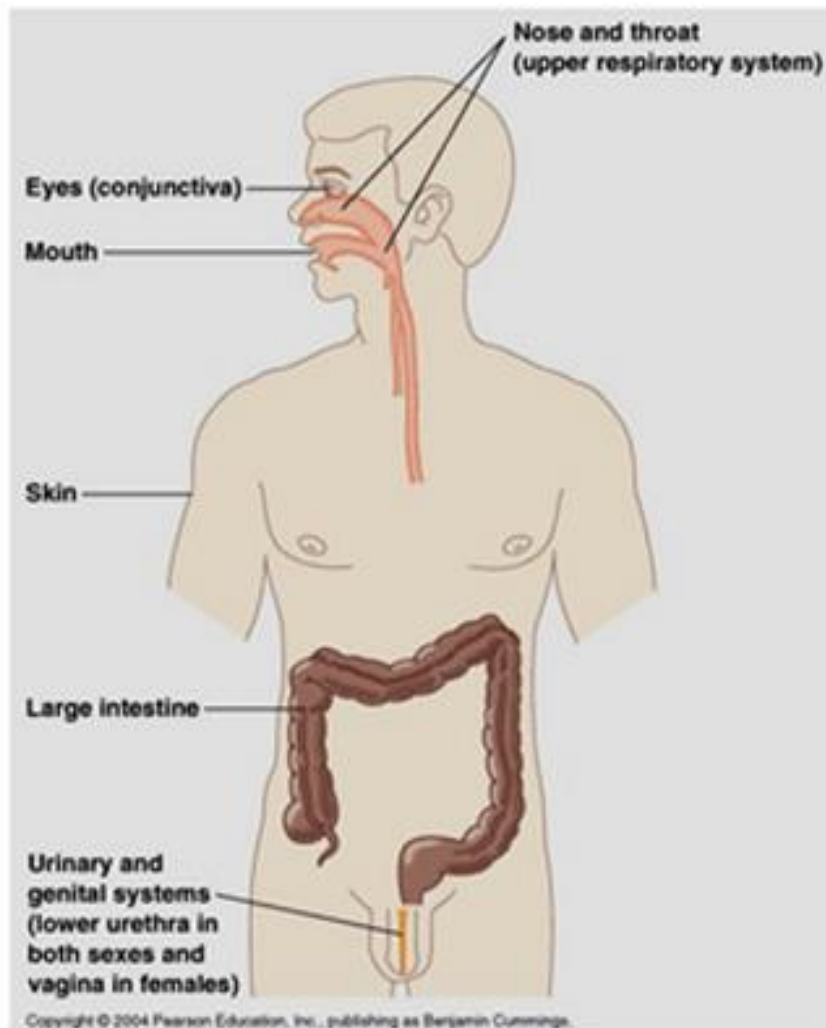


Microbiota

■ Normal flora region by region

□ Eyes (conjunctiva)

- *Streptococcus epidermidis*
- *Staphylococcus aureus*

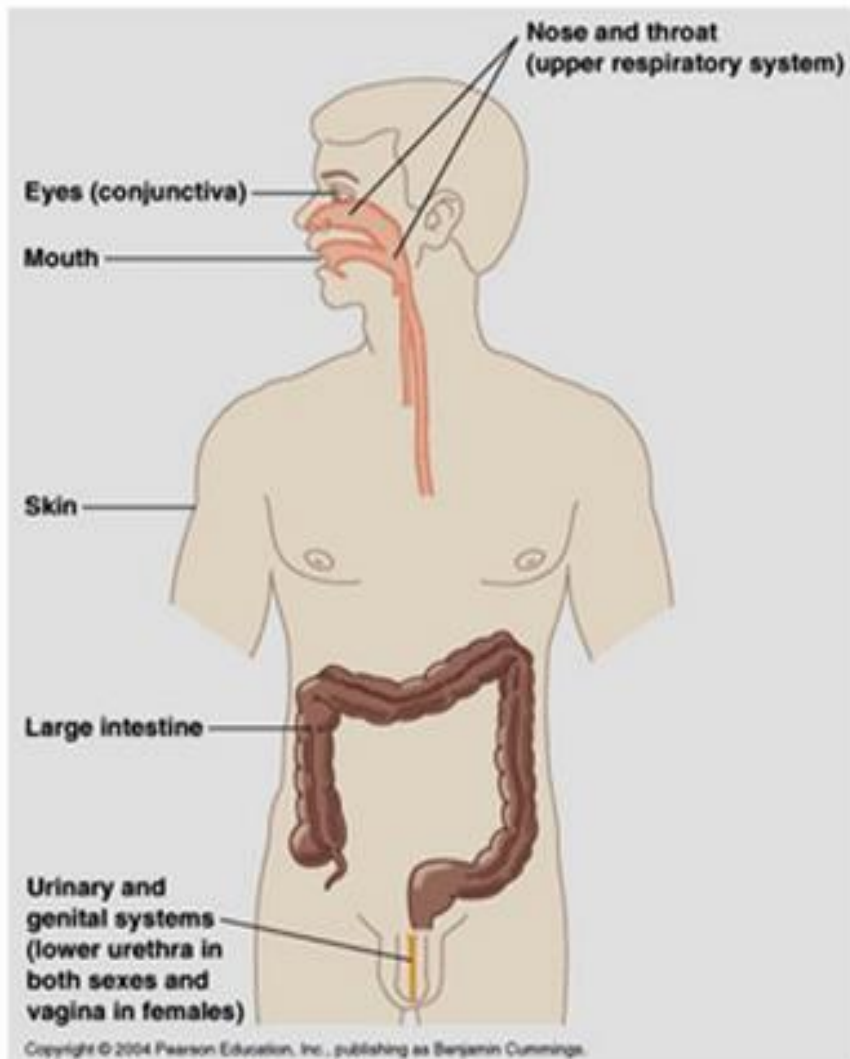


Microbiota

■ Normal flora region by region

□ Nose and throat

- *Staphylococcus aureus*
- *Staphylococcus epidermidis*
- *Neisseria spp*

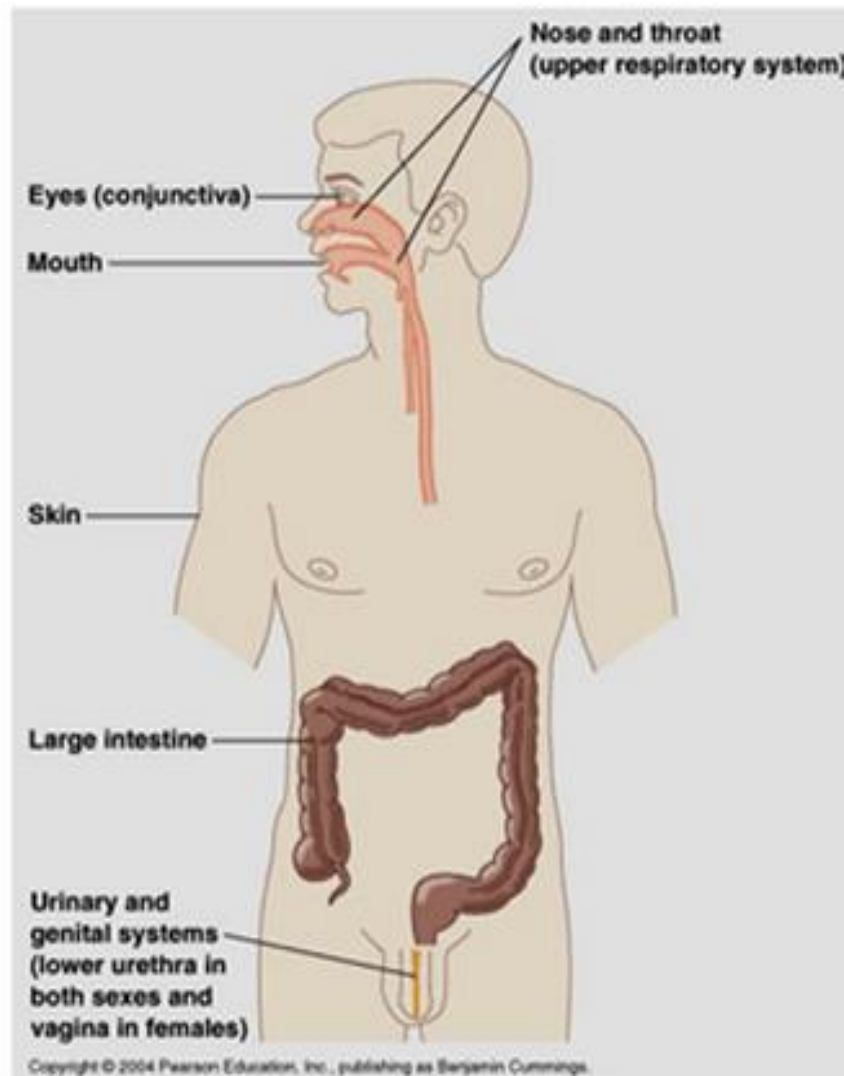


Microbiota

■ Normal flora region by region

□ Mouth and oral cavity

- *Streptococcus*
- *Lactobacillus*
- *Actinomyces*
- *Candida*

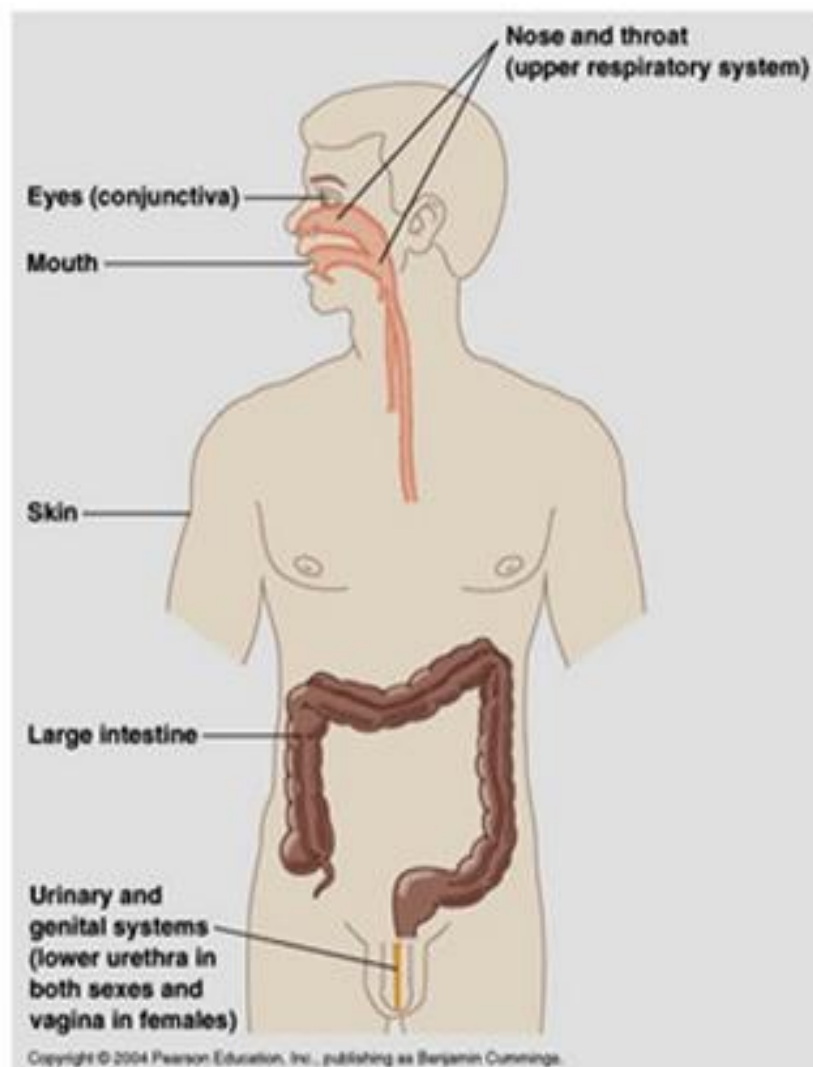


Microbiota

■ Normal flora region by region

□ Large intestine

- *E. coli*
- *Bacteroides*
- *Fusabacterium*
- *Lactobacillus*
- *Enterococcus*

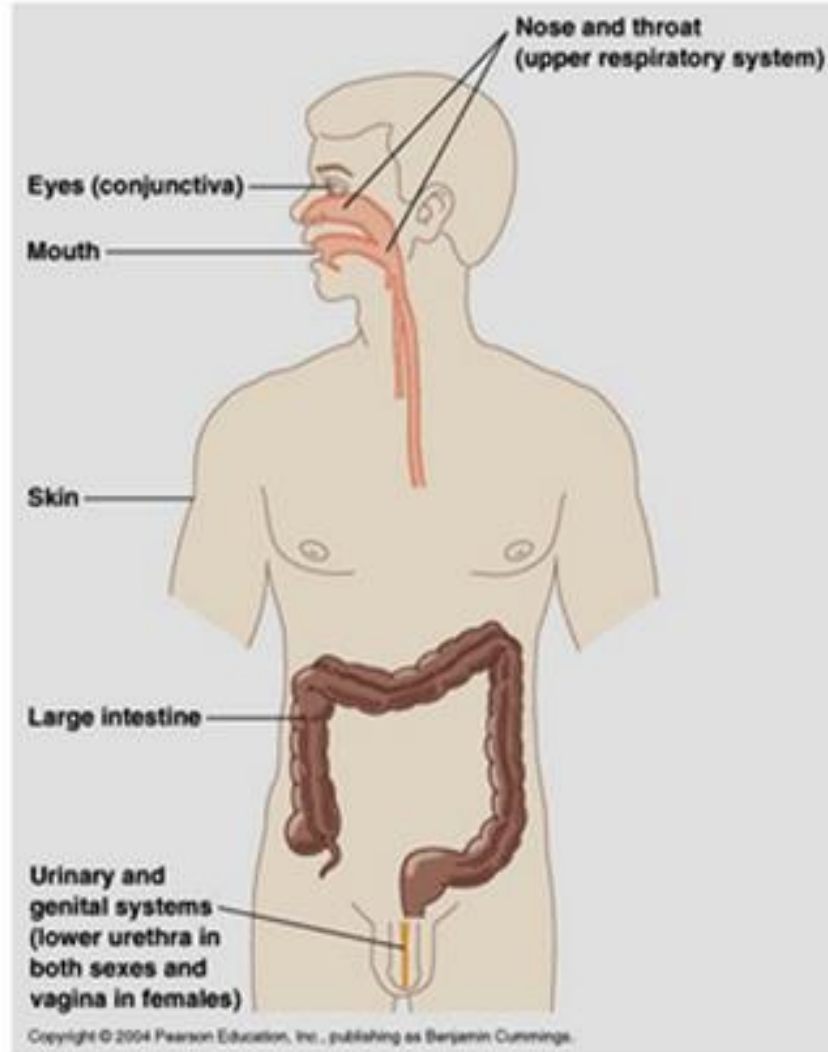


Microbiota

■ Normal flora region by region

□ Urogenital system

- *Staphylococcus epidermidis*
- *Micrococci*
- *Candida albicans*
- *Enterococcus*



Microbial Antagonism

- Microbial antagonism – normal microbiota can benefit the host by preventing the overgrowth of harmful microorganisms
 - Competition among microorganisms
 - Nutrients
 - Producing substance harmful to invading bacteria
 - Altering pH and available oxygen

Microbial Antagonism

■ Examples

□ Vagina

- Normal flora maintain pH of 3.5 – 4.5
- Inhibits growth of *Candida albicans*
- Antibiotics, excessive douching pH rises to neutral
 - *Candida albicans* overgrowth causes vaginitis (yeast)

Microbial Antagonism

■ Example

□ Mouth

- *Streptococci* produce compounds that prevent growth of g+ and g- cocci

□ Large intestine

- *E. coli* produce bacterocins
 - Proteins inhibit growth of other bacteria
 - Inhibits *Shigella* and *Salmonella*

Microbial Antagonism

■ Examples

□ Large intestines

■ Intestinal microbiota

- *Clostridium difficile* inhibited and prevented from attaching
- *Cl. difficile* establishes after antibiotic treatment
 - Mild diarrhea, colitis, fatal toxemia

Definitions

■ Symbiosis

- Two organisms that live together
- Microbiota and host

■ Commensalism

- A symbiotic relationship between two organisms
- One organism benefits (microbiota)
- One organism is unaffected

Definitions

■ Mutualism

- A symbiotic relationship between two organisms
- Both organisms benefit from relationship
- *E. coli* in large intestine
 - Synthesize B and K vitamins (host benefits)
 - Supply nutrients to normal flora (flora benefits)

Definitions

■ Parasitism

- A symbiotic relationship between two organisms
- One organism benefits (tapeworm, bacteria, etc)
- One organism is harmed (host)

■ Opportunists (Opportunistic pathogens)

- Under proper conditions mutualistic organisms may become pathogens
- *E. coli* in large intestine relatively harmless
- *E. coli* in other parts causes disease
 - Urinary bladder – cystitis
 - CSF - meningitis

Opportunistic Pathogen

■ Examples

- *Staphylococcus aureus* normal inhabitant of skin
 - Cut or wound allow bacteria to cause disease
 - Abscess
- Immunocompromised individuals
 - *Pneumocystis jiroveci* pneumonia

Opportunistic Pathogens

- Some may reside in healthy host and not cause disease
 - *Neisseria meningitidis*
 - Normally resides benignly in respiratory system
 - Can cause potentially fatal meningitis

Definitions Associated with Diseases

- Symptoms – changes in body functions, that are subjective and not apparent to an observer
 - Pain
 - Malaise
- Signs – changes that can be measured or observed by a physician. They are objective.
 - Fever
- Lesions – any change in tissue

Definitions Associated with Diseases

- Signalment – overview of patient
 - Age
 - Gender
 - Race
- Syndrome – specific group of symptoms or signs that always accompany
- Diagnosis – conclusion or classification of a type of disease
 - Diagnosis is made by
 - Evaluation of signs and symptoms
 - Laboratory tests

Classifications of Disease

- Communicable disease – any disease that spreads from one host another, either directly or indirectly
 - Chickenpox, measles, genital herpes
- Contagious disease – a disease that is easily spread from one host to another
 - Chickenpox, measles, tuberculosis
- Non-communicable disease - a disease that is not spread from one host to another.
 - Tetanus

Occurrence of Disease

- Incidence – number of people who develop a disease during a particular time period.
 - An indicator of spread of disease
- Prevalence – number of people who develop a disease, regardless of when they appeared.