

# **Normal Microbial Flora of Human Body**

## Lecture 17

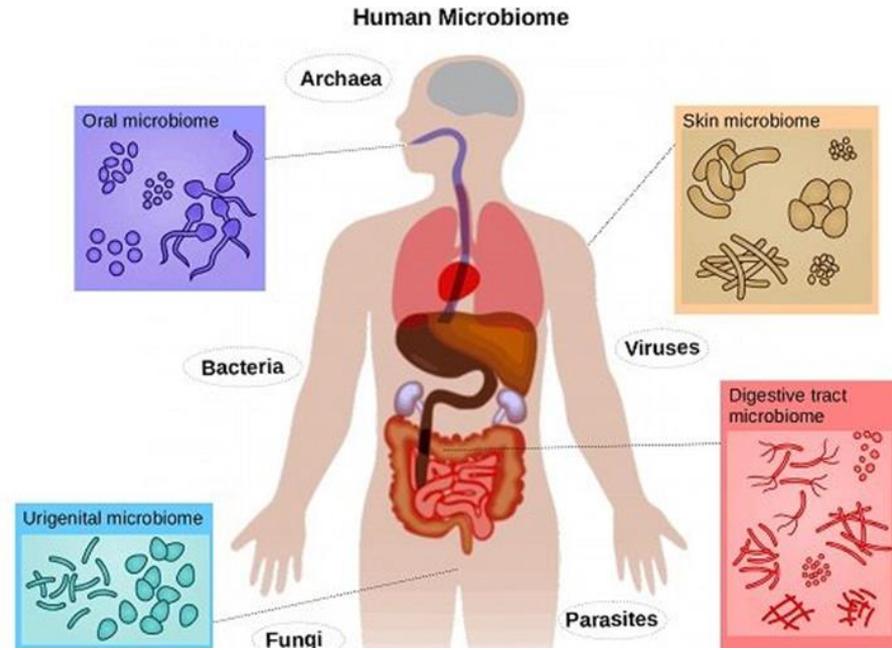
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# Normal flora

- Also called “**indigenous microbiota**” or Microbiota or Microbiome.
- Diverse group of microbial population that inhabit various body parts like **skin** and **mucous membranes** of **healthy normal persons**.
- **Sites** - gastrointestinal tract (GIT), respiratory tract, genitourinary tract & skin



# Normal Flora

➤ Our **skin** and **mucous membranes** always harbor a variety of microorganisms that can be categorized into **two groups**:

## 1. Resident Flora

- It consists of relatively **fixed types** of microorganisms regularly found in a given area at a given age.
- If disturbed, it promptly reestablishes itself.
- Do not cause harm; rather can be beneficial.

## 2. Transient Flora

- It consists of non-pathogenic or potentially pathogenic microorganisms for hours, days or even weeks.
- It is derived from the environment, doesn't produce disease, and doesn't establish itself permanently on the surface.
- Many are **potential pathogens**, e.g. pneumococcus and meningococcus in nasopharynx
- Can be **easily eliminated** by using proper hand hygiene and other infection control practices.
- ❖ If the resident flora is disturbed, transient microorganisms may colonize, proliferate and produce disease.
- **MRSA** in nose and skin (No illness)

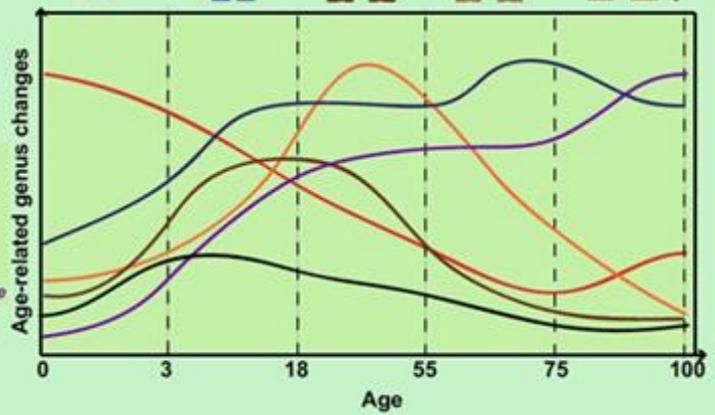
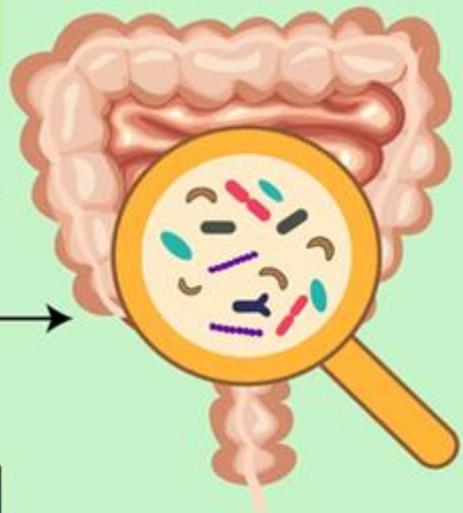
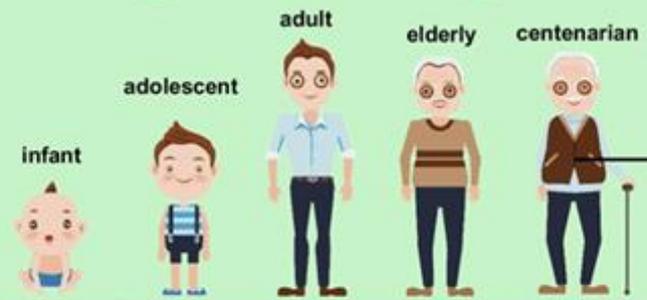
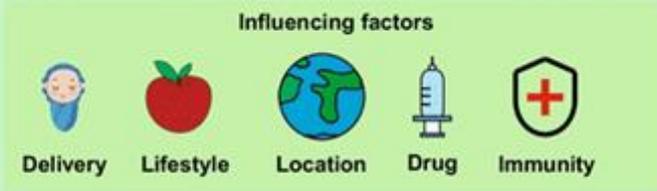
- ❖ **Composition:** Predominantly **bacteria** & some **fungi**.
- ✓ **Total population** of normal flora - about  $(10^{14})$  microbes; which is more than total number of cells  $(10^{13})$  present in human body
- ✓ **Anaerobes > aerobes**, depending upon the body site.

# Microbiology of Normal Flora

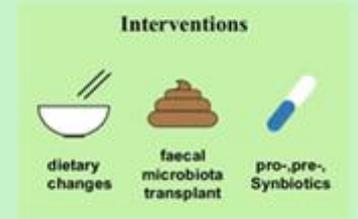
- A **fetus is sterile** when born (No normal flora).
- Normal flora acquired soon after birth (**newborn**) and persist till death.

## ❖ **Their presence depends upon:**

1. Local temperature, moisture, pH.
2. Presence of certain nutrients and inhibitory substances.
3. Environmental flora.
4. Immune status of the individual .
5. Anatomical site: Skin or mucosa.



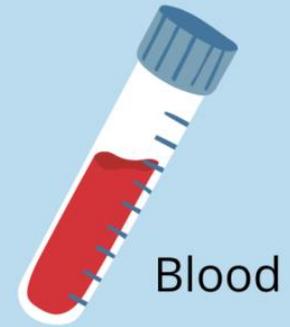
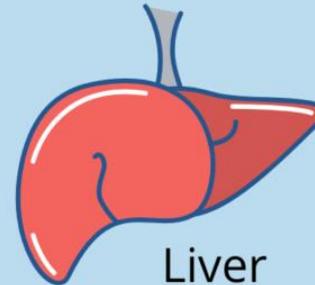
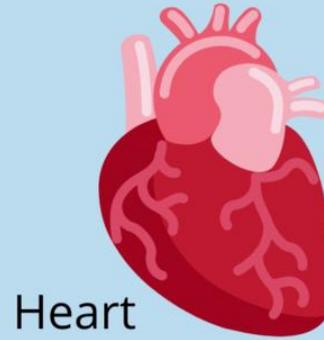
*Bifidobacterium*  
*Bacteroides*  
*Enterobacter*  
*Faecalibacterium*  
*Lachnospiraceae*  
*Christensenellaceae*



# Microbiology of Normal Flora

- Our internal organs are sterile **unless** have getting infections.
- **Examples:**
  - Brain,
  - Spleen
  - Liver
  - Bladder
  - Blood
  - Cerebral spinal fluid (CSF)
  - Pancreas.

## Sterile sites of infection



# Normal Flora found

- It is found in contact with external environments.

✓ **Skin**

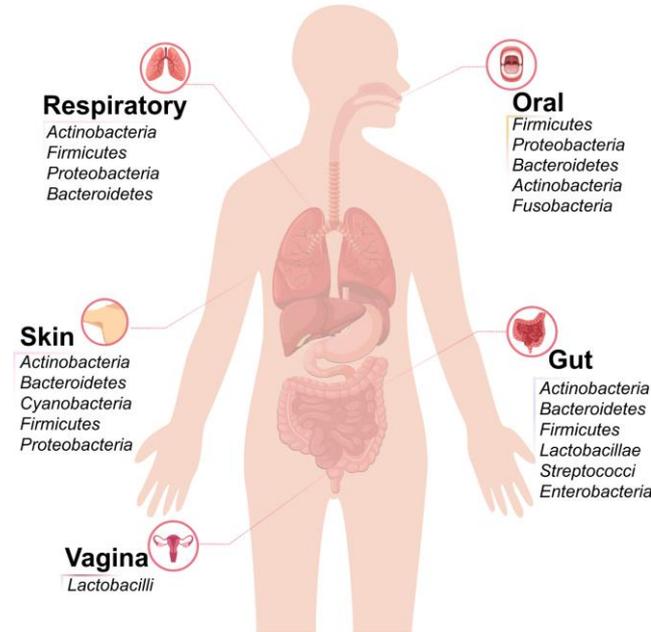
✓ **Mucous membrane that lines of;**

I. Respiratory system.

II. Gastrointestinal tract.

III. Genitourinary tract.

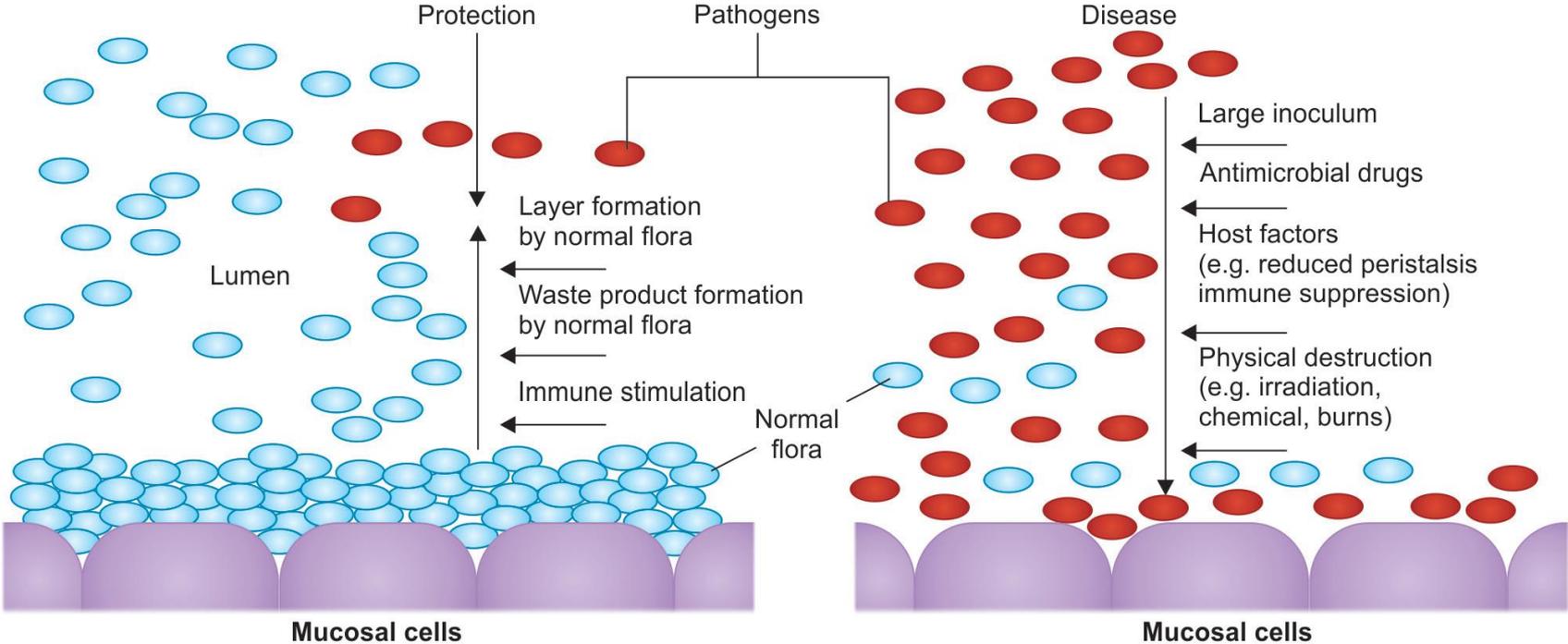
Microbiota composition in different regions



# Beneficial Effects of Normal Flora

- **Prevent colonization of pathogen:** compete for attachment sites or for essential nutrients
- **Synthesize vitamin:** Vitamin K and B complex (B12)
- **Immune stimulation** (act as immune sensors) 
- **Development of lymphatic tissues:** e.g. Peyer's patches in intestine
- **Waste produced antagonize other bacteria:**
  - Fatty acids and peroxides
  - Lactic acid: Lactobacilli in vagina of adult females maintain acidic pH
  - Bacteriocin: antibiotic-like substances.

# Beneficial Effects of Normal Flora



## Disadvantages of microflora

- When the **host immunity is lowered** e.g. Gram negative organisms colonizing the respiratory tract → pneumonia. (Opportunistic infection).
- **Entry into wrong site or tissue**
  - (e.g. blood, sterile body cavities) → disease (E.coli, intestinal commensal → Urinary tract infections).
  - (e.g. by dental procedure, chewing or vigorous brushing) → entry of small numbers of bacteria (e.g. *Streptococci viridians* ) transiently into bloodstream → bacterial endocarditis.

# Diseases produced by Normal Flora

<b>Diseases produced by normal flora</b>	<b>Anatomical site from which the flora is transferred</b>
Urogenital infections including UTI	Gut ( <i>E.coli</i> , <i>Klebsiella</i> , <i>Proteus</i> )
Endocarditis	Oral flora ( <i>Streptococcus viridans</i> )
Dental caries and periodontal disease	Oral flora ( <i>Streptococcus mutans</i> )
Peritonitis, abdominal infection	Intestinal flora
Pneumonia	Transient respiratory flora
Septicemia	From any site

## Normal flora of the skin

❖ **Resident Flora:** The microorganisms that are always present on the skin, including in hair follicles and sweat glands.

- *Staphylococcus epidermidis*: A very common resident, especially in aerobic areas.

- *Micrococcus*: Frequently found on normal skin.

- *Corynebacterium* (Diphtheroids): A group of bacteria that are part of the normal flora.

- *Propionibacterium*: Often found in oily areas like hair follicles.

❖ **Fungi**

- *Malassezia*: A type of yeast that is a common inhabitant of the skin.

- *Candida*: Another type of yeast found in the skin's normal flora.

# Factors That Influence Skin Flora

## 1. **Dryness of Skin:**

- Dry skin inhibits microorganism growth.
- Areas with more moisture (e.g., webs, toes, nipples, genital area) are more conducive to microbial growth.

## 2. **Acidic/Low pH:**

- Normal skin pH: 3-5
- Inhibits the growth of most microorganisms.

## 3. **Inhibitory/Antimicrobial Substances:**

- Lysozyme (secreted by sweat glands)
- Lactic acid and lipids (secreted by sebaceous glands)
- Soap and disinfectants (e.g., hexachlorophene) can reduce transient skin flora.

# Normal flora of the Upper Respiratory Tract (URT) and Lower Respiratory Tract (LRT)

## A. Upper Respiratory Tract (URT):

- Nasopharynx
- Oropharynx
- Throat

## B. Lower Respiratory Tract (LRT):

- Trachea
- Bronchi
- Lungs (alveoli)

# Defense Mechanisms of the URT

❖ Air contains many microorganisms, but most are removed by:

1. **Mucous lining** of the respiratory tract
2. **Ciliary movement** pushing mucous into the oropharynx

❖ **Microorganisms trapped in mucous are:**

- **Swallowed**
- **Destroyed by stomach acidity**

- **Resident Flora of the Nose**

- Prominent microorganisms:

- Corynebacteria
- Staphylococci
  - *S. epidermidis*
  - *S. aureus*
- Streptococci

- **Resident Flora of the Pharynx**

- Predominant organisms:

- Non-hemolytic streptococci
- Alpha-hemolytic streptococci
- Neisseriae

# Lower Respiratory Tract (LRT)

- **Normally free of resident microbial flora**

## Why LRT Has No Normal Flora?

1. As air enters LRT, its **velocity decreases** → microorganisms **settle on walls**
2. **Cilia move mucous upward**, removing microbes.
3. Microorganisms reaching alveoli are destroyed by:
  - **Alveolar macrophages** (phagocytic cells)

# Normal Flora of the Gastro-Intestinal Tract (GIT)

## ❖ GIT includes:

- Esophagus
- Stomach
- Small intestine
- Large intestine (colon)

## ❖ Each region differs in:

- ✓ pH
- ✓ Oxygen levels
- ✓ Transit time
- ✓ Secretions

➤ **These factors determine *amount and type* of normal flora.**

# Factors Affecting GIT Microflora

- **Stomach acidity** kills many microbes.
- **Bile salts** in duodenum inhibit microorganisms.
- **Antibiotics (oral)** reduce microbial numbers.
- **Fast transit** in small intestine → fewer bacteria.
- **Diarrhea** → rapid movement → decreased bacterial count.
- **Diet** strongly influences microbial composition.

# Normal Flora of the Stomach

- Stomach receives microbes with food.
- Very low pH → kills most organisms.
- Only acid-tolerant organisms survive.
- **Common flora:**
  - *Lactobacillus*
  - *Candida albicans*
  - *Helicobacter pylori* (present in some individuals—but **pathogenic**)

## Normal Flora of the Small Intestine

- ❖ **Sterile at birth** → quickly colonized with feeding.
- ❖ **Common flora:**
  - *Enterococci*
  - *Lactobacilli*
  - *Candida albicans*
  - Anaerobes: *Bacteroides*, *Bifidobacterium*, *Clostridium*
  - Facultative anaerobes: *Escherichia coli* and other Enterobacteriaceae.

# Normal Flora of the Large Intestine (Colon)

- ✓ Contains the **highest number** of microorganisms in the body.
- ✓ Mostly **anaerobes** + facultative anaerobes.
- ✓ Facultative anaerobes consume oxygen → create anaerobic environment.

## Common Microorganisms in the Large Intestine

### ❖ Anaerobes:

- *Bacteroides*
- *Bifidobacterium*
- *Clostridium perfringens*
- *Peptococcus*
- *Peptostreptococcus*

### ❖ Protozoa:

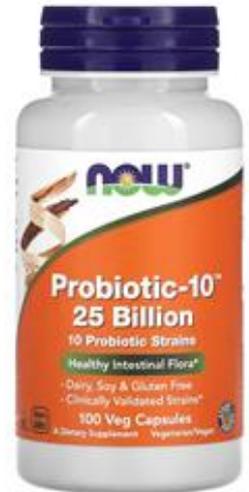
- *Trichomonas hominis*

### ❖ Facultative Anaerobes:

- *E. coli*
- *Streptococcus faecalis*  
(Enterococcus)
- *Candida albicans*

# Probiotics

- **Definition:** As live microorganisms (part of normal flora) which, when administered in adequate amounts, confer a health benefit to the host
- **Indication:** when normal intestinal flora is suppressed
- **Commercially available probiotics contain:**
  - *Bacillus coagulans*
  - *Bifidobacterium longum*
  - *Lactobacillus acidophilus*
  - *Saccharomyces boulardii*



# Uses of Probiotics

- Gastroenteritis due to any cause
- Antibiotic-associated diarrhea
- Lactose intolerance
- Irritable bowel syndrome and colitis
- Necrotizing enterocolitis
- *Helicobacter pylori* infection

# Type of infectious disease

## 1. Course:

- acute, develops rapidly and run quickly.
- chronic, develop more slowly, less severe, and persist for long time ( **Hepatitis C** )
- Latent, Mo never eliminated, sleeping, but can activated (**Herpes**)

**2. Site:** local, systemic infection

**3. Causative organisms:** Bacterial, viruses, or Fungi