

Normal Flora

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Normal flora

- denotes the population of microorganisms that inhabit the skin and mucous membranes of healthy normal persons without causing any harm to the host.
- Internal organs such as blood, kidney, heart, lungs, brain etc are sterile in normal healthy individuals. Therefore, if microorganism is found in these internal organs it is referred as diseased condition.
- The skin and mucous membranes always harbor a variety of microorganisms that can be arranged into two groups:

(1) **THE RESIDENT FLORA**

consists of relatively fixed types of microorganisms regularly found in a given area at a given age.

(2) **THE TRANSIENT FLORA**

consists of microorganisms that inhabit the skin or mucous membranes for hours, days, or weeks which is derived from the environment, does not produce disease, and does not establish itself permanently on the surface.

Characteristics of Normal Flora

- **Not disease-inducing:** They are not typical disease causing micro-organisms found in and on healthy individuals.
- **Very abundant:** The normal flora are extremely abundant in terms of numbers. For instance, an ordinary human has approximately 10^{13} body cells and 10^{14} individual normal flora.
- **All found externally:** Normal flora are found more often on the skin, eyes, nose, oral fissure as well as on the throat and lower parts of the urethra and the large intestine.

Types of normal flora

- Commensal microflora:
- Mutualistic microflora:
- Opportunistic microflora:
- **Commensal microflora:**
- These microorganisms get benefits from human host and give neither benefits nor harmful effects to host.
- Majority of normal flora are commensal types
- **Mutualistic microflora:**
- These microorganisms get benefits from host and at the same time give benefits to the host.
- **Opportunistic microflora:**
- These microorganisms, under normal conditions live as commensal on host body but they cause diseases if opportunity is available.
- For example; Normal flora of GI tract i.e. E.coli causes urinary tract infection (UTI), if the site of habitat is changed.

Beneficial roles of normal flora

- 1. Synthesize and excrete vitamins in excess of their own needs, which can be absorbed as nutrients by their host. For example, in humans, enteric bacteria secrete Vitamin K and Vitamin B12, and lactic acid bacteria produce certain B-vitamins.
- 2. Prevent colonization by pathogens by competing for attachment sites or for essential nutrients.
- 3. Antagonize other bacteria through the production of substances which inhibit or kill nonindigenous species. The intestinal bacteria produce a variety of substances like fatty acids and peroxides to highly specific bacteriocins, which inhibit or kill other bacteria.

Beneficial roles of normal flora

- 4. Stimulate the development of certain tissues, i.e., the caecum and certain lymphatic tissues (Peyer's patches) in the GI tract.
- 5. Stimulate the production of natural antibodies. Since the normal flora behave as antigens in an animal, low levels of antibodies produced against components of the normal flora are known to cross react with certain related pathogens, and thereby prevent infection or invasion.

Normal flora of the Skin

- The skin microflora are microorganisms that are resident on our skin. Also called as the skin microbiota or the skin microbiome.
- An average adult human is covered with approximately 2 m² of skin. It has been estimated that this surface area supports about 10¹² bacteria.
- Man's epidermis is not a fertile region for microorganisms to inhabit since the surface is comparatively dry and somewhat acidic.
- It, therefore, impedes the development of many microbes but, however, inhabited by few that have adjusted to the skin.
- *Staphylococcus epidermidis* is the most common normal flora
- Less common but notable organisms- *Staphylococcus aureus*, *Corynebacteria (diphtheroids)* *Streptococci*, Anaerobes e.g. *Peptostreptococci*, Yeast (*Candida* sp.)

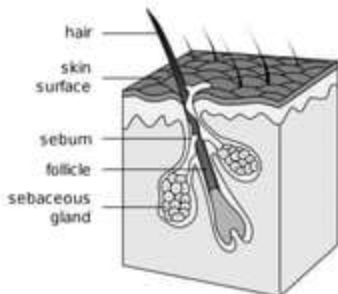
Normal flora of the Skin

Resident microorganisms

- Resident microbiota are found in the upper parts of the epidermis and congregated in and around the hair follicles.

They include:

- *Staphylococcus*
- *Micrococcus*
- *Corynebacterium*
- *Brevibacterium*
- *Dermabacter*
- *Malassezia*

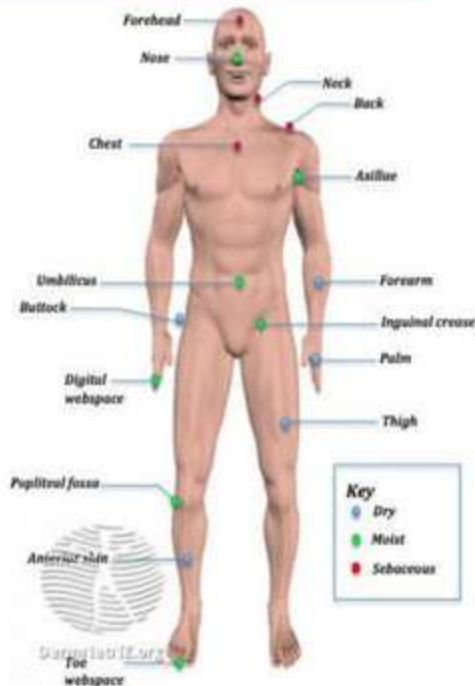


Transient bacteria

- Some microbiota are considered transient, as they can be only isolated and cultured from skin samples from time to time.
- These are mainly Gram-positive bacteria, including clostridia in the perineal area. Occasionally, moist areas allow the growth of Gram-negative *Acinetobacter*.
- Other Gram-negative bacteria are not considered part of the normal skin microbiota, as the relatively low humidity and high osmotic pressure of the skin are unfavourable for their growth.

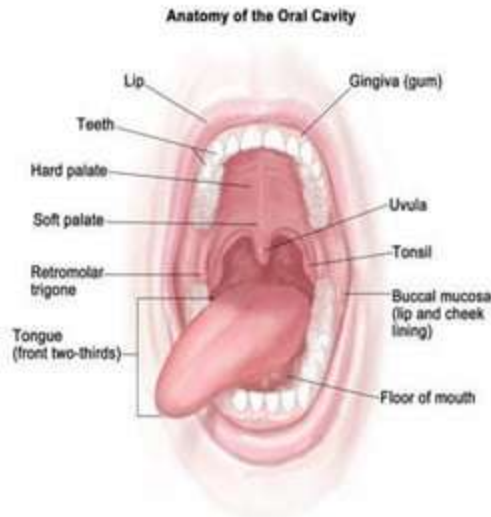
Skin sites

- Skin sites can be grouped into three types:
- Dry, Moist and Oily.
- **Dry body sites**
 - Dry sites include the forearms, hands, legs and feet. They have the most diverse microbiota, due to high exposure to the external environment. Coagulase-negative staphylococci predominate (eg, *S. epidermidis* and *S. hominis*).
- **Moist body sites**
 - *Corynebacterium* flourish in the moist skin of the skin folds: elbow creases, beneath the breasts, in-between the toes and the groins.
- **Sebaceous sites**
 - Sebaceous body sites include the head, neck and trunk, where sebaceous glands secrete an oily substance, sebum, allowing cutibacteria to thrive. Demodex mites (*Demodex folliculorum* and *Demodex brevis*) and the fungus *Malassezia* also congregate in the oily areas of the face.



Normal Flora of Oral Cavity

- The oral cavity or mouth is totally free of microorganisms at the time of birth, but it is colonized by microorganisms from the surrounding environment within hours after a human baby is born.
- In the beginning the microbial flora that establish in the mouth belong to the genera *Streptococcus*, *Neisseria*, *Actinomyces*, *Veillonella*, *Lactobacillus*, and some yeasts. These initial microorganisms are aerobes and obligate anaerobes.



Normal Flora of Oral Cavity

- When the first teeth erupt, the anaerobic forms (e.g., *Porphyromonas*, *Prevotella*, *Fusobacterium*) dominate as the space between the teeth and gums is anaerobic.
- Later on, *Streptococcus* spp. come on to the enamel surfaces of teeth, and also attach to the epithelial surfaces and colonize saliva.
- The presence of these bacteria contributes to the eventual formation of dental plaques, dental caries, gingivitis (inflammation of gum tissues), and periodontal disease (destroy of tissue and bone).

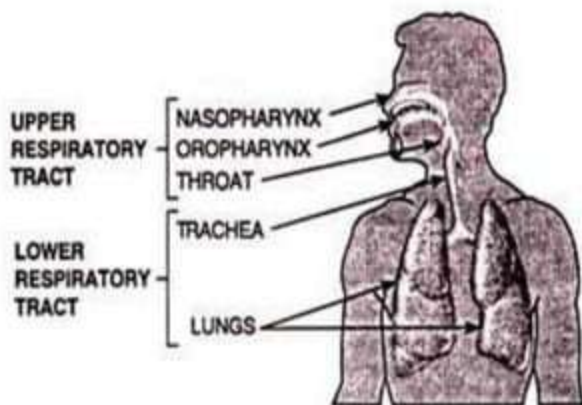
DENTAL CARIES



Normal flora of respiratory tract

- A large number of bacterial species inhabit the upper respiratory tract.
- The normal microflora of the nose occurs just inside the nostrils, and consists of *Staphylococci*, *Streptococci*, *Neisseria*, *Haemophilus*, etc. Out of these *S. aureus* and *S. epidermidis* occur predominantly in approximately the same numbers as on the skin of the face.

The lower respiratory tract (trachea, bronchi, and lungs) has no resident microflora, despite the large numbers of microorganisms potentially able to reach this region during breathing. (Innate Immunity)



Normal flora of the digestive tract

- The **stomach** contains fewer bacteria due to its high acidity nature. However, there are some bacteria that survive there like the *Helicobacter Pylori* that is currently proving to be the cause of most cases of gastritis and peptic ulcers.
- Likewise, the **small intestine** contains small numbers of *Streptococci*, *Lactobacilli*, and yeasts, particularly *Candida albicans*. Nevertheless, bigger numbers of these bacteria are found in the lower parts of the ileum.
- The **colon** is the main site for bacteria in the body.
- Several bacteria like *Bacteroides*, *Bifidobacterium*, *Eubacterium*, Coliforms (e.g. *E. coli*), *Streptococcus*, *Lactobacillus* and *Clostridium* reside in the **large intestine**.

Normal flora of the digestive tract

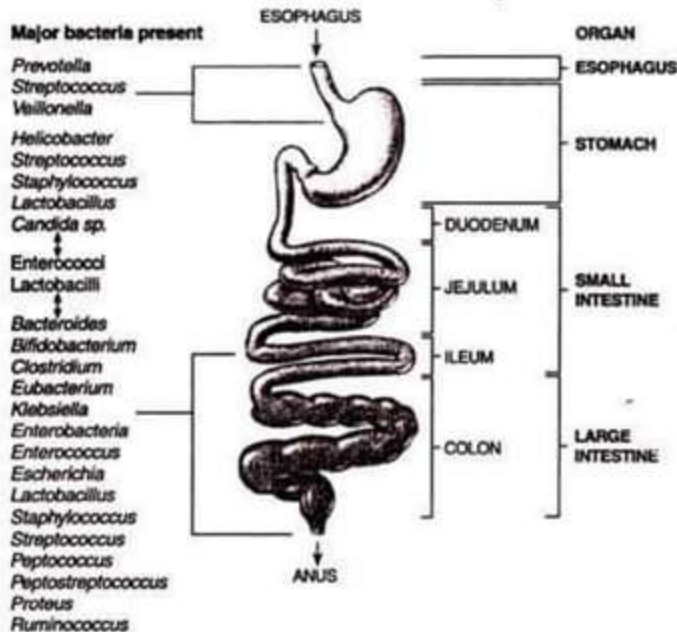


FIG. 44.3. Human gastrointestinal tract showing normal microbial flora found in different parts of it.

Normal flora of the digestive tract

- The small intestine is anatomically divided into three areas: the duodenum, jejunum, and ileum.
- The duodenum, adjacent to the stomach, is fairly acidic and contains few microorganisms (gram- positive cocci and bacilli bacteria) because of the combined influence of the acidic fluids of stomach and the inhibitory effect of bile and pancreatic secretions. Lactobacilly diphtheroids, Enterococcus faecalis, and Candida albicans (yeast) occasionally occur in the jejunum.
- In ileum, the distal part of the small intestine, the pH becomes more alkaline and, as a result, anaerobic gram-negative bacteria and members of the family Enterobacteriaceae occur in it.

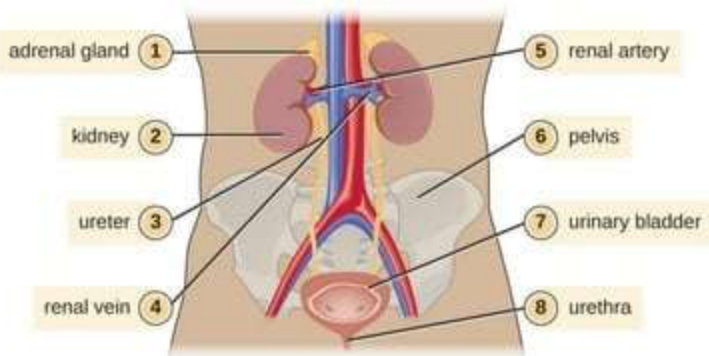
Normal flora of the digestive tract

Large intestine:

- The large intestine or colon contains the largest number of bacterial community in human body.
- The large intestine or colon acts as a fermentation vessel, and the microflora of it consists primarily of anaerobic, gram-negative, nonsporing bacteria and gram-positive, spore-forming, and nonsporing bacilli.

Normal flora of the Urogenital (Genitourinary) Tract

- The urinary bladder itself is sterile in both male and female urogenital tracts, but the epithelial cells lining the urethra are colonized by gram-negative facultatively aerobic cocci and bacilli bacteria (e.g., *Staphylococcus epidermidis*, *Enterococcus faecalis*, *Corynebacterium* spp.)
- The genital tract (vaginal tract) of an adult female, because of its large surface area and mucous secretions, possesses complex microflora.



Normal flora of the Urogenital (Genitourinary) Tract

- It is weakly acidic and contains significant amounts of the polysaccharide glycogen. *Lactobacillus acidophilus* ferments glycogen to produce lactic acid and maintains the acidic condition.
- Other microbes such as yeasts (*Torulopsis* and *Candida* species), *Streptococci*, and *E. coli* may also be present.
- Vaginal microflora constantly changes between puberty and the menopause.

Opportunistic pathogens

- A **pathogen** is a microorganism that is able to produce disease. Salmonell typhi cause typhoid disease so it's a pathogen.
- An infectious microorganism that is normally a commensal or does not harm its host but can cause disease when the host's resistance is low is called as opportunistic pathogens.
- In other words, Bacteria which cause a disease in a compromised host which typically would not occur in a healthy (noncompromised) host are acting as **opportunistic pathogens**.
- Examples of opportunistic pathogens are:
- Candida albicans - a causal agent of opportunistic oral and genital infections in human.
- Staphylococcus aureus - occur as commensal on human skin but may cause staph infections.

***Staphylococcus aureus* is an opportunistic pathogen**

- *Staphylococcus aureus* is an opportunistic pathogens of skin.
- In normal condition *S. aureus* lives as commensal in skin but it causes opportunistic wound infection when skin is damaged by burn, wound, biting, scratching etc. form the damaged skin, bacteria enters into deeper tissue and multiplies to give pus filled lesions.
- *Staphylococcus aureus* is also as opportunistic pathogen of upper respiratory tract.
- in normal condition, *S aureus* is commensal in nasal chamber but it causes secondary bacterial pneumonia in immunocompromised host.
- Patient infected with influenza or measles virus infection are at very high risk of *S. aureus* infection. Virus infection damages the mucus lining of respiratory tract so that deeper soft tissue is exposed to commensal flora ie *Streptococcus aureus* which penetrates and causes secondary bacterial infection.

ANY QUERIES ???.....

