
Lecture-12: Normal flora and other opportunistic bacteria

The normal flora is also termed **commensals**, which literally means "organisms that dine together." Except for occasional transient invaders. The internal organs and systems are sterile, including the spleen, pancreas, liver, bladder, central nervous system, and blood.

Disease can make people more susceptible to infection as a result of being very young or very old, pregnancy, malnutrition, or trauma. All these situations have in common some form of immunosuppression that makes the host more susceptible to infections. The organisms found in these situations are often opportunistic organisms.

Opportunistic organisms are those that typically do not cause disease in an immunocompetent host but can cause that in immunocompromised patient. These organisms either **endogenous** or **exogenous** source. An endogenous infection occurs when a member of the host microbiota invades a body site where it is not normally found and causes disease. For example, ***viridans streptococci***, normally found in the oral cavity, can gain access to the **bloodstream and cause endocarditis** when the patient has poor dental hygiene or when a dental procedure that disrupts the normal mucous membrane barrier is performed. In an exogenous infection, an organism presents in the environment or another source, such as another person, enters the body through inhalation, ingestion, or traumatic inoculation and causes disease. For example, fungal conidia present in the soil are inhaled and may cause a respiratory tract infection.

Microbial Flora and most common sites: The body inhabited by normal flora are, as might be expected, those in contact or communication with the outside world, namely,

the skin, eye and mouth as well as the upper respiratory, gastrointestinal, and urogenital tracts.

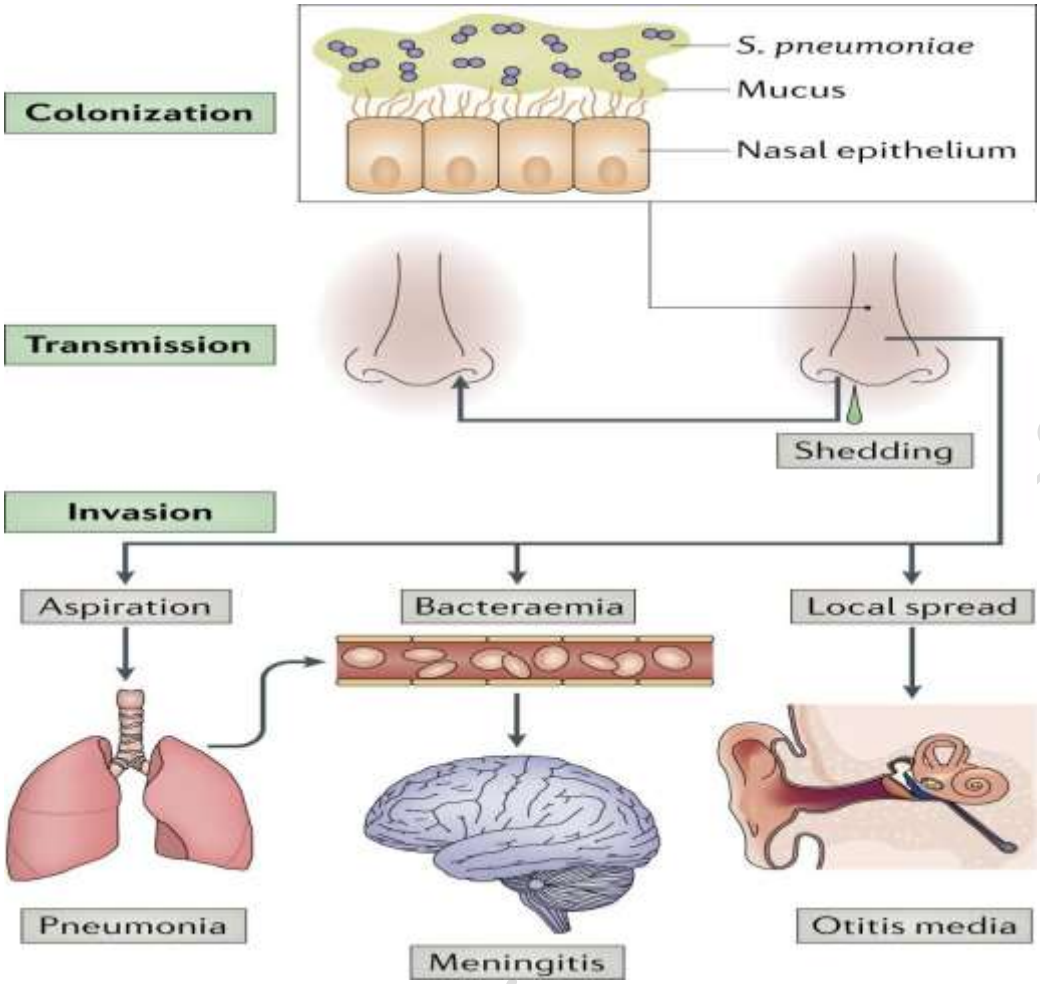
1- **Skin: skin can acquire any bacteria** that happen to be in the immediate environment, but this transient flora either dies or is removable by washing, so, the skin supports a permanent bacterial population (resident flora), residing in multiple layers of the skin. *Staphylococcus epidermidis* and other **coagulase-negative staphylococci (CON)** that reside in the outer layers of the skin appear to account for some 90 % of the skin aerobes.

Anaerobic organisms, such as ***Propionibacterium*** acnes, reside in deeper skin layers, hair follicles, and sweat and sebaceous glands. Skin inhabitants are generally harmless, although ***S. epidermidis*** can attach to and colonize plastic catheters and medical devices that penetrate the skin, sometimes resulting in serious bloodstream infections.

2- **Eye:** The conjunctiva of the eye is colonized primarily by ***S. epidermidis***, followed by ***S. aureus***, aerobic ***Corynebacteria (diphtheroids)***, and ***Streptococcus pneumoniae***. Tears, which contain the antimicrobial enzyme lysozyme, help, limit the bacterial population of the conjunctiva.

3-Buccal cavity and Nasal passages: The mouth and nose harbor many microorganisms, both aerobic and anaerobic. Among the most common are ***diphtheroids*** (aerobic ***Corynebacterium*** species), ***S. aureus***, and ***S. epidermidis***. In addition, the teeth and surrounding gingival tissue are colonized by their own particular species, such as ***Streptococcus mutans***.

Some normal residents of the **nasopharynx** can also cause disease like ***S. pneumoniae***, found in the nasopharynx of many healthy individuals, can cause acute **bacterial pneumonia**, especially in older adults and those whose resistance is impaired ((**Pneumonia is frequently preceded by an upper or middle respiratory viral infection, which predisposes the individual to *S. pneumoniae* infection of the pulmonary parenchyma**).



4-Gastrointestinal tract

In an adult, the density of microorganisms in the stomach is relatively low (103 to 105 per gram of contents) due to gastric enzymes and acidic pH.

Bacteroides species constitute a significant percentage of bacteria in the large intestine. ***Escherichia coli***, a facultative anaerobic organism, constitutes less than 0.1 % of the total population of bacteria in the intestinal tract. However, this **endogenous *E. coli*** is a major cause of **urinary tract infections (UTIs)**.

5-Urogenital tract

The low pH of the adult vagina is maintained by the presence of **Lactobacillus** species, which are the primary components of normal flora. If the Lactobacillus population in the vagina is decreased (for example, by antibiotic therapy), the pH rises, and potential pathogens can overgrow. The most common example of such overgrowth is the yeast-

like fungus, ***Candida albicans*** which itself is a minor member of the normal flora of the vagina, mouth, and small intestine.

Normal flora benefits

Normal flora can provide some definite benefits to the host:

1- the large number of harmless bacteria in the lower bowel and mouth make it unlikely that, in a healthy person, an invading pathogen could compete for nutrients and receptor sites.

2- Some bacteria of the bowel produce antimicrobial substances to which the producers themselves are not susceptible.

3- Bacteria of the gut provide important nutrients, such as vitamin K, and aid in digestion and absorption of nutrients; although humans can obtain

vitamin K from food sources, bacteria can be an important supplemental source if nutrition is impaired.

Microbial flora problems

Clinical problems caused by normal flora arise in the following ways:

1-The organisms are displaced from their normal site in the body to an abnormal site. An example is the introduction of the normal skin bacterium, ***S. epidermidis***, into the bloodstream where it can colonize catheters and heart valves, resulting in bacterial endocarditis.

2- Potential pathogens gain a competitive advantage due to diminished populations of harmless competitors such as when normal bowel flora are depleted by antibiotic therapy leading to overgrowth by the resistant ***Clostridium difficille*** , which can cause severe colitis.

3- Individuals are immunocompromised, normal flora can overgrow and become pathogenic

4- Colonization by normal, but potentially harmful, flora should be distinguished from the carrier state in which a true pathogen is carried by a healthy (asymptomatic) individual and passed to other individuals where it results in disease such as **Typhoid fever is an example of a disease that can be acquired from a carrier**