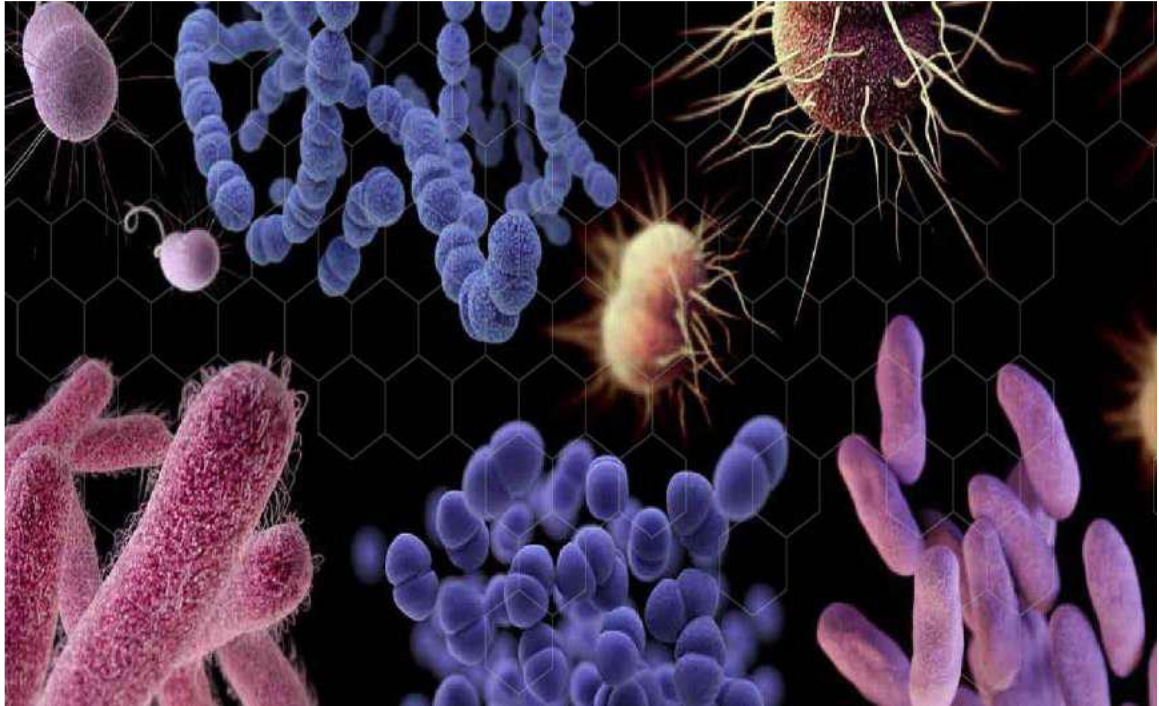


Harmful Activity of Bacteria



Pathogenic bacteria: are bacteria that cause bacterial infection. This subject deals with human pathogenic bacteria .Although most bacteria are harmless or often beneficial, several are pathogenic. One of the bacterial diseases is tuberculosis, caused by the bacterium *Mycobacterium tuberculosis* discovered by Robert Kock (1843-1910).

Koch's postulates are four criteria designed to establish a causative relationship between a microbe and a disease (**scientific basis which provides the evidence for microorganism to be the causative agent of an infectious disease**). The postulates were formulated by Robert Koch and Friedrich Loeffler in 1884.



Koch's postulates are the following:

1. The microorganism must be found in abundance in all organisms suffering from the disease but should not be found in healthy organisms.
2. The microorganism must be isolated from a diseased organism and grown in pure culture.
3. The cultured microorganism should cause disease when introduced into a healthy organism.
4. The microorganism must be re isolated from the inoculated, diseased experimental host and identified as being identical to the original specific causative agent.

In (1865-1869) Louis Pasteur (French Scientist) discovered the parasite infects the silkworm. Joseph Lister (British scientist) in 1867 used phenol as disinfectant.

Host parasite relationship:

Symbiosis - long-term interactions between different biological species, which can be mutualistic, commensal or parasitic.

Parasitism the two (both) organisms of different species exist in a relationship in which the **parasite where benefits while the another is harmed.**

Mutualism is individual benefits, in which **both organisms benefit** (such as individual) and bacteria within their intestines (normal flora) .

Commensalism is a class of relationship between two organisms **where one organism benefits without affecting the other.**

Amensalism, where **one is harmed while the another is unaffected.**

Antagonism refers to **the action of any organism that suppresses or**



interfere the normal growth and activity of a pathogen, such as the main parts of bacteria or fungi.

NORMAL FLORA

The microorganisms are found normally in the tissues such as intestine, skin , and other mucous membranes . But the **blood, brain, muscle, urine etc., are normally free of microorganisms.** However, the surface tissues, i.e., **skin and mucous membranes**, are constantly in contact with environmental organisms and become readily colonized by various microbial species. **The mixture of organisms regularly found at any anatomical site is referred to as the normal flora.** The normal flora of humans consists of a few **eukaryotic fungi and protists**, but bacteria are the most numerous and obvious microbial components of the normal flora. Thus, we can classify normal flora in to

1-TRANSIENT FLORA

Some of These organisms may be **Pathogens** (more frequently among the transient flora group).Some among the normal flora may be **opportunists** (may be found for hours. Days , weeks) .

2- Resident flora : Regularly found inside the body (endosymbionts) or on its surfaces (ectosymbionts) usually not pathogenic but may be opportunistic.

Table 1. Bacteria commonly found on the surfaces of the human body.

BACTERIUM S C N Ph

M

G

Ur V

Staphylococcus epidermidis ++ + ++ ++ ++ + ++ ++



*Staphylococcus aureus** + +/- + + + ++ +/- +

Streptococcus mitis + ++ +/- + +

Streptococcus salivarius ++ ++

*Streptococcus mutans** + ++

*Enterococcus faecalis** +/- + ++ + +

*Streptococcus pneumoniae** +/- +/- + + +/-

*Streptococcus pyogenes** +/- +/- + + +/- +/-

Neisseria sp. + + ++ + + +

*Neisseria meningitidis** + ++ + +

*Enterobacteriaceae**(*Escherichia coli*)

+/- +/- +/- + ++ + +

Proteus sp. +/- + + + + + +

*Pseudomonas aeruginosa** +/- +/- + +/-

*Haemophilus influenzae** +/- + + +

*Bacteroides sp.** ++ + +/-

Bifidobacterium bifidum ++

Lactobacillus sp. + ++ ++ ++

*Clostridium sp.** +/- ++

Clostridium tetani +/-

Corynebacteria + + + + + + + + +

Mycobacteria + +/- +/- + +

Actinomycetes + +

Spirochetes + ++ ++



Mycoplasmas + + + +/- +

What are the bacterial virulence factors?

Virulence factors can most simply be defined as the character(s) that are directly involved in the development of disease. The term **virulence** is used to grade the ability of an organism to cause disease. The measurement of virulence is made by comparing the numbers of organisms necessary to cause disease in a suitable model.

- 1- Adherence to host cells
- 2- Invasiveness
- 3- Iron sequestering
- 4- Virulence factors that inhibits phagocytosis
- 5- Bacterial toxins include (Exotoxin , Endotoxin)
- 6- Antibiotic resistance
- 7- Super antigen

☐☐ **Infectivity**: Describes the ability of an organism to establish itself in a new host and this is defined by the ID₅₀. The LD₅₀ is used in the measurement of virulence between two strains of the same organism.

1. **Colonization**

The first stage of microbial infection is **colonization**: the establishment of the pathogen at the appropriate portal of entry. Pathogens usually colonize host tissues that are in contact with the external environment.

Sites of entry in human hosts include skin and mucous membrane, such as (the urogenital tract, the digestive tract, the respiratory tract and the conjunctiva). In its simplest form, bacterial adherence or attachment to a



eukaryotic cell or tissue surface requires the participation of two factors: a **receptor** and a **ligand**. The receptors so far defined are usually specific **carbohydrate or peptide residues on the eukaryotic cell surface**. The bacterial ligand, called an **adhesin**, is typically a **macromolecular component of the bacterial cell surface which interacts with the host cell receptor**.

There are several terms used to describe adherence factors in microbiology such as (Adhesin, Receptor, Fimbriae, Biofilm, Capsule..etc)