

General Characteristics of Bacteria

Introduction to Bacteriology

- **Bacteria** are the most abundant group of microorganisms in nature. It is found everywhere on the planet, such as hot spring, deep ocean, deserts and even thrive inside our intestine.
- Bacteria are unicellular micro-organisms ranging in length from a few micrometres to half a millimetre.
- Bacteria are found 2 billion years before eukaryotes
- Some bacteria are pathogenic and cause disease thus called pathogenic bacteria in contrary to those called beneficial bacteria.
- Bacteria were first observed by Anton Van Leeuwenhoek in 1676.
- The term 'bacteria', Greek for 'small stuff' was first used in 1838.
- Robert Koch and Louis Pasteur were the first to discover that bacteria caused many diseases (mid19th century).
- The first antibiotic used to treat bacterial disease was made by Paul Ehrlich in 1910. It was used to treat Syphilis. The branch of science which deals with the study of bacteria is known as **Bacteriology**.
- Smallest bacteria: *Dialister pneumosintes*
- Largest bacteria: *Epulopiscium fishelsoni*

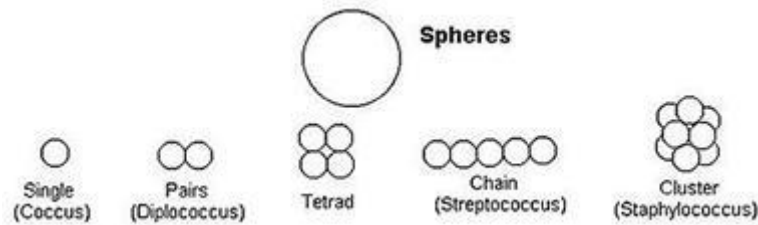
General Characteristics

- Bacteria are prokaryotic organisms (Kingdom: Monera)
- They do not have cell defined organelles like mitochondria, Golgi bodies, Endoplasmic reticulum., etc.
- They may occur singly or in small groups to form colonies.
- They possess rigid cell wall. Cell wall is made up of peptidoglycan (Mureins) and Lipo polysaccharides.
- Absence of well-defined nucleus i.e., DNA is not enclosed in a nuclear membrane.
- Ribosomes are scattered in the cytoplasmic matrix and are of 70S type.
- The plasma membrane is invaginated to form mesosomes.
- Most of the bacteria are heterotrophic. Some bacteria are autotrophic, possess bacteriochlorophyll
- Motile bacteria possess one or more flagella.
- The common method of multiplication is binary fission.

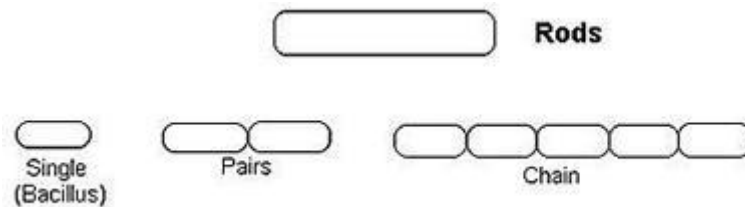
- True sexual reproduction is lacking, but genetic recombination occurs by conjugation, transformation and transduction.

Bacterial Shapes

The most basic method used for identifying bacteria is based on the bacterium's shape and cell arrangement.



- Cocci** (or **coccus** for a single cell) are round cells, sometimes slightly flattened when they are adjacent to one another.
 - Cocci bacteria in pairs is called as Diplococci :*Diplococcus pneumoniae*
 - Cocci in chains is called as Streptococci :*Streptococcus*
 - Cocci in clusters/ groups is called as Staphylococci :*Staphylococcus aureus*
 - Cocci in four is called as Tetracocci :Genus *Micrococcus* often divide in two planes to form square groups of 4 cells called Tetrad
 - Cocci in eight is called as Sarcine :*Sarcina lutea*



- Bacilli** (or **bacillus** for a single cell) are rod-shaped bacteria. Like coccus bacteria, bacilli can occur singly, in pairs, or in chains. Examples - Rod shaped: *Bacillus subtilis*,
3. Comma shaped bacteria is *Vibrio cholera*



- Spirilla** (or **spirillum** for a single cell) are curved bacteria which can range from a gently curved shape to a corkscrew-like spiral.

Many spirilla are rigid and capable of movement.

5. A special group of spirilla known as spirochetes are long, slender, and flexible:
Spirillum volutans
6. Bacteria which often changes its shape is called Pleomorphic: *Corynebacterium diphtheriae*

Economic importance of Bacteria:

1. Bacteria as decomposers- Bacteria in soil fix atmospheric nitrogen and ammonia in roots and helps in plants and soil fertility

- Nitrifying bacteria –*Nitrosomonas* , *Nitrobacter*, *Rhizobium* & *Azotobacter*
- Ammonifying bacteria

2. Bacteria are used in food production:

- Soy sauce-*Pediococcus*
- Cheese-*Lactobacillus*
- Vinegar-*Acinetobacter*

3. Bacteria are also used in various industries:

a. Fibre retting- *Clostridium felsineum* & *Clostridium pectinovorum*

b. Industrial production of organic compound- Acrylic acid & Proplene Glycol- *Bacillus* species

c. Bacteria in dairy products- Lactic acid bacteria

d. Bacteria in the production of vitamins- Riboflavin (Vitamin B) -*Clostridium butylicum*

- Cobalamine (Vitamin B12) -*Pseudomonas denitrificans*

e. Bacteria in the production of antibiotics

- Bacitracin- *Bacillus subtilis*
- Aureomycin – *Streptomyces* species
- Terramycin – *Streptomyces rimosus*
- Streptomycin-*Streptomyces griseus*

f. Bacteria in the production of enzymes

- Streptokinase-*Streptococcus pyogenes*
- Proteokinase- *Bacillus subtilis*
- Amylase-*Bacillus* species

g. Bacteria in the production of Steroids - *Cornyebacterium* & *Streptomyces*