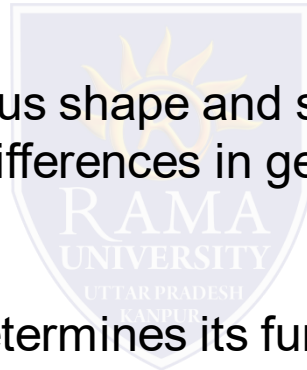




FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

Structural and functional relation of prokaryotes

- ❖ The main focus of this unit will be about morphology of prokaryotes and cellular composition.
- ❖ Here we will be discussing about both external and internal cellular architecture of prokaryotes.
- ❖ Prokaryotes can exist in various shape and sizes and this difference in prokaryotic structure is due to differences in genetics and environmental conditions.
- ❖ Size and shape of bacteria determines its functions and applications, so we will be starting this unit with detailed view of bacterial size, shape and arrangements.



Size, shape and arrangement

- ❖ Bacteria size ranges from 0.2 – 2.0 μm in diameter and from 2 to 8 μm in length.
- ❖ Bacteria has large surface area/volume ratio.
- ❖ Large surface area/volume of bacteria facilitates easy nutrient uptake, waste removal and efficient transfer of nutrient through procaryotic cells without circulatory mechanism.
- ❖ The shape of the bacteria is governed by its rigid cell wall and can attain any of shape such as spherical-shaped coccus (plural: cocci, meaning berries), rod-shaped bacillus (plural: bacilli, meaning little rods or walking sticks), and rod that are helically curved spirilla, singular spirillum).
- ❖ These are called spirilla when rigid and spirochetes when flexible. Bacteria that look like curved rods are called vibrios.

- ❖ Bacteria are further grouped depending upon their arrangements.
- ❖ Cocci that remain in pairs after dividing are called diplococci (e.g. *Neisseria*); those that divide and remain attached in chainlike patterns are called streptococci (e.g. *Streptococcus*, *Enterococcus*, and *Lactococcus*).
- ❖ Those that divide in two planes and remain in groups of four are known as tetrads.
- ❖ Those that divide in three planes and remain attached in cubelike groups of eight are called sarcinae.
- ❖ Those that divide in multiple planes and form grapelike clusters or broad sheets are called staphylococci.



- ❖ Bacilli divide only across their short axis.
- ❖ Most bacilli appear as single rods, called single bacilli (e.g. *Bacillus megaterium*).
- ❖ *Diplobacilli* appear in pairs after division and *streptobacilli* occur in chains. Some bacilli look like straws.
- ❖ Others have tapered ends, like cigars. Still others are oval and look so much like cocci that they are called coccobacilli.
- ❖ Another group of bacteria are also defined which does not have constant shape and are capable of exhibiting variety of shape.
- ❖ Such types of bacteria are called as pleomorphic bacteria. E.g. *coynebacterium*, *rhizobium*

Question: Calculate the surface area/volume ratios of coccus bacterial species having diameter $1\mu\text{m}$, $1\times 10^3\mu\text{m}$ and $1\times 10^6\mu\text{m}$.

Question: Calculate the surface area, volume and surface area/volume ratio of lactobacillus having diameter of $2.0\mu\text{m}$ and length $8\mu\text{m}$.

Question: It is given that lactobacillus and streptococcus bacteria have same volume. Calculate their surface area and surface area/volume ratio. Which one of these two bacteria has greater surface area/volume ratio?