

Difference between Prokaryotic and Eukaryotic cells

Lecture 4

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II) Classification of Microbiology

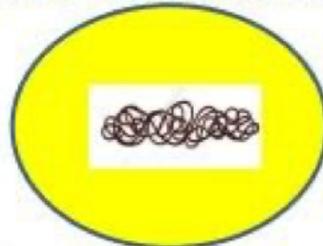
A) Eukaryotic (True

nucleus)



membrane-bound
organelles present

B) Prokaryotic (Not True nucleus)



Membrane bound
organelles Absent

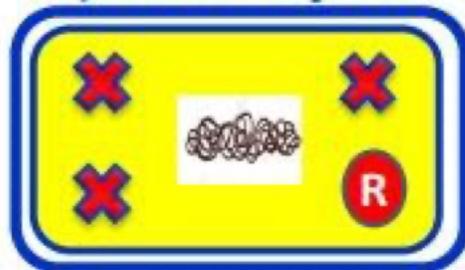
II) Classification of Microbiology

A) Eukaryotic



- ❖ Fungi
- ❖ Protozoa
- ❖ Algae

B) Prokaryotic



- ❖ Bacteria

Characteristic	Prokaryotic	Eukaryotic
1) Nucleus	No	Yes
2) Size	0.05-10μm	10-100μm
3) Nuclear membrane	No (Nucleoid)	Yes (Nucleus)
4) Membrane-bound organelles <ul style="list-style-type: none"> ▪ Mitochondria ▪ Golgi apparatus ▪ Endoplasmic reticulum 	Absent	Present
5) Chromosome Number	One (circular)	Multiple (linear)
6) Ribosome	70S (30S-50S)	80S (40S -60S)

Characteristic	Prokaryotic	Eukaryotic
7) Cell wall	Present EXCEPT Mycoplasma	Absent Fungi (Chitin)
8) Cell membrane	No sterols EXCEPT in mycoplasma	Has sterols
9) Division	Binary fission	Mitosis

Prokaryotes (Cell Shape and Arrangements)

- Most of the bacteria have a rigid cell wall that provides a definite shape to the bacteria while protecting the internal components.
- They vary in shape that allows them to be classified into different groups based on their forms.
- This wide variety of shapes is determined by the **bacterial cell wall and cytoskeleton**.
- Most of the pathogenic bacteria, appear in one of three basic shapes:
 1. Bacilli (Rod-shaped)
 2. Sphere or Cocci
 3. Spiral.

**Prokaryotic
Shapes**



1 μm

**(a) Spherical
(cocci)**



2 μm

**(b) Rod-shaped
(bacilli)**



5 μm

(c) Spiral

Bacterial Shape

- It has been observed that bacterial shape play crucial roles contributes of survival when facing difficult condition, like:
- Nutrient acquisition
 - Cell division
 - Predators
 - Attachment to surfaces
 - Passive dispersal (the movement of bacteria from one place to another without their own effort — they are carried by outside forces such as wind, water, animals, or humans).
 - Active motility
 - Internal or external differentiation.

The common categories of bacteria based on their shapes are:

1. Cocci

- ✓ The bacteria that are oval or spherical in shape are included called **cocci bacteria**.
- ✓ These may either remain single or attached to one another in groups.
- ✓ They appear flattened when placed in groups.

2. Bacilli (Rod-shaped)

- ✓ Like cocci, remain either single or attached to other cells.
- ✓ Bacilli bacteria are among the first bacteria to have arisen, and **this** shape is said to be not as advantageous as other shapes.

3. Spiral

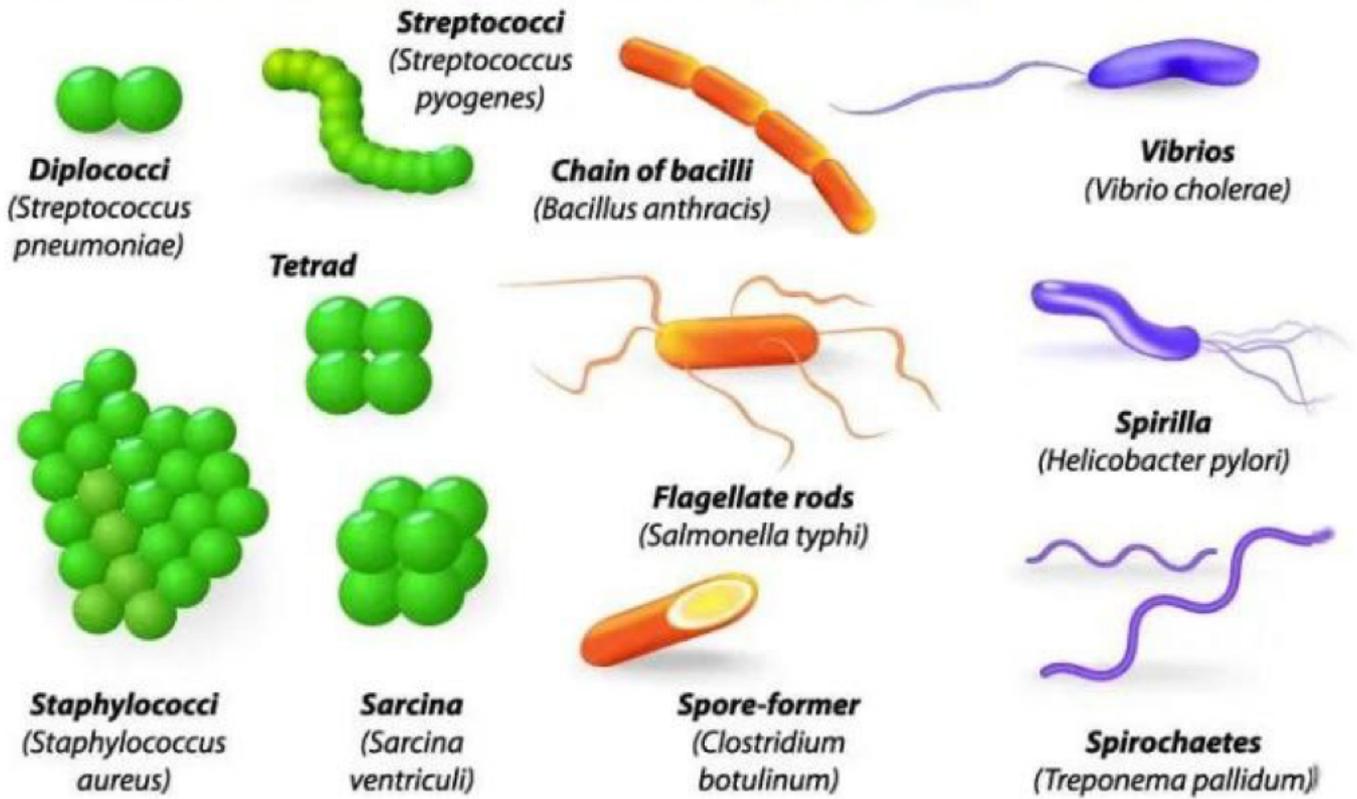
- ✓ This group includes bacteria that are either helical-shaped or curved (comma-shaped).
- ✓ The bacteria can range from slightly curved to corkscrew-like spiral.

BACTERIA SHAPES

SPHERES (COCCI)

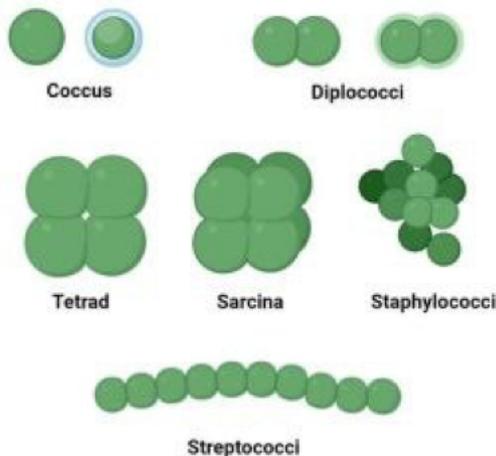
RODS (BACILLI)

SPIRALS

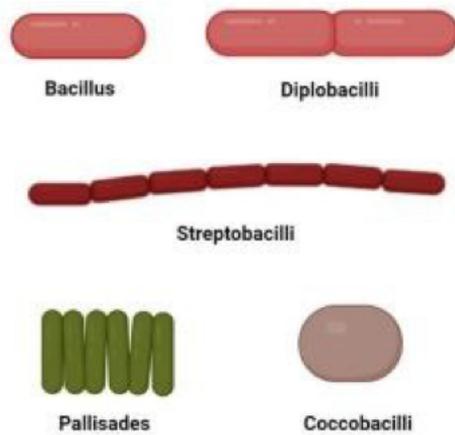


Bacterial Shapes and Arrangement

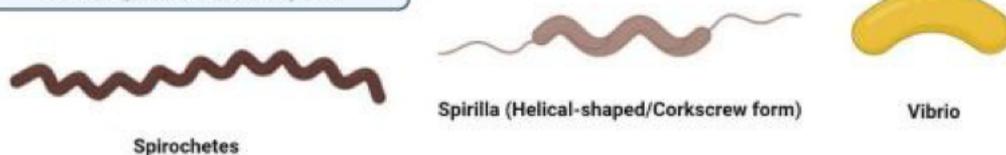
Arrangements of Cocci



Arrangements of Bacilli



Arrangements of Spiral



Bacterial Arrangements

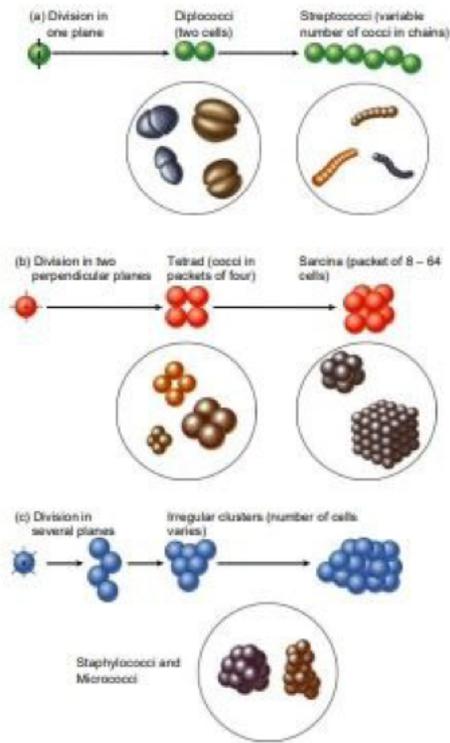
- Arrangement of cells is dependent on pattern of division and how cells remain attached after division:

- **Cocci:**

- Singles
- Diplococci – in pairs
- Tetrads – groups of four
- Irregular clusters
- Chains
- Cubical packets (sarcina)

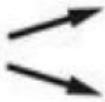
- **Bacilli:**

- Diplobacilli
- Chains
- Palisades

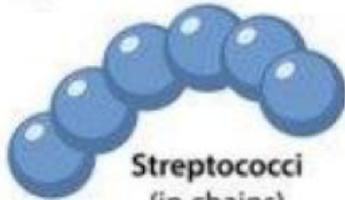


Arrangements of Cocci

Plane of division



Diplococci
(in twos)

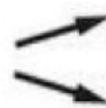
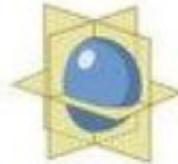


Streptococci
(in chains)

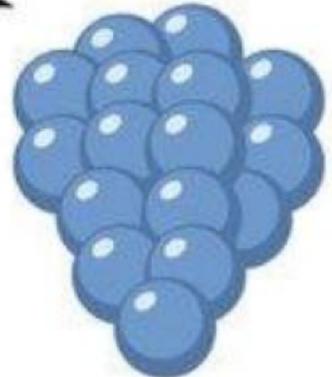


Tetrad
(in tetrads)

Plane of division



Sarcina
(3-dimensional
geometrical forms)



Staphylococci
(irregular grape-like cluster)

Arrangements of Cocci

- Cocci bacteria can be arranged either singly, in pairs, in groups of four, in chains, in clusters or cubes consisting of eight cells.
- These cells remain attached during cell division.

Coccus

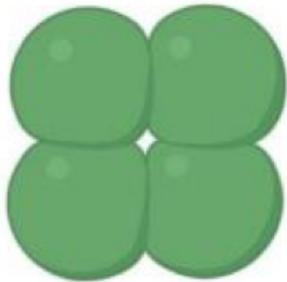


Diplococci



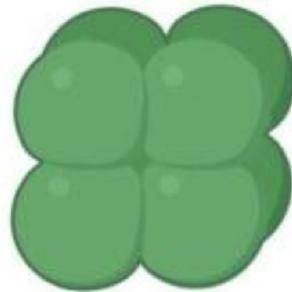
- This arrangement results when two bacterial cells occur as a pair (joined together).
- Some of the cells in this arrangement might remain spherical while some might appear flattened, elongated, or bean-shaped.
- Examples: *Streptococcus pneumoniae*

Tetrad



- Tetrad bacteria are arranged in a group of **four cells**.
- Examples: *Tetragenococcus*.

Sarcina



- The bacterial cells form a group of **eight cells**.
- The common characteristic associated with these organisms is being **strict anaerobe**.
- Examples: *Sarcina ventriculi*.

Streptococci



- Bacteria are arranged in long chains.
- Present in family **Streptococcaceae**, which is characterized by a lack of motility and Gram-positive bacteria.
- Examples: *Streptococcus pyogenes*, *Streptococcus mutans*.

Staphylococci



- This type includes bacteria that are arranged in **grape-like clusters**.
- Characterized by organisms which are **immotile** and Gram-positive.
- Examples: *Staphylococcus aureus*

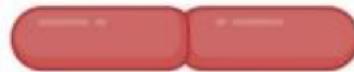
Arrangement of Bacilli

• Bacillus



- Bacilli are the bacteria which are rod-shaped and are present as single cells.
- These bacteria can form **endospores** and are **facultative anaerobes**.
- Examples: *Salmonella enterica*, *Bacillus cereus*

• Diplobacilli



- As in Diplococci, Diplobacilli also exists in pairs.
- After cell division, the two cells do not divide and grow in an attached arrangement.
- Examples: *Coxiella burnetii*, *Moraxella bovis*.

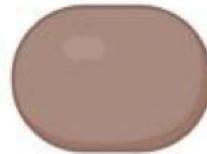
Arrangement of Bacilli

• Streptobacilli



- In this group, bacteria are arranged in chains.
- This results from cell division in a single chain.
- Examples: *Bacillus anthracis*.

• Coccobacilli



- As the name suggests, coccobacilli resemble both cocci as well as bacilli.
- These are shorter in size and thus, appear stumpy.
- Examples: *Chlamydia trachomatis*,
Haemophilus influenzae

Arrangement of Spiral

Vibrio



- These are the slightly curved bacteria resembling a comma shape.
- Examples: *Vibrio mytili*, *Vibrio cholera*.

Spirochetes



- Spirochetes are spiral bacteria having a helical shape.
- These have an axial filament which helps in motility. These filaments are essential distinguishing character between spirochetes and other bacteria.
- These filaments help the motion of the bacteria.
- Examples: *Leptospira interrogans*, *Treponema pallidum*

Spirilla (Helical-shaped/Corkscrew form)



- Similar in structure with spirochetes but are more rigid.
- They, too, have a flagellum but lack the endoflagella like in spirochetes.
- Examples: *Campylobacter jejuni*, *Helicobacter pylori*.

Other Shapes and Arrangements

✓ Appendaged Bacteria

- The bacteria that produce a unique structure like pillus or fimbriae are called appendaged bacteria.

✓ Box-shaped/ Rectangular Bacteria

✓ Club-shaped Rod Bacteria

- These bacteria are thinner on one side than the other.

✓ Filamentous Bacteria

- They, sometimes, divide to form branches resembling strands of hair or spaghetti called mycelium.

✓ Triangular-shaped Bacteria

✓ Pleomorphic Bacteria

- The bacteria that do not have a specified shape are included in this group.

✓ Stalked Bacteria

- These are the bacteria that possess a stalk on one end of the cell.

✓ Star-shaped Bacteria