



## GENERAL BIOLOGY

1<sup>st</sup>. Stage

Lec. 7

2<sup>nd</sup>. course

## THE BACTERIA

BY

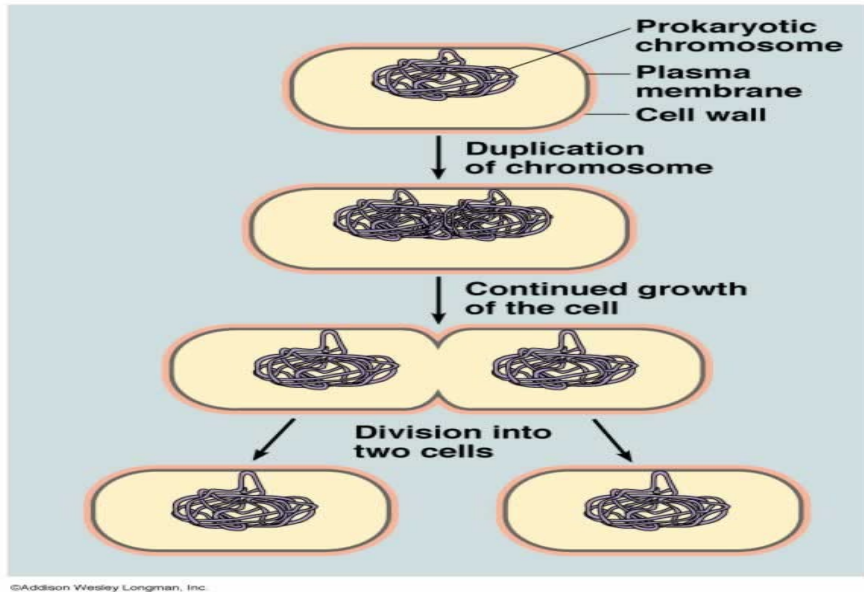
DR. MOHAMMED AL-MURIB

### Definition :

Bacteria are Prokaryotes cells, single-celled (unicellular) microorganisms which :

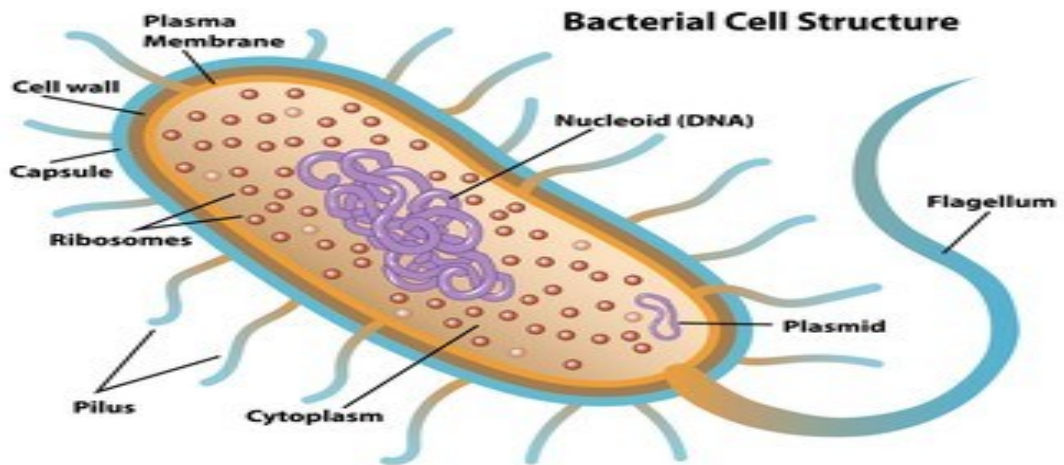
- have cell walls
- lack organelles and an organized nucleus
- their size (0.2-10 $\mu$ m)
- cell division by binary fission
- and have single-stranded circular DNA

## Binary fission of Bacteria



## Bacterial structures

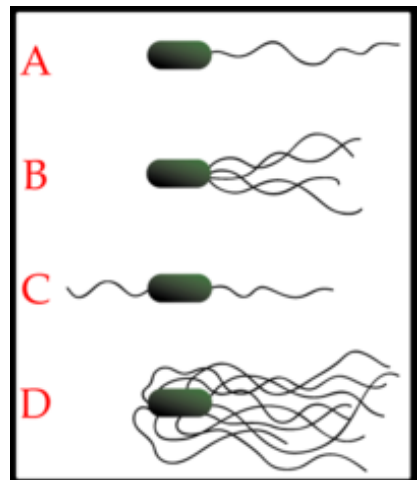
| No. | Bacterial structure  | Composition                             | function                                  |
|-----|----------------------|-----------------------------------------|-------------------------------------------|
| 1.  | s-layer (slim layer) | G+ : proteins<br>G-: Lipopolysaccharide | protection against environment conditions |
| 2.  | Capsule              | polysaccharide                          | protection against environment conditions |
| 3.  | cell wall            | Peptidoglycan                           | Provides bacterial shape and rigidity     |
| 4.  | Cytoplasmic membrane | phospholipid bilayer                    | Exchanging molecules                      |
| 5.  | Flagella             | flagillin protein                       | movement                                  |
| 6.  | Pili                 | Pilin protein                           | adhere to host tissue surfaces            |



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## Types of Flagella

- A. [Monotrichous](#) – Single flagellum
- B. [Lophotrichous](#) – A tuft of flagella found at one of the cell poles
- C. [Amphitrichous](#) – Single flagellum found at each of two opposite poles
- D. [Peritrichous](#) – Multiple flagella found at several locations about the cell

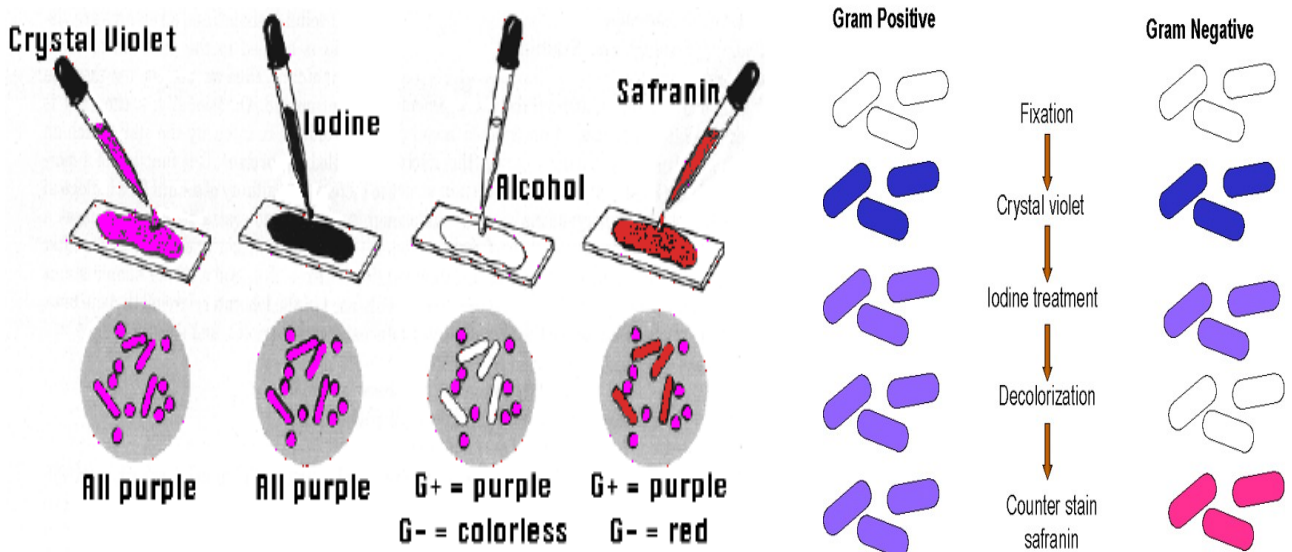


# Classification of bacteria

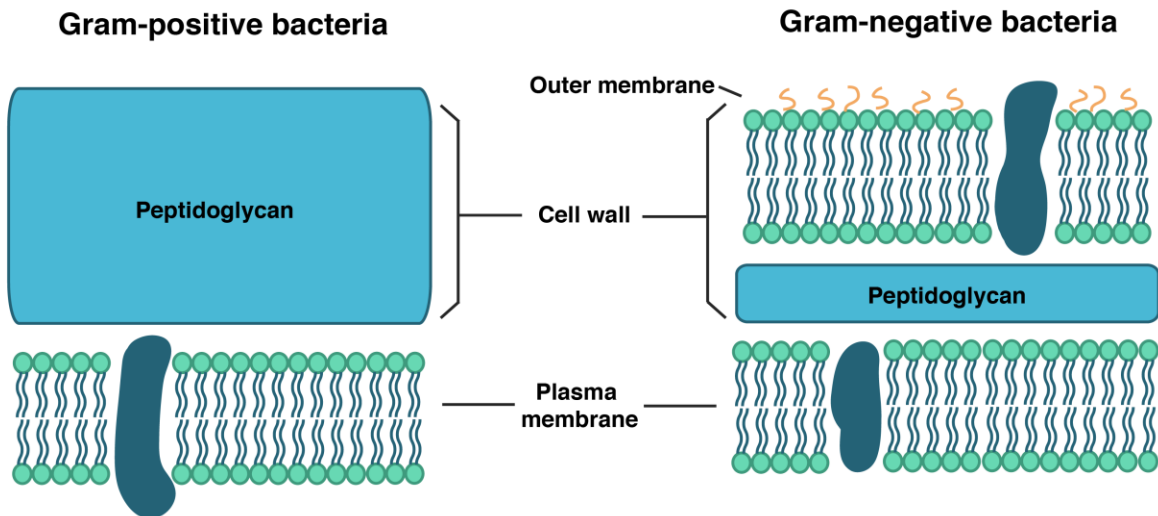
- I. Classification on gram stain**
- II. Classification on the shape**
- III. Classification on the basis of mode of nutrition**
- IV. Classification on the basis of oxygen requirement**

## I. Classification on gram stain

Grams stain classify bacteria to: G +ve (purple cells) and G -ve (red cells)



## Bacterial Cell layers



## Classification on the shape

**A. Cocci:** These types of bacteria are unicellular, spherical or oval shape

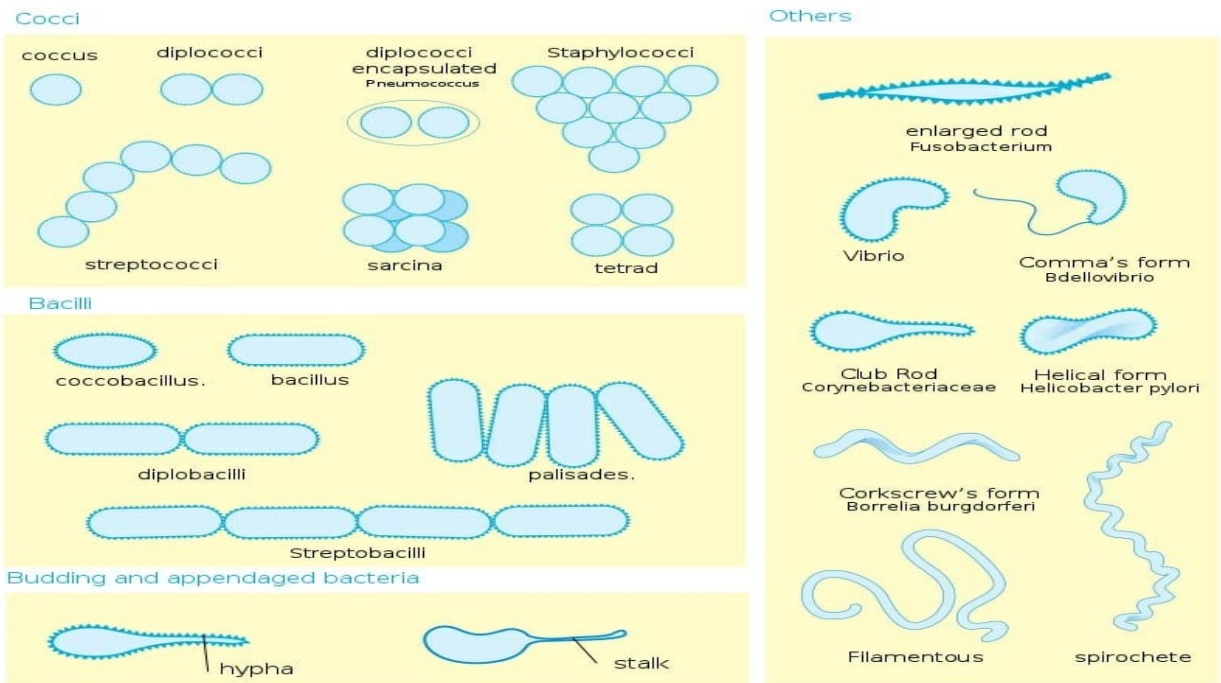
- **Monococcus:** they are also called micrococcus its single cell
- **Diplococcus:** two cells attached to each other.
- **Streptococcus:** its chain of cells.
- **Tetracoccus:** this consists of four cells.
- **Staphylococcus:** the cells forming a structured like bunches of grapes

## Classification on the shape

**B. Bacilli:** These are rod shaped or cylindrical bacteria which either remain singly or in pairs.

**C. Vibrio:** its the curved, comma shaped bacteria and represented by a single genus.

**D. Spirilla:** These type of bacteria are spiral or spring like with multiple terminal flagella.



## Classification on the basis of Mode of Nutrition

### 1. Phototrophs:

- Those bacteria which gain energy from light.
- Phototrophs are further divided into two groups on the basis of source of electron.
- **Photolithotrophs**: these bacteria gain energy from light and uses reduced inorganic compounds such as  $\text{H}_2\text{S}$  as electron source.
- **Photoorganotrophs**: these bacteria gain energy from light and uses organic compounds such as **succinate** as electron source

### 2. Chemotrophs:

Those bacteria gain energy from chemical compounds.

- They cannot carry out photosynthesis.
- Chemotrophs are further divided into two groups on the basis of source of electron.
- **Chemolithotrophs**: they gain energy from oxidation of chemical compound and reduces inorganic compounds such as  $\text{NH}_3$  as electron source.
- **Chemoorganotrophs**: they gain energy from chemical compounds and uses organic compound such as glucose and amino acids as source of electron.

### 3. Autotrophs:

- Those bacteria which uses carbon dioxide as sole source of carbon to prepare its own food.
- Autotrophs are divided into two types on the basis of energy utilized to absorption carbondioxide. ie. Photoautotrophs and chemoautotrophs.
- **Photoautotrophs:** they utilized light to assimilate CO<sub>2</sub>. They are further divided into two group on the basis of electron sources to:- Photolithotropic autotrophs and Photoorganotropic autotrophs
- **Chemoautotrophs:** They utilize chemical energy for absorption of CO<sub>2</sub>

### 4. Heterotrophs:

- Those bacteria which uses organic compound as carbon source.
- They lack the ability to fix CO<sub>2</sub>.
- Most of the human pathogenic bacteria are heterotropic in nature.
- Some heterotrops are simple because they have simple nutritional requirement.

## Classification of bacteria on the basis of Oxygen Requirement

### 1. Obligate Aerobes:

- Require oxygen to live.
- Example: *Pseudomonas*.
- Can use oxygen, but can grow in its absence.
- They have complex set of enzymes.
- Examples: *E. coli*, *Staphylococcus*, yeasts, and many intestinal bacteria.

### Obligate Anaerobes:

- Cannot use oxygen and are harmed by the presence of toxic forms of oxygen.
- Examples: *Clostridium* bacteria that cause tetanus and botulism.

### Aerotolerant Anaerobes:

- Cannot use oxygen but tolerate its presence.
- Can break down toxic forms of oxygen.
- Example: *Lactobacillus* carries out fermentation regardless of oxygen presence.

### Microaerophiles:

- Require oxygen but at low concentrations.
- Sensitive to toxic forms of oxygen.

## Types of culture media used in microbiology

These are classified into six types of routine laboratory media :

**1. Basal media**:- Basal media are those that may be used for growth (culture) of bacteria that do not need enrichment of the media. Examples: **Nutrient broth**

**2. Enriched media**:- The media are enriched usually by adding blood, serum or egg. Examples: Enriched media are **blood agar**

**3. Selective media**:- These media favor the growth of a particular bacterium by inhibiting the growth of undesired bacteria and allowing growth of desirable bacteria. Examples: **MacConkey agar**. Antibiotic may be added to a medium for inhibition.

**4. Indicator (differential) media**:- An indicator is included in the medium. A particular organism causes change in the indicator, e.g. blood. Examples: **Blood agar** and **MacConkey agar** are indicator media.

**5. Transport media**:- These media are used when specie-man cannot be cultured soon after collection.

**6. Storage media**:- Media used for storing the bacteria for a long period of time.