Micro-organisms

Micro-organisms:

- They are living structure of microscopial view.
- They are originally classified under plants & animal kingdom.

Protista:

→ Eukaryotes:

- Fungi, algae, protozoa, mould are included in this group.

→ Prokaryotes:

- Bacteria belongs to this group.

→ Difference between Eukaryotes & Prokaryotes:

Structure	Eukaryotes	Prokaryotes
Nuclear membrane	present	Absent
Nucleoles	present	Absent
chromosomes	more than one	one
DNA	present	Absent
Division	Mitosis	Binary fission
cytoplasm	present	Absent
Mytochondria	present	Absent
Golgi apparatus	present	Absent
Ribosomes	present	Absent
Endoplasmic Rectical	present	Absent

⇒ Bacteria :

- size of bacteria is measured in unit 'Micron'.

  1 Micron or micrometre (μm) = $\frac{1}{1000}$ millimeter

  1 millimicron or nanometre = $\frac{1}{1000}$ micron (μm)

  1 Angstrom unit (Å) = $\frac{1}{10}$ nm

- Bacteria of medical importance measure between 2-5 mm(L)

  2-5mm(L) x 0.2 x 1.5 mm

- Resolution power of an unaided eye is about 200 micron
- Bacteria is smaller than resolution limit it can be visualized only under magnification hence the study of bacteria is required use of microscope.

a) Nucleus :

- Bacterial nucleus has no nuclear membrane. or nucleolus.
- DNA is double stranded inform of circle.
- when straighten bacterial DNA is haploid. replicated by binary fission & maintain genetic characteristics.

b) Bacterial Capsule & slime layer :

- It is the outer most layers of bacteria
- Polysaccharide in nature but it is polypetide in anthrax bacillus.
- Capsule enhances bacterial virulence by inhibiting phagocytosis.
- Its a protective covering against. anti-bacterial substance such as bacteriophages, phagocytes enzymes.
- It antigen is specific for bacteria & can be used for identification & typing of bacteria.

c) Flagella: (Flagellum)

- It is long, hollow, helical filamentous organs of locomotion that arise from cytoplasmic membrane & pass out through cell wall.
- They are found in Gram-positive & negetive bacteria.
- Location of flagella on cell varies depending upon bacterial species.
- Flagella helps in motility of bacteria.

d) Fimbriae (Pili):

- Pili (Pilus) are hollow, non-helical, filamentous appendages that are thinner, shorter & more than flagella.
- Pili occurs in both flagellated & non-flagellated bacteria.
- Pili donot function in motility.

e) Cell wall:

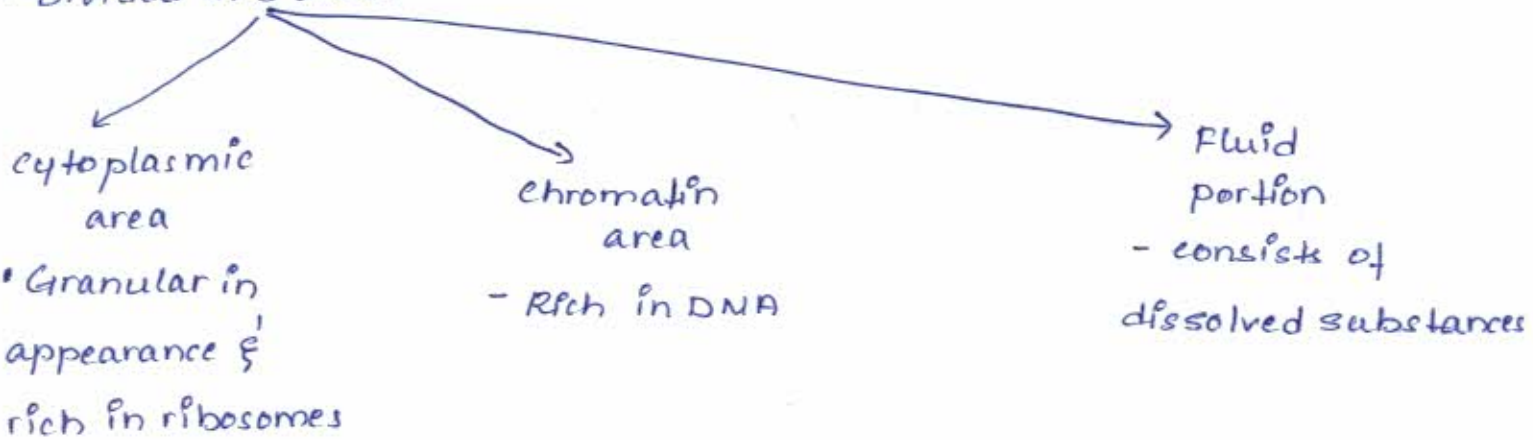
- It is rigid structure surroundings plasma membrane & is present in all prokaryotes
- cellwall of gram positive bacteria appears as a thick homogenous layer & ~~rigidity~~
- cell wall of gram negetive are more complex than gram positive.

f) Cytoplasmic membrane / Plasma membrane:

- Immediately beneath the cell wall is plasma membrane.
- It is composed of lipids & proteins.
- It acts as permeable barrier, regulating the flow of material in & out of cell.
- It contains specific attachment sites for chromosomes & for plasmid the plays vital role in cell division.

g.) Cytoplasm :

- An aqueous solution bounded by cell membrane
- Divided in 3 areas



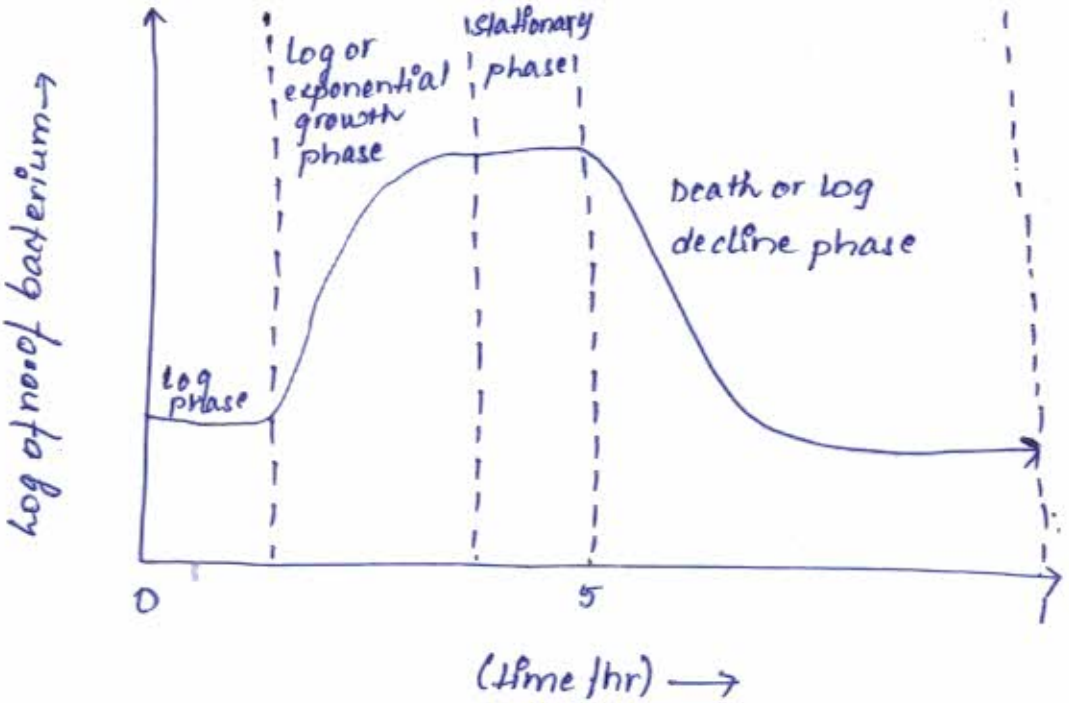
h.) Nuclear Material :

- They have an area near the centre of cell that is regarded as nuclear structure
- Because is not discrete nucleus, it has been given many names like nucleoid, chromatin body,
- Nucleoid is large molecule of DNA.
- DNA is visible under microscope

→ Difference b/w

Character	Gram Positive	Gram Negetive
Thickness	Thicker	Thinner
periplasmic space	Absent	Present
Lipids	Absent or small	Present
Tefchoic acid	Present	Absent
peptidoglycon	16-80nm	2nm

→ Bacterial Growth Curve :



1.) Log phase :

- During this phase, bacteria adapt themselves to growth condition.
- It is a phase of intense metabolic activity in which bacteria prepare for reproduction, synthesizing DNA, enzymes & macromolecules needed for cell division.
- Therefore, during this phase there may be increase in size but no increase in cell number.
- Length of this phase depends on type of bacteria.

2.) Log phase or Exponential phase :

- This phase is characterised by cell doubling.
- During this phase, bacteria multiply at maximum rate & their number since the bacteria is growing in constant.

Therefore, duration of this phase is limited, because of exhaustion of nutrients.

3) stationary phase:

- During this phase, the growth rate slows down as result of nutrient depletion
- Bacterial cells starts dying & no. of such cells balance no. of newborn cells
- Growth rate become equal to death rate in this phase.

4) Death or Decline phase:

- During this phase death rate exceeds reproduction rate & thus no. of bacterial cells starts declining
- After variable period, the entire bacteria population dies.

* Reproduction in Bacteria:

a) Asexual reproduction:

- reproduction in bacteria is asexual taking place by means of binary fission, anthrospore formation, conidia formation & budding.

a) Binary fission:

- It is quick & most common method of reproduction in bacteria.
- It is a process in which parent cell divides to produce a 2 cell equal sizes
- In binary fission, parent cell wall & plasma membrane begin to grow inward in middle region
- Circular bacterial chromosome replicates in prokaryotic manner resulting in 2 daughter bacterial chromosomes.

b) Anthrospore Formation:

- They are formed in bacteria having fungus like bodies
- Filamentous body of these bacteria, break into rod like shaped smaller

fragments called anthrospores.
- Each is capable of growing into a new filament.

c) Conidia formation:
- It is common method of reproduction.
- Bacteria produce smaller, oval or rounded structure called conidia terminally on apical branches called conidiospores.
- Each conidium germinates giving rise to a new bacteria cell.

d) Budding:
- It is a type of division by an unequal division of cellular material.
- It takesplace in some rode-shaped bacteria which develop small out growths
- These outgrowth finally bud off from the parent cell as daughter cells.

2) Sexual reproduction:
- In bacterial sexual reproduction, there is no meiosis
- formation of gamates & zygote
- It involves transfer of a portion of genetic material, DNA.

* Common Staining Technique:

i) Simple stains:
- Basic dyes such as methylene blae
- They provide color constrast but impact the same color to all bacteria in smear

ii) Negetive staining:
- Bacteria are mixed with dyes.
- This is very useful in demonstration of bacteria capsules which donot

take simple status.

iii) Differential stains:

- They impact different colors to different bacteria or bacterial structure.
- 2 common stains: - Gram stain
  - Acid-fast stain.

→ Gram's stains:

- Heat fixed smear of specimen is stained with crystal violet for 1 min.
- Pour Gram's iodine over side for 1 min
- Decolourise with acetone for 10-30sec
- counter stain with a dye safanin for 30 sec.
- Types:

Gram +ve	Gram -ve
- resist decolaurisation & retain the color of primary stain ie violet	• decolorisation by acetone/ alcohol & therefore take counter stain & appear red

→ Acid-fast staining: (Ziehl-Neelsen stain)

- It was discovered by Ehrlich & modified by Zieh-Neelsen.
- Carbol fuxhsin stain is poured on aslide containing fixed smear.
- Gentle heat is applied to undersize of slide
- wash in tap water
- stained smear is decolourised with 20% sulphuric acid & washed with water
- This step repeated till pink color stop coming out.

- Smear is counter stained with 2% methylene blue for 1-2mins.
- wash & with water & air dry.