Bacteria & other Microorganisms

Causative agents & their Classification

- Bacteria – Prokaryotic kingdom
- Fungi – Protists kingdom(uni-multi)
- Protozoa – Protists kingdom
- Helminths – Animal kingdom
- Viruses – Replicates only with in cells

- Helminth and protozoa are called parasites.

Features of microorganisms

- Bacteria, fungi, helminths and protozoa are cellular where as viruses are not.
- Distinction is based on structure, chemical composition, bio-synthetic and genetic organization.

1) Structure:

Cell has nucleus with DNA surrounded by cytoplasm within which proteins are synthesized for energy.

- Viruses have inner core of genetic material DNA or RNA but no cytoplasm.
- They are dependent on host cells for energy and protein synthesis.

2) Replication:

- Prokaryotics i.e. bacteria replicate by binary fission, and eukaryotics divide by mitosis.

Binary Fission in Bacteria

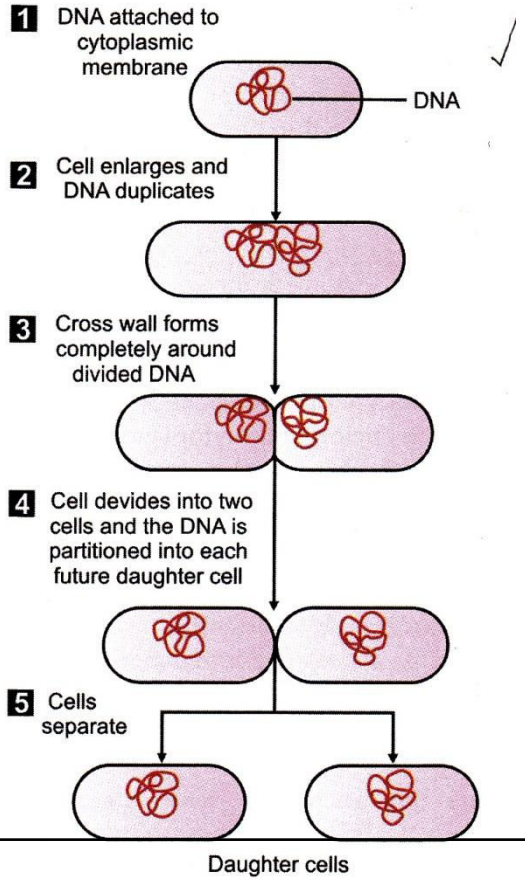

Fig. 4.1: Binary fission in bacteria

- Viruses disassemble, produce many copies of their nucleic acid, proteins and then reassemble into multiple progeny viruses within the host cell.

3) Nucleic acid:

- Cells contain both DNA and RNA while viruses contain either of the two.

Types of Cells

- Prokaryotic- bacteria
- Eukaryotics- Helminths, fungi and protozoa.
- Eukaryotics have true nucleus with multiple chromosomes and surrounded by cell membrane, divide by mitosis.
- Prokaryotics have nucleoid consisting of single circular molecule of DNA without nuclear membrane and mitotic apparatus.

- Eukaryotics contain organelles e.g. mitochondria, lysosomes, and large ribosome (80S).
- Prokaryotics contain no organelles and smaller ribosomes(70S). Comprised of 30 and 50 sub units.
- Eukaryotics do not have peptidoglycan in their cell wall and bounded by a flexible cell membrane or in case of fungi a rigid cell wall with chitin (homopolymer of N.acetylglucosamin).

- Prokaryotics have a rigid external cell wall containing of peptidoglycan i.e. the polymer of amino acid plus sugar.
- Eukaryotics cell membrane contains sterols.
- Prokaryotics do not have cell membrane except wall less Mycoplasma which contains sterols.
- Prokaryotics are haploid with single chromosome.

- Eukaryotics have diploid chromosomes.
- Most protozoa and some bacteria are motile while fungi and viruses are non-motile.
- Protozoa possess three different organs for locomotion i.e. flagella, cillia and pseudopodia
- Motile bacteria only move by flagella.

Flagella

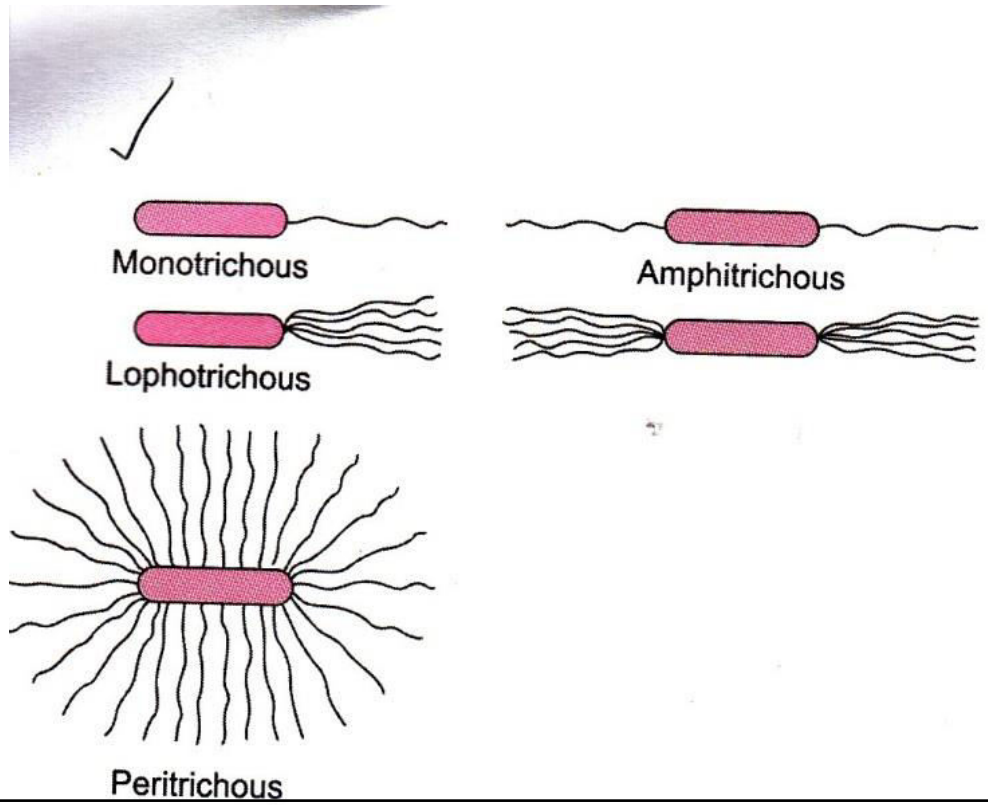

Fig. 3.9: Arrangement of flagella

Comparison of Medically Important Organisms

Table 1–2 Comparison of Medically Important Organisms

Characteristic	Viruses	Bacteria	Fungi	Protozoa and Helminths
Cells	No	Yes	Yes	Yes
Approximate diameter (μm)[1]	0.02–0.2	1–5	3–10 (yeasts)	15–25 (trophozoites)
Nucleic acid	Either DNA or RNA	Both DNA and RNA	Both DNA and RNA	Both DNA and RNA
Type of nucleus	None	Prokaryotic	Eukaryotic	Eukaryotic
Ribosomes	Absent	70S	80S	80S
Mitochondria	Absent	Absent	Present	Present
Nature of outer surface	Protein capsid and lipoprotein envelope	Rigid wall containing peptidoglycan	Rigid wall containing chitin	Flexible membrane
Motility	None	Some	None	Most
Method of replication	Not binary fission	Binary fission	Budding or mitosis[2]	Mitosis[3]

Characteristics of Pro & Eu-karyotic Cells

Table 1–3 Characteristics of Prokaryotic and Eukaryotic Cells

Characteristic	Prokaryotic Bacterial Cells	Eukaryotic Human Cells
DNA within a nuclear membrane	No	Yes
Mitotic division	No	Yes
DNA associated with histones	No	Yes
Chromosome number	One	More than one
Membrane-bound organelles, such as mitochondria and lysosomes	No	Yes
Size of ribosome	70S	8OS
Cell wall containing peptidoglycan	Yes	No

Viruses

- Are not cells and not visible with light microscope.
- Are obligate intracellular parasite.
- Contain no organelles and biosynthetic machinery.
- Contain only DNA or RNA.
- Are called bacteriophage if the host is a bacteria.