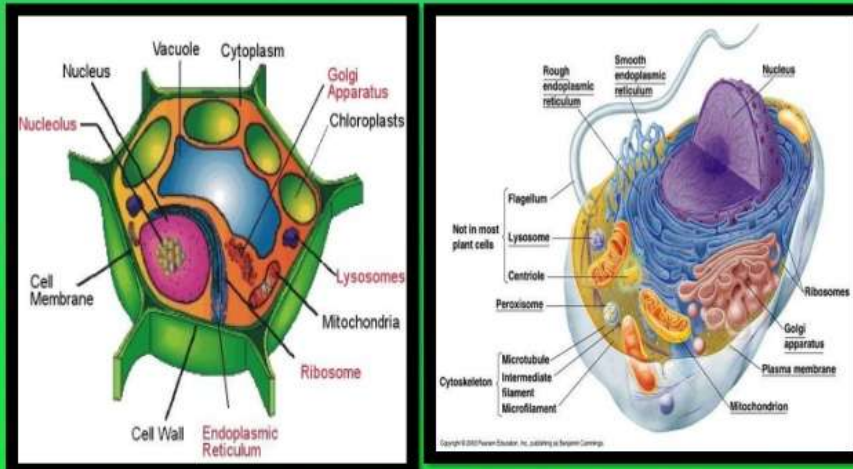


CHAPTER 8 : CELL - THE UNIT OF LIFE

PLANT CELL & ANIMAL CELL

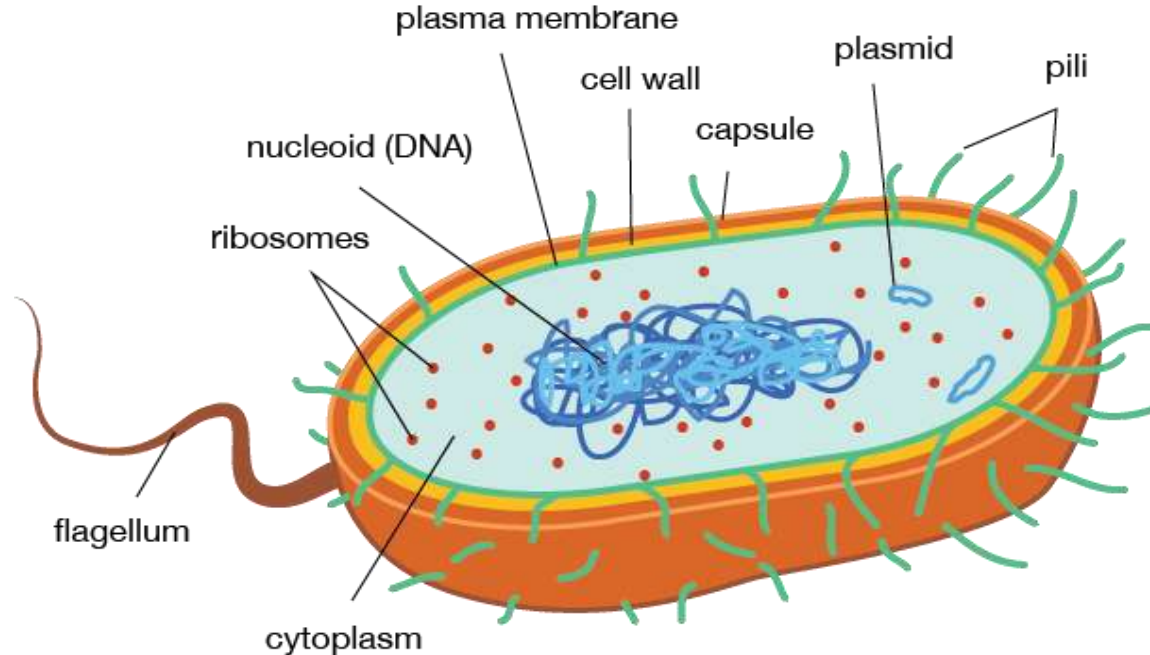


K C MEENA
PGT BIOLOGY
KV VIKASPURI II SHIFT

- All organisms are made of cells or aggregates of cells. Cells vary in their shape, size and functions.
- Based on the presence or absence of a membrane bound nucleus and other organelles, cells can be named as Prokaryotic or Eukaryotic.
- Cell is the fundamental structural and functional unit of all living organisms.
- Anton Von Leeuwenhoek first observed and described a liver cell.
- Robert Brown later discovered the nucleus.

Cell theory

- **Schleiden and Schwann (later Virchow)**
- All living organism are made of cells and their products.
- All cells arise from pre – existing cells.
- **Prokaryotic cell**



- **Bacteria, Blue-green algae, Mycoplasma, PPLP (Pleuro Pneumonia Like Organisms).**
- Glycocalyx, cell wall, plasma membrane
- Based on staining property gram + and gram –ve bacteria.
- Mesosome, chromatophores (extension of plasma membrane)
- Motile, non motile,
- Flagellum- three parts are – filament. Hook, and basal body
- Pili, fimbriae – surface structure do not play a role in motility but helps in attachment
- Ribosomes and inclusion bodies.
- Ribosomes. 15-20 nm, 2 sub – units 50S and 30S-together form 70S. – help in Protein synthesis – polysomes / polyribosomes on m RNA
- *Inclusion bodies. Reserve materials: Phosphate granules, Cyanophycean , Glycogen granules,*
- Gas vacuoles.

Eukaryotic cell :

- Protists, Fungi, Plant cell and animal cell
- Cell membrane – fluid mosaic model by Singer & Nicholson (1972) - bilipid layer of phospholipids with two types of membrane proteins called peripheral protein and integral proteins with cholestral, glycolipids and glycoproteins.

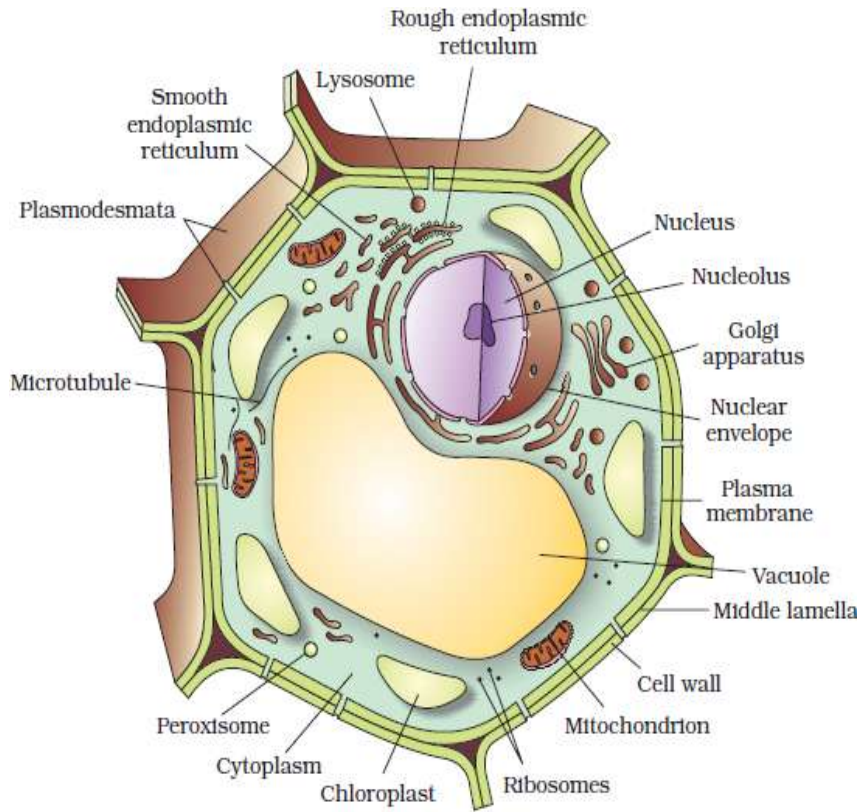


Figure 8.3 Diagram showing : (a) Plant cell

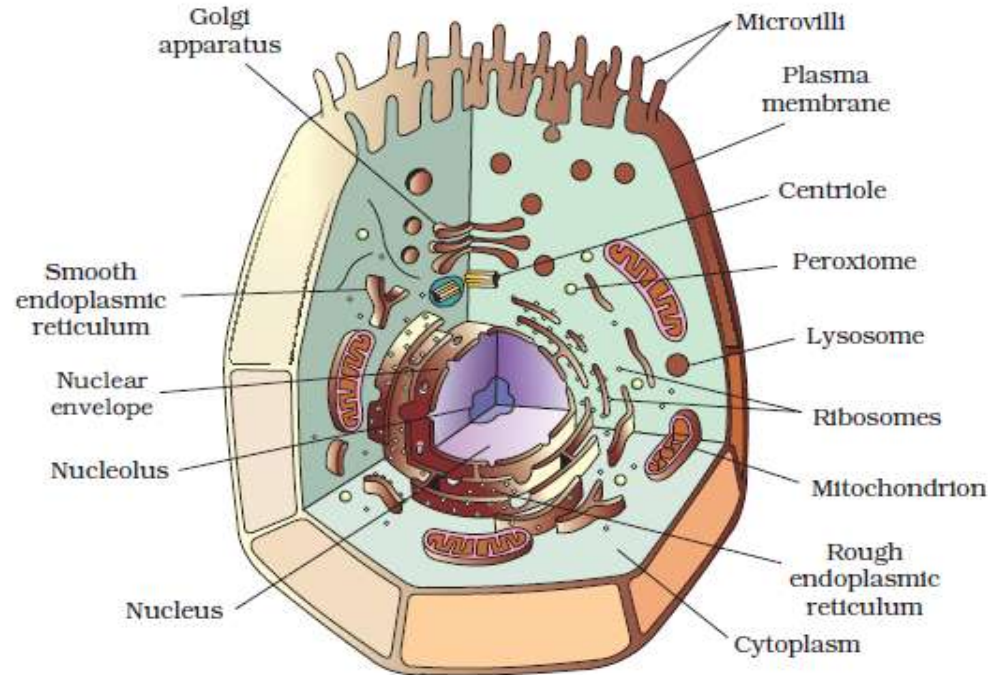


Figure 8.3 Diagram showing : (b) Animal cell

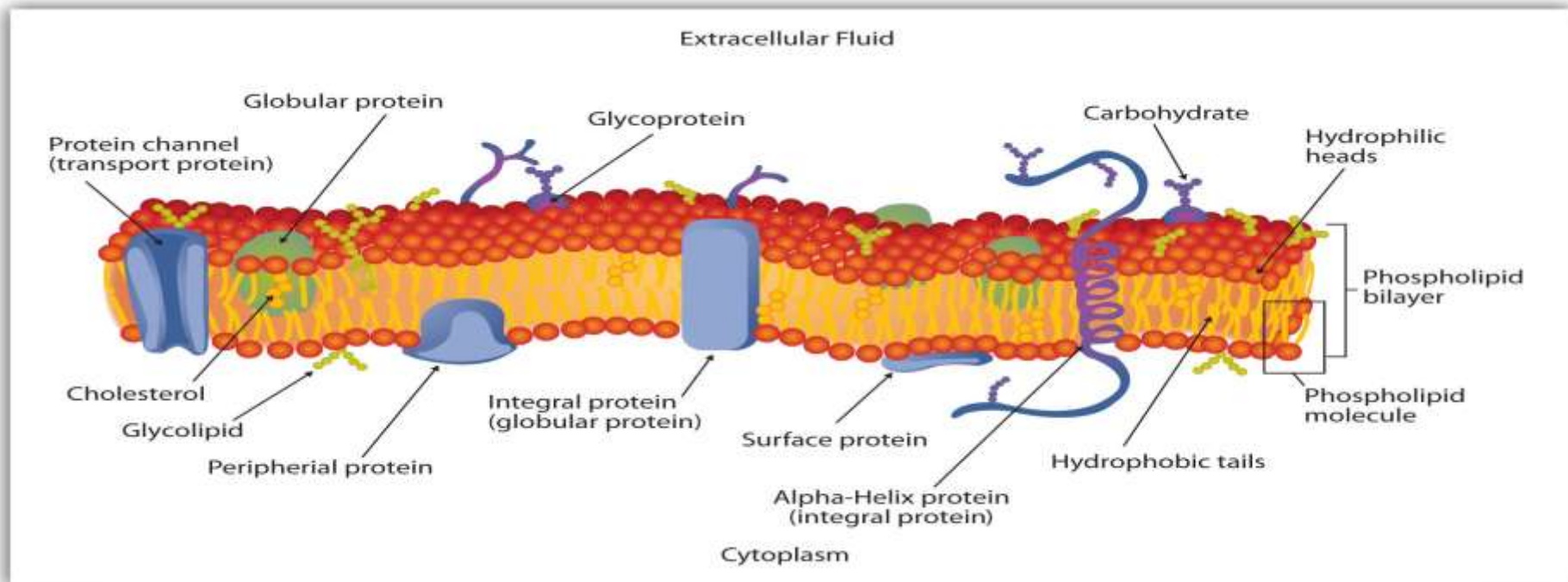
Cell wall

- It gives shape, mechanical support, cell-to-cell interaction – made of cellulose, hemicelluloses,
- pectins (in plants) and cellulose, galactans, mannans, calcium carbonate (in algae).
- Primary cell wall – in young plant cell, capable of growing till cell matures
- Secondary cell wall – formed on the inner side of the cell.
- Middle lamellae – calcium pectate
- The cell wall middle lamellae may be traversed by plasmodesmata which connect the cytoplasm of neighbouring cells.

Cell Membrane

- The **cell membrane** (also known as the **plasma membrane** or **cytoplasmic membrane**) is a biological membrane that separates the interior of all cells from the outside environment.
- The cell membrane is selectively permeable to ions and organic molecules and controls the movement of substances in and out of cells. The basic function of the cell membrane is to protect the cell from its surroundings.
- It consists of the phospholipid bilayer with embedded proteins. Cell membranes are involved in a variety of cellular processes such as cell adhesion, ion conductivity and cell signalling and serve as the attachment surface for several extracellular structures, including the cell wall, glycocalyx , and intracellular cytoskeleton. Cell membranes can be artificially reassembled

- According to the fluid mosaic model of S. J. Singer and G. L. Nicolson (1972), which replaced the earlier model of Davson and Danielli, biological membranes can be considered as a two-dimensional liquid in which lipid and protein molecules diffuse more or less easily.
- Although the lipid bilayers that form the basis of the membranes do indeed form two-dimensional liquids by themselves, the plasma membrane also contains a large quantity of proteins, which provide more structure. Examples of such structures are protein-protein complexes, pickets and fences formed by the actin-based cytoskeleton, and potentially lipid rafts



- **Endoplasmic reticulum :**
- SER – no ribosomes on its surface, appears smooth (helps in lipid synthesis/steroids)
- RER – ribosomes are present on its surface, appears rough surface (helps in protein synthesis)
- **Golgi apparatus** – first observed by Camillo Golgi - packaging unit - makes glycoprotein and glycolipids.
- **Lysosomes** – contain enzyme, hydrolases – help intra cellular digestion.
- **Vacuoles** : tonoplast is vacuole membrane - contractile vacuole (for excretion) – food vacuole (engulfing).

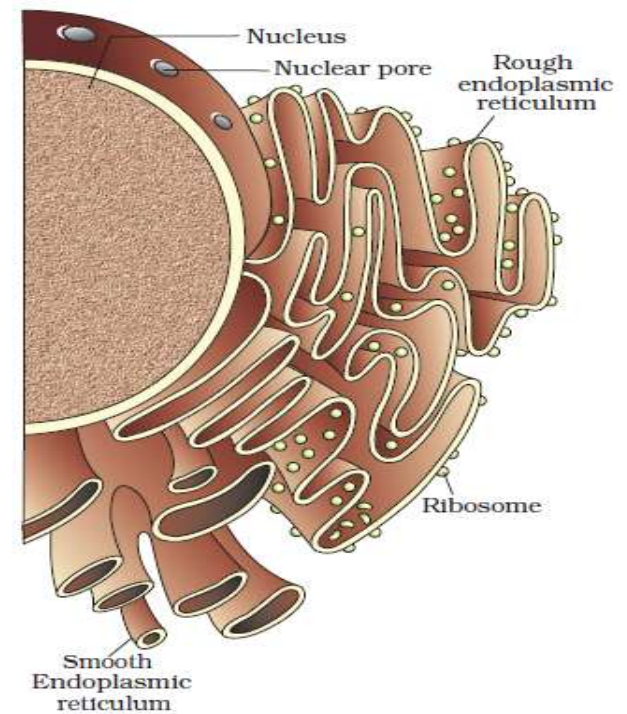


Figure 8.5 Endoplasmic reticulum

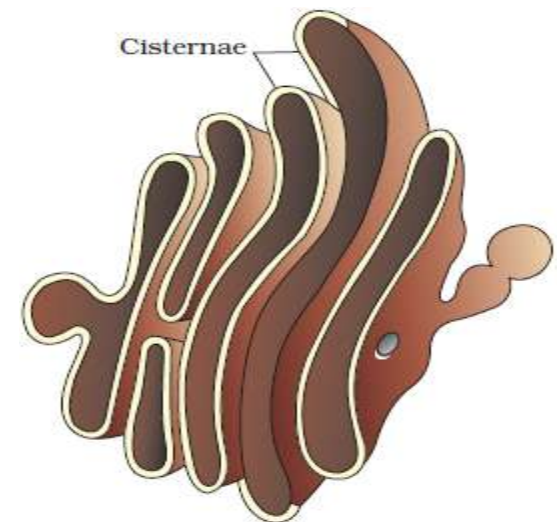


Figure 8.6 Golgi apparatus

Mitochondria

- **Power house of the cell – sites of aerobic respiration, produce energy capsules ATP** double membrane structure, inner compartment is known as Matrix – inner membrane forms a number of infoldings called Cristae to increase the surface area – matrix possesses single circular DNA, few RNA and ribosomes (70S).

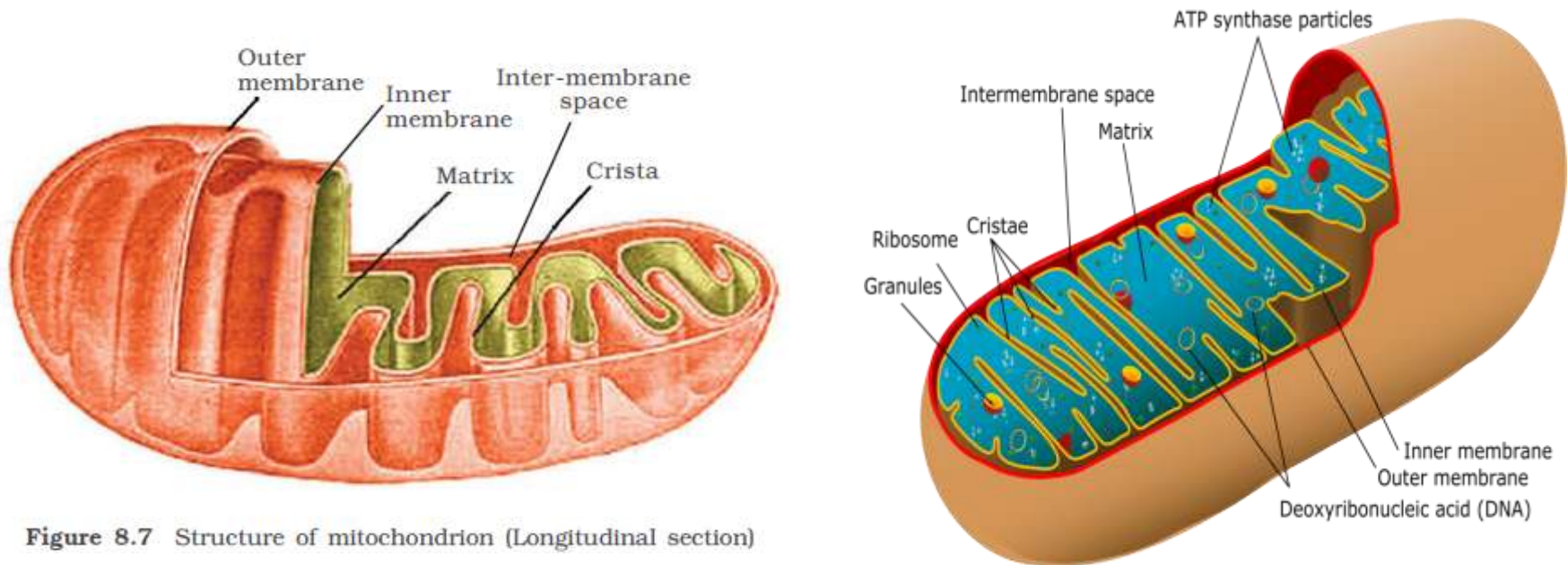


Figure 8.7 Structure of mitochondrion (Longitudinal section)

Plastids

- Chloroplast, chromoplast and leucoplasts -
Leucoplasts - amyloplasts, (starch); Elaioplasts
(oil/fat); Aleuroplasts (proteins).

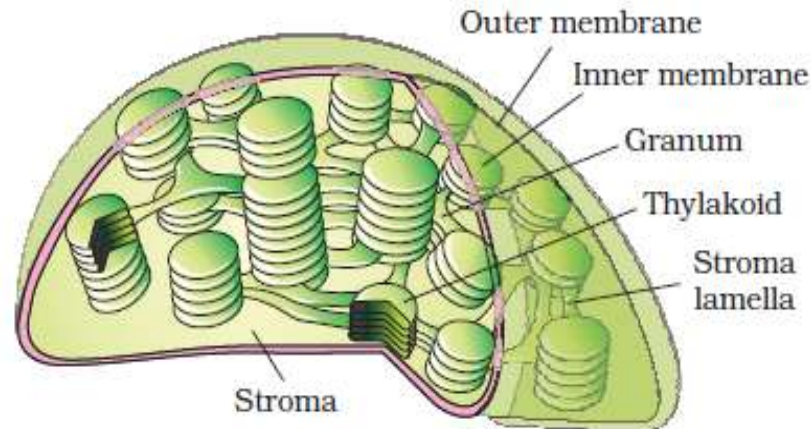


Figure 8.8 Sectional view of chloroplast

- **Ribosomes (George Palade)** - Composed of RNA and proteins - Eukaryotic ribosomes are 80 S.
- 'S' stand for the sedimentation coefficient (Svedbergs unit) - Site of protein synthesis.
- **Cytoskeleton: Network of filaments proteinaceous structures in the cytoplasm** - made up of microtubules and micro filaments. Functions:- Mechanical support, motility, maintenance of the shape of the cell.
- **Cilia and flagella: Core is called axoneme** - has 9 pairs of doublets of microtubules on peripheral and one pair in the centre 9+2 array emerged from centriole like structure called the Basal bodies.
- **Centrosome and centrioles: Centrosome contains 2 centrioles - Each centriole has a cart wheel like**
- organization with 9 evenly spaced microtubule - triplets connected to central hub by radial spokes –
- produces spindle apparatus during cell division

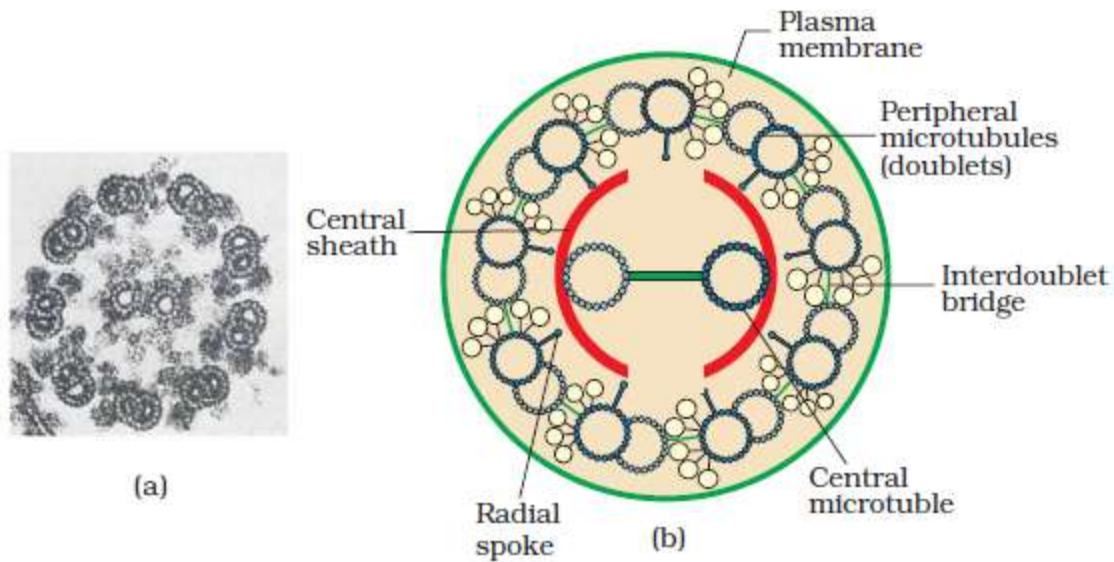


Figure 8.9 Section of cilia/flagella showing different parts : (a) Electron micrograph
(b) Diagrammatic representation of internal structure

Nucleus

- (Robert brown, 1831)
- Chromatin named by Flemming.
- Nucleoli – active ribosomal RNA synthesis
- Nucleoplasm – nucleolus + chromatin
- Nuclear membrane – with perinuclear space
- Chromosome – DNA + histone proteins
- Centromere –primary constriction – disc is known as kinetochores
- No nucleus in erythrocytes (RBC) of mammals and sieve tube cells in vascular plants

Based on the position of centromere

- Metacentric, sub-metacentric, acrocentric, telocentric

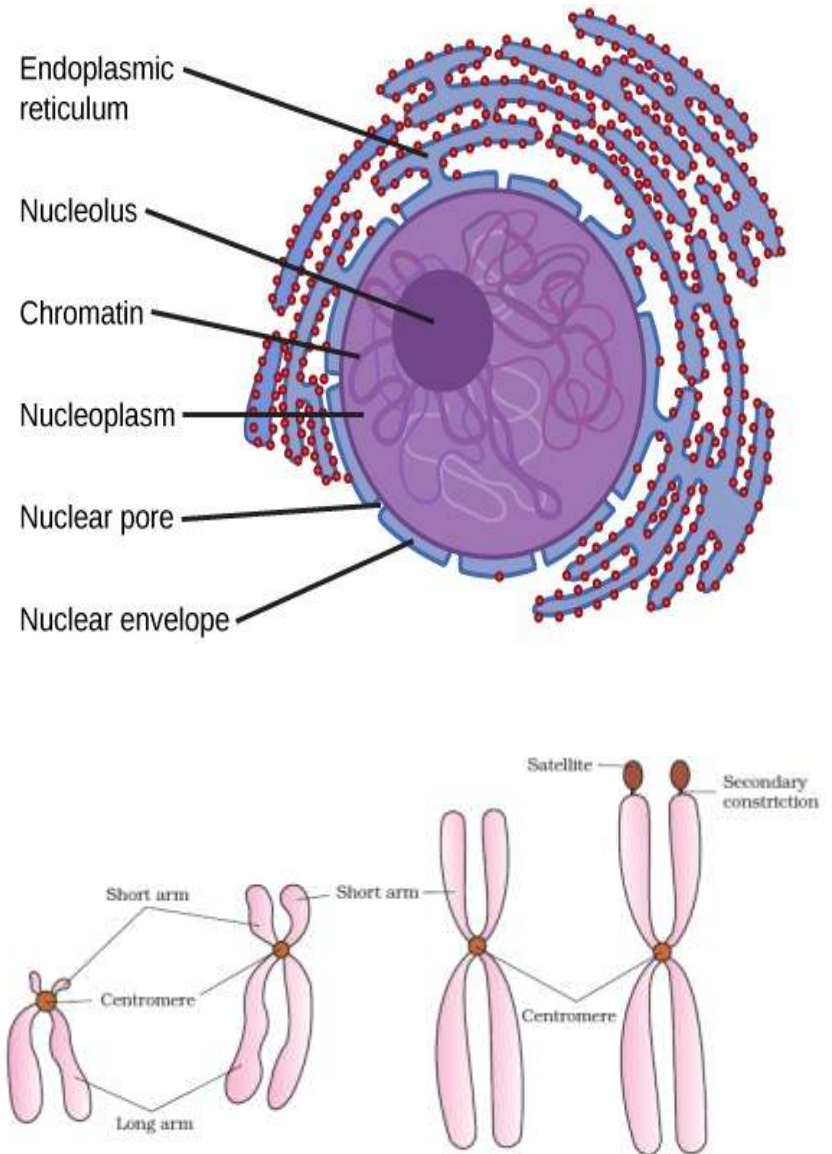


Figure 8.12 Types of chromosomes based on the position of centromere