Plasmamembrane

Ultrastructure of organelles

Dr. Sonawane H.B.
Department of Botany
Prof. Ramkrishna More Arts Commerce and Science College, Akurdi, Pune
Amolsbr@gmail.com
**Plasmamembrane**

- All cells are enclosed in a membrane that serves as their outer boundary, separating the cytoplasm from the external environment. Called as **plasma membrane**.
- It allows the cell to take up and retain certain substances while excluding others.
- Various transport proteins embedded in the plasma membrane are responsible for this selective traffic of solutes across the membrane.
- The accumulation of ions or molecules in the cytosol through the action of transport proteins consumes metabolic energy.
- Membranes also delimit the boundaries of the specialized internal organelles of the cell and regulate the fluxes of ions and metabolites into and out of these compartments.
Bilayer and fluid mosaic model

- According to the **fluid-mosaic model**, all biological membranes have the same basic molecular organization.
- They consist of a double layer (bilayer) of either *phospholipids* in which proteins are embedded.
- In most membranes, proteins make up about half of the membrane’s mass. However, the composition of the lipid components and the properties of the proteins vary from membrane to membrane.
Phospholipids

• There are two important parts of a phospholipid: the head and the two tails.
• The head is a phosphate molecule that is attracted to water (*hydrophilic*).
• The two tails are made up of fatty acids (chains of carbon atoms) that aren’t compatible with, or repel, water (*hydrophobic*).
• The cell membrane is exposed to water mixed with electrolytes and other materials on the outside and the inside of the cell.
• When cellular membranes form, phospholipids assemble into two layers because of these hydrophilic and hydrophobic properties.
• The phosphate heads in each layer face the aqueous or watery environment on either side, and the tails hide away from the water between the layers of heads, because they are hydrophobic.
Proteins

- The cell is made up of two different types of proteins. *Integral proteins* are nestled into the phospholipid bilayer and stick out on either end.
- Integral proteins are helpful for transporting larger molecules, like glucose, across the cell membrane.
- They have regions *polar* and *nonpolar* regions, that correspond with the polarity of the phospholipid bilayer.
- Polar and nonpolar refer to the concentration of electrons on a molecule.
- The other class of protein is called *peripheral proteins*, They can be attached to the ends of integral proteins, or not, and help with transport or communication.
Fatty Acids

- Saturated and unsaturated fatty acids: Fatty acids are what make up the phospholipid tails. Saturated fatty acids are chains of carbon atoms that have only single bonds between them.
- As a result, the chains are straight and easy to pack tightly.
- Unsaturated fats are chains of carbon atoms that have double bonds between some of the carbons.
- The double bonds create kinks in the chains, making it harder for the chains to pack tightly.
Ultrastructure and functions of chloroplast

• The chloroplast in green plants constitutes the photosynthetic apparatus.
• In higher plants, the chloroplast is discoid in shape, 4-6 µ in length and 1-2µ thick.
• The chloroplast is bounded by two unit membranes of approximately 50°A thickness and consists of lipids and proteins.
• The thickness of the two membranes including the space enclosed by them is approximately 300°A (1 Angstrom: 0.1 cm).
• Internally, the chloroplast is filled with a hydrophilic matrix called as stroma embedded with grana.
• Chloroplast membranes are rich in glycosylglycerides.
• The fluid compartment surrounding the thylakoids, called the stroma, is analogous to the matrix of the mitochondrion. Adjacent grana are connected by unstacked membranes called stroma lamellae.
• Each grana consists of 5-25 disc shaped grana lamellae (thylakoid) placed one above the other like the stack of coins.
• Each grana lamella of thylakoid encloses a space called loculus and the thylakoid membrane consists of alternating layer of lipids and proteins.
• Some of the grana lamella of thylakoid of grana are connected with thylakoid of other grana by somewhat thinner stroma lamella.
• The photosynthetic pigments are located in grana portions of the chloroplast.
• The chlorophylls are the site of photochemical reactions.
Ultrastructure and functions of chloroplast

- A typical plant cell has two types of energy-producing organelles: mitochondria and chloroplasts.

- **Mitochondria** *are the cellular sites of respiration, a process* in which the energy released from sugar metabolism is used for the synthesis of ATP (adenosine triphosphate) from ADP (adenosine diphosphate) and inorganic phosphate(Pi)

- It is also called as Powerhouse of the cell
• Mitochondria can vary in shape from spherical to tubular.
• They have a smooth outer membrane and a highly complicated inner membrane.
• The infoldings of the inner membrane are called crista.
• The compartment enclosed by the inner membrane, the mitochondrial matrix, contains the enzymes of the pathway of intermediary metabolism called the Krebs cycle.
• the inner membrane of a mitochondrion is almost 70% protein and contains some phospholipids.
• The proteins in and on the inner membrane have special enzymatic and transport capacities
Ultrastructure and functions of Endoplasmic reticulum

- The endoplasmic reticulum (ER) is a network of flattened sacs and branching tubules that extends throughout the cytoplasm in plant and animal cells.
- These sacs and tubules are all interconnected by a single continuous membrane so that the organelle has only one large, and complexly arranged lumen (internal space).
- Usually referred to as the endoplasmic reticulum cisternal space, the lumen of the organelle often takes up more than 10 percent of the total volume of a cell.
• The endoplasmic reticulum membrane allows molecules to be selectively transferred between the lumen and the cytoplasm, and since it is connected to the double-layered nuclear envelope, it further provides a pipeline between the nucleus and the cytoplasm.
• The endoplasmic reticulum manufactures, processes, and transports a wide variety of biochemical compounds for use inside and outside of the cell.
• There are two basic kinds of endoplasmic reticulum morphologies: rough and smooth.
• The surface of rough endoplasmic reticulum is covered with ribosomes, giving it a rough appearance when viewed through the microscope.
• This type of endoplasmic reticulum is involved mainly with the production and processing of proteins that will be exported, or secreted, from the cell.
• The smooth endoplasmic reticulum in most cells is much less extensive than the rough endoplasmic reticulum.
• Smooth endoplasmic reticulum is chiefly involved, however, with the production of lipids (fats), building blocks for carbohydrate metabolism, and the detoxification of drugs and poisons.
• The smooth endoplasmic reticulum is important in cellular function.
• Smooth endoplasmic reticulum also plays a role in various cellular activities through its storage of calcium and involvement in calcium metabolism.
Reference


• AskIITians.

• NCERT
  • Introductory Crop Physiology, Mukesh Chavan, [http://ecoursesonline.iasri.res.in/course/view.php?id=126](http://ecoursesonline.iasri.res.in/course/view.php?id=126)

• Crop physiology, Agrimoon, TNAU.

•
Thank You................