Department of biology

BOTANY (PLANT BIOLOGY)

First stage

(3)

Plant Cell Structure

By

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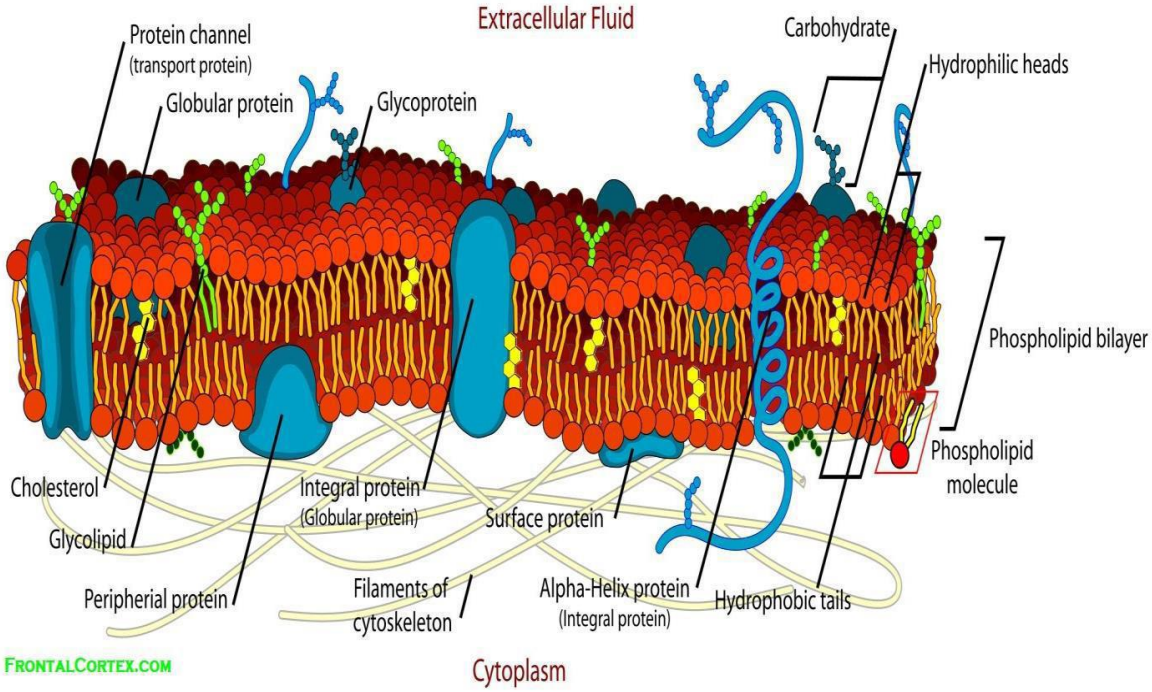
Plasma Membrane (Plasmalemma)

➢ **All cells** are enclosed in a membrane that serves as their outer boundary, separating the cytoplasm from the external environment.

➢ **This plasma membrane allows** the cells to take up and retain certain substances while excluding others. Thus, plasmalemma accounts for **selective** traffic of solutes across membrane.

➢ **All biological membranes consist** of a double layer (bilayer) of phospholipids in which proteins are embedded.

➢ **The membrane is not a static structure**, but it is a **dynamic** structure. Both lipid and protein molecules are free to move and are usually in a constant motion. However, these molecules readily move in the plane of membrane, a process known as lateral diffusion.



Phospholipids

➢ **Phospholipids** are a class of lipids in which 2 fatty acids are linked to glycerol, which is linked to a phosphate group.

➢ **A head group** such as **choline** is also attached to phosphate group.

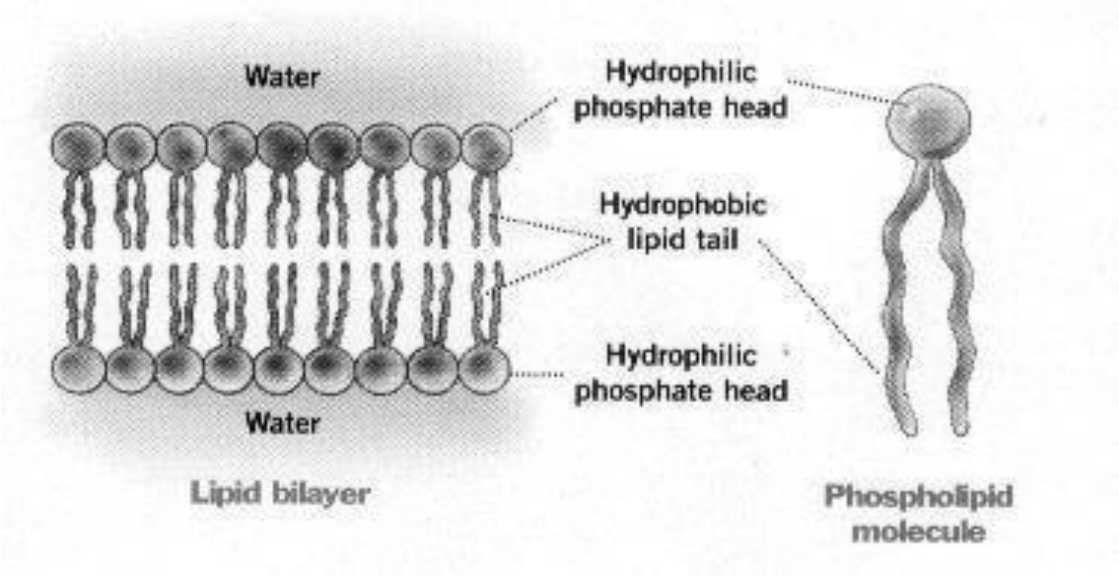
- **Phosphatidylcholine** is a phospholipid common to most membranes.

- **The head groups** are highly polar (hydrophilic) whereas the hydrocarbon chains of fatty acids are highly nonpolar (hydrophobic).

- **Thus, phospholipids display** both hydrophilic and hydrophobic properties, hence they are amphipathic.

- **In the bilayer,** the amphipathic lipids are arranged is such a way that their hydrophobic tails point toward each other and the hydrophilic heads make the surfaces.

- **The bilayer** is stable in aqueous environment because its surfaces readily associate with water.



- **Plastid (chloroplast) membranes are made** of glycosylglycerides instead of phospholipids.

- **In glycosylglycerides,** the polar head group consists of galactose, without a phosphate group.

- **The fatty acid chains of phospholipids or glycosylglycerides contain** 14-24 carbons.

- **One of the fatty acid is saturated (no double bonds),** whereas the other fatty acid chain is unsaturated containing one or more *cis* double bonds.

➢ **The presence of *cis* double bond prevents** the tight packing of phospholipids, hence increase the fluidity of membrane.

➢ **Membrane fluidity** is also influenced by temperature. Because plants generally cannot regulate their body temperature, plant phospholipids have a high percentage of unsaturated fatty acids such as oleic acid (1 double bond), linoleic acid (2 double bonds) and linolenic acid (3 double bonds) which increase the fluidity of their membranes.

Proteins

➢ **The proteins** which are embedded in lipid bilayer are globular.

➢ **These proteins can be divided** into two types, integral and peripheral.

➢ **Integral proteins** are deeply embedded in the lipid bilayer. Most integral proteins span the entire width of the lipid bilayer so one part of the protein interacts with the outside of cell, another part interacts with hydrophobic core and the third part interacts with interior of cell (cytosol).

➢ **Ion channels** are always integral proteins.

➢ **Certain receptors** that participate in signal transduction are integral proteins.

➢ **Peripheral proteins are bound** to polar surfaces of lipid bilayer by electrostatic (ionic) or hydrogen bonds.

➢ **Peripheral proteins** can be dissociated from membrane with high salt solutions or chaotropic agents, which break ionic and hydrogen bonds respectively.

➢ **Peripheral proteins are involved** in interactions between plasma membrane and the components of cytoskeleton.

Nucleus

- **The nucleus** is surrounded by a double membrane called the nuclear envelope. The space between these two membranes is called the perinuclear space. The joining sites of the two nuclear membranes are called the nuclear pores.

- **The material filled** in the nucleus is called nucleoplasm (or nuclear sap).

- **About 8%** of the surface area of the nuclear membrane is occupied by pores. These pores allow the transport of substances between cytosol and nucleus

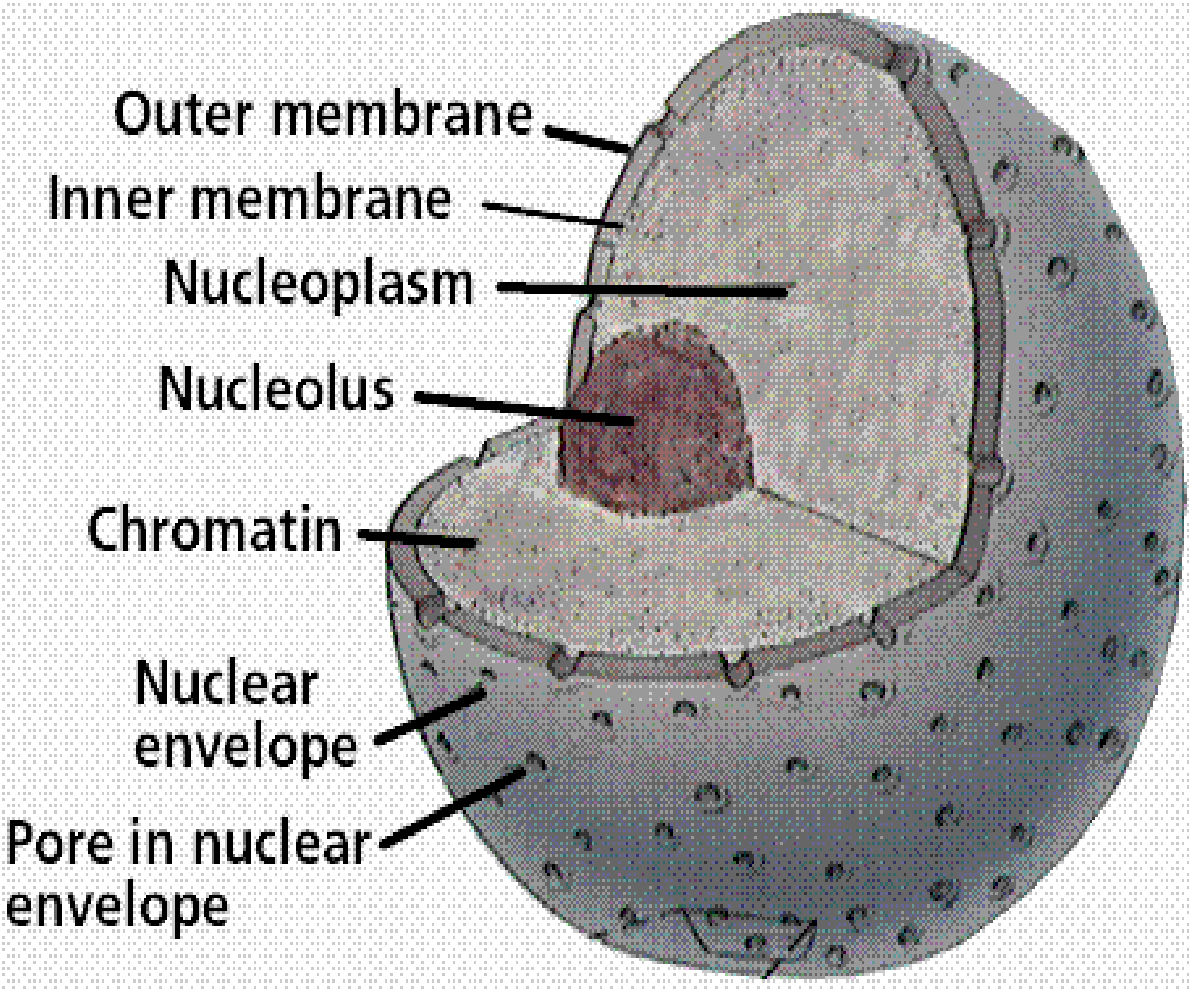
- **Nucleus is the site of storage and replication of chromosomes**, composed of DNA and its associated proteins (histones). The DNA-protein complex is known as **chromatin**.

- **Nucleus contains** a densely granular region called the **nucleolus**, which is the site of ribosome (ribosomal RNA) synthesis.

- **Ribosomal proteins** are synthesized in cytosol and transported into nucleus via nuclear pores, where they bind with rRNA to form 40S and 60S subunits. These subunits pass into cytosol and aggregate to form 80S ribosomes.

- **The genes are transcribed in nucleus** to form mRNA, tRNA and rRNA. mRNA and tRNA pass from nucleus to cytosol where they are used for protein synthesis.

- **The nucleotide sequence of mRNA is translated** into amino acid sequence of proteins by ribosomes. tRNA assists by transferring amino acids to mRNA codons.


Outer membrane
Inner membrane
Nucleoplasm
Nucleolus
Chromatin
Nuclear envelope
Pore in nuclear envelope