

BIOLOGY

CLASS NOTES FOR CBSE

Chapter 08. Cell The Unit of Life

01. Introduction

The study of cell is called **cytology**. It deals with the study of cell terms of structure, function and chemistry. Robert Hooke is considered as the **Father of Cytology**.

Cell theory

This theory was formulated by a German botanist Matthias Jakob Schleiden (5 April, 1804-23 June, 1881) and a German physiologist Theodor Schwann (7 December, 1810-11 jun, 1882) in the year 1838-39. A major expansion of this theory was done by Virchow 1855. He gave the statement '*Omnis cellula-e-cellula*', i.e. all cell arise from pre-existing cells. The statement '*Omnis cellula-e-cellula*' is also known as **cell lineage theory**. This concept was the actual idea of Nageli (1846). It was experimentally proved by Louis Pasteur in 1862.

Cell Types

Broadly all living cell are classified into two groups namely **prokaryotic** (Gr. Pro-primitive or pre or before; *karyon*-nucleus) and **eukaryotic** (Gr. Eu-true; *karyon*- nucleus). Prokaryotic cells contain a primitive type of nucleus which is not bounded by a membrane. It is also called as **nucleoid** or **genophore**. On the other hand eukaryotic cell contain a true double membrane bound. nucleus. Sometimes, a third type of cell, i.e. **mesokaryotic** cells are also found. These cell have well-defined nucleus, but their DNA lacks histone proteins, e.g. Some algae and Protozoa.

02. Cell Structural organisation

The component of a cell can be broadly categories to following three categories)

- (i) **Outer covering**, i.e. cell wall and cell membrane.
- (ii) **Protoplasm**, i.e. the fluid content of cell.
- (iii) **Cell organelles**, i.e. structures that float within the protoplasm like, mitochondria, chloroplast, ribosome, etc.

Outer coverings cell wall

It is the outermost, rigid and non-living covering of the cell. It was discovered by Robert Hooke in 1665 in the cork cells. It is protective and supportive in nature.



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Structure

Cell wall is made up of pectin or hemicellulose.

- (i) **Middle lamella** It is the outermost layer of cell wall. It exist as a cementing layer between primary cell walls of neighbouring cell. Its major constituent are Ca and Mg pectates.
- (ii) **Primary cell wall** It is thin and elastic layer which is capable of growth. It is found in cell wall of younger plant cell and disintegrates as cell matures. Primary cell wall is present inner to the middle lamella. It is composed of 2-5% cellulose and 50% hemicellulose.
- (iii) **Secondary cell wall** This layer is present inner to primary cell wall and just outside the plasma membrane. The main constituents of this layer are cellulose (50-95%) and hemicellulose (5-25%). The other components include xylan, lignin, etc Due to more cellulose component, this layer is non-elastic and rigid
- (iv) **Tertiary cell wall** It may present occasionally inside to the secondary cell wall. This cell wall is purely cellulose in nature. Some times xylan is also present in this layer, e.g. tracheids of gymnosperms.

Formation and growth of cell wall

The formation and Growth of cell wall occur by either of the following two ways

- (i) **By intussusception** it is the deposition of cell wall material in the for fine granules. These granules become embedded within the original wall.
- (ii) **By apposition** In this method, the new cell wall material is deposited in the form of thin plates one over the other.

Functions

- (i) It maintains the shape of plant cell and protects it form mechanical injury.
- (ii) It acts as a protective covering barrier against pathogens.
- (iii) It provides the mechanical support to plant. Thus, allowing it to stand erect.
- (iv) It allows the protoplasmic continuation. This continuation is important for the transport of substance between the cells.
- (v) It prevents the osmotic bursting of the cell.
- (vi) It helps in cell to cell adhesion and prevent the entry of undesirable macromolecules.

Cell membrane or Plasma membrane

It is a thin, delicate, elastic and living boundary. Therm ‘cell membrane’ was given by C Nageli and C cramer (1855).

According to this study, following compound are present in plasma membrane

- (i) **Lipids** These are amphipathic molecules having a hydrophilic head and two hydrophobic fatty acid chains in tail. These form the continuos structural framework of the cell membrane. Phospholipids Constitute the major category of membrane lipids. Some of these lipid are rich in unsaturated fatty acids. This feature provides fluidity to the membrane. Phosphatidylserine, phosphatidylcholine, p-ethanol amine (cephalin) are common phospholispids of plasma membrane. Sterols, glycolipids and sphingolipids are also found in membranes.



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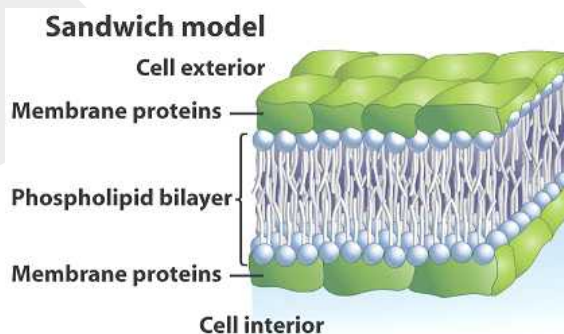
- (ii) **Proteins** The proteins of plasma membrane are called **membrane proteins**. These are of following two type
- (iii) **Carbohydrates** Oligosaccharides (sialic acid) are the main carbohydrates present in the cell membrane.

Structure

To explain the arrangement of constituents of plasma membrane following models have been proposed

Sandwich or Lamellar model

Danielli-Davson in 1935, first suggested the lipid protein structure of the cell membrane. They proposed that the $75\text{\AA}$ thick plasma membrane is made up of three layers. In this arrangement, a $35\text{\AA}$ thick lipid layer is sandwiched between two protein layers each having a thickness of $20\text{\AA}$.

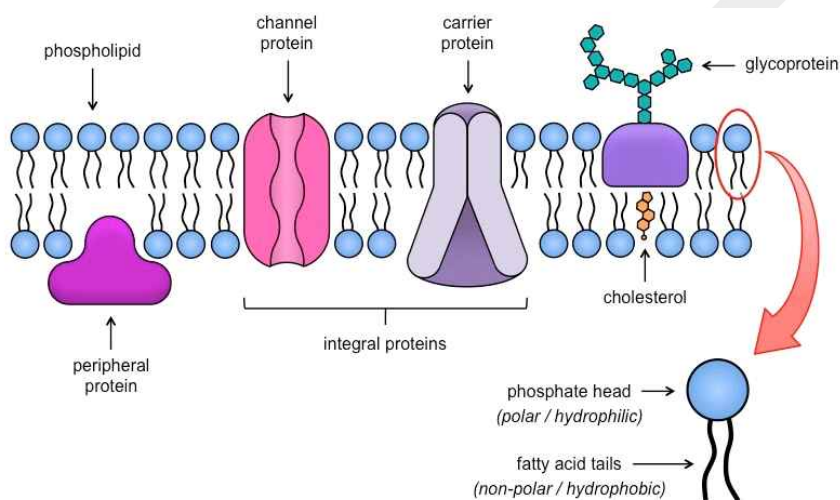


Unit membrane model

This model was proposed by J David Robertson in 1959.

Fluid mosaic model or Quasifluid model

This model was proposed by Singer and Nicholson in 1972. It is the most accepted model of plasma membrane structure. According to this model the membrane structure consists of a continuous bilayer of phospholipid molecules in which globular proteins and sterols are embedded. This arrangement resembles to icebergs (proteins) floating in a sea of phospholipids. Thus, proteins floating in the lipids give quasi (false) fluid-like appearance to the membrane.



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