
- **Cellular organelles of Eukaryotes**

- **Internal membranes**

- 1) Unlike prokaryotes, eukaryotic cells possess internal membranes that encase their organelles and control the exchange of essential cell components.
- 2) All cellular organelles in eukaryotes are enclosed by internal membrane and they include:
 - a) Nucleus, mitochondrion, and chloroplast (in plants).
 - b) Lysosomes, peroxisomes, and (in plants) glyoxysomes.
 - c) Endoplasmic reticulum and Golgi apparatus.
 - d) Storage and transport vesicles and the vacuoles of plant cells.
- 3) Each membrane structure of each organelle has its own distinct composition of proteins and lipids enabling it to carry out unique functions.

- **The importance and general functions of internal membranes**

- ✓ **Chemical communication between organelles**

- 1) The permeases are membrane transport proteins, which present in the lysosomal membrane.
- 2) These enzymes allow amino acids generated inside the lysosome to cross into the cytoplasm.

- ✓ **Isolation of cellular organelles from one another**

- 1) The conditions of cellular processes are different among cellular organelles.
- 2) For example lysosomes are much more acidic (pH 5) than that of the cytosol (pH 7).
- 3) This condition is maintained by specific proton pumping transport proteins in the lysosome membrane.

✓ **Prevent competing enzymatic reactions from interfering with one another**

- 1) Fatty acids are made in the cytosol and then broken down in the mitochondria.
- 2) Essential proteins are synthesized on the rough endoplasmic reticulum and in the cytosol, while unwanted proteins are broken down in the lysosomes.

✓ **Prevent the lethal effect of some enzymes or final products.**

- 1) A degradative enzymes are enzymes which degrade biological molecules.
- 2) Such as lipase, which digests lipids, proteases, which digest proteins and nucleases, which digest nucleic acids.
- 3) These enzymes may have lethal effect if they across to another place or organ inside the cell.
- 4) The internal membrane sequester their degradative activities in their membrane-bounded compartments.

• **The lipid composition of internal membrane**

- 1) Phospholipid is the primary lipid forming all cellular membranes, which form the phospholipid bilayer.
- 2) Cholesterol, which contributes to the fluidity and stability of all membranes.
- 3) Glycolipids are play a role in cell-cell interaction, induce immune response and determine blood groups.

▪ **The nucleus**

• **The structure of nucleus**

- 1) The nucleus is the information centre of the cell and is surrounded by a nuclear membrane in all eukaryotic organisms.

- 2) The contents of the nucleus are present as a sticky, amorphous mass of material enclosed by a complex nuclear envelope that forms a boundary between the nucleus and cytoplasm.
- 3) The typical interphase of the nucleus includes:
 - a) The chromosomes, which are present as highly extended nucleoprotein fibers, termed chromatin.
 - b) One or more nucleoli, which are irregularly, shaped electron-dense structures that function in the synthesis of ribosomal RNA and the assembly of ribosomes.
 - c) The nucleoplasm, the fluid substance in which the solutes of the nucleus are dissolved.
 - d) The nuclear matrix, which is a protein-containing fibrillar network.

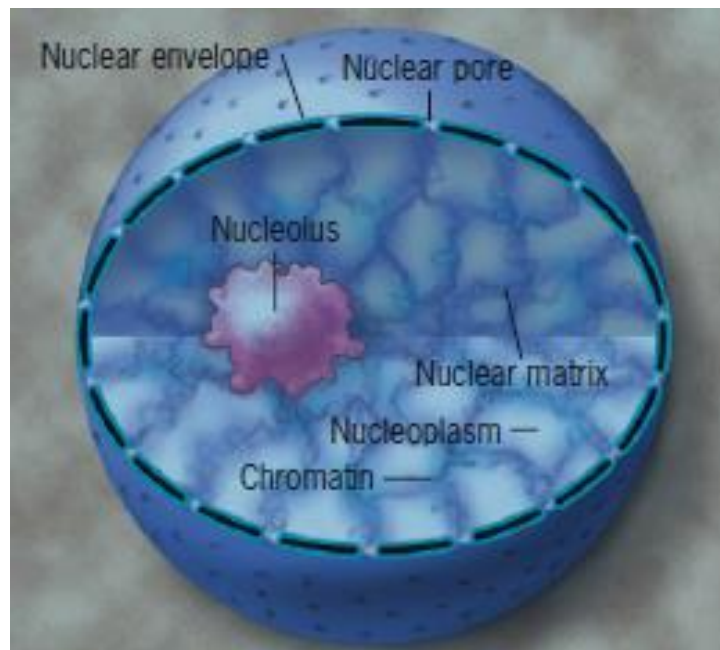


Figure 1: Schematic drawing showing some of the major components of the nucleus.

• Functions of the nucleus

- 1) It controls the heredity characteristics of an organism.
- 2) It is responsible for protein synthesis, cell division, growth and differentiation.
- 3) Stores heredity material in the form of deoxy-ribonucleic acid (DNA) strands.
- 4) Also stores proteins and ribonucleic acid (RNA) in the nucleolus.
- 5) It is a site for transcription process in which messenger RNA (mRNA) are produced for protein synthesis.
- 6) Aids in exchange of DNA and RNA (heredity materials) between the nucleus and the rest of the cell.
- 7) Nucleolus produces ribosomes and are known as protein factories.
- 8) It also regulates the integrity of genes and gene expression.

• Nuclear Envelope

- 1) The nuclear envelope is also known as the nuclear membrane.
- 2) It is made up of two membranes the outer membrane and the inner membrane.
- 3) The outer membrane of the nucleus is continuous with the membrane of the rough endoplasmic reticulum.
- 4) The space between these layers is known as the perinuclear space.
- 5) The nuclear envelope encloses the nucleus and separates the genetic material of the cell from the cytoplasm of the cell.
- 6) It also serves as a barrier to prevent passage of macro-molecules freely between the nucleoplasm and the cytoplasm.

• The role of nuclear envelope in molecules transport

- 1) The nuclear envelope is perforated with numerous pores called nuclear pores.

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- 2) The nuclear pores are composed of many proteins known as nucleoproteins, which surrounded the pores and composed the nuclear pore complex.
 - 3) The nuclear pores regulate the passage of the small molecules between the nucleus and cytoplasm for example energy molecules (ATP), water and ions.
 - 4) The larger molecules are transferred through active transport by using nuclear pore complex for example molecules like of DNA, RNA and histones.

- **Nucleolus**

- 1) The nucleolus is not surrounded by a membrane, it is a densely stained structure found in the nucleus.
- 2) The nucleoli are formed around the nuclear organizer regions.
- 3) It synthesizes and assembles ribosomes and *rRNA*.
- 4) The number of nucleoli is different from species to species but within a species the number is fixed.
- 5) During cell division, the nucleolus disappears.
- 6) Studies suggest that nucleolus may be involved in cellular aging and senescence.

- **Chromosomes**

- 1) The nucleus of the cell contains majority of the cells genetic material in the form of multiple linear DNA molecules.
- 2) These DNA molecules are organized into structures called chromosomes.
- 3) The DNA molecules are in complex with a large variety of proteins (histones) which form the chromosome.
- 4) In the cell they are organized in a DNA-protein complex known as chromatin.

- 5) During cell-division the chromatin forms well-defined chromosomes.
- 6) The genes within the chromosomes consists of the cells nuclear genome.
- 7) Human cells has nearly 6 feet of DNA, which is divided into 46 individual molecules.

- **Number of chromosome in eukaryotic cell**

- 1) The number of chromosomes in eukaryotic cells is different among organisms (plant, animal and human).
- 2) All human cells contain two copies of each chromosome, one inherited from the mother and one from the father.
- 3) There are two exceptions:
 - a) First in germ cells (sperm and egg), which have single copy of chromosome.
 - b) Second the mature red blood cells, which lack the DNA entirely.
- 4) The paired chromosomes in female called homologous chromosomes as a result of two similar chromosome (XX).
- 5) The paired chromosomes in male called non-homologous chromosomes as a result of two different chromosomes (XY).