Ultrastructure Of Nucleus

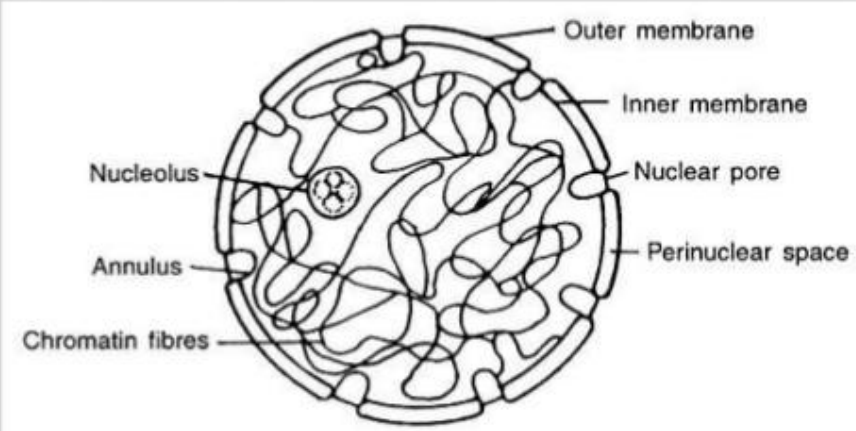


Fig. 2.1. Ultrastructure of Nucleus.

History:

- First discovered & named by Robert Brown (1833).
- Term Nucleolus -Bowman(1840).
- Term Chromatin – W. Flemming(1879).
- Term Cytoplasm & Nucleoplasm- Strasburger (1882)

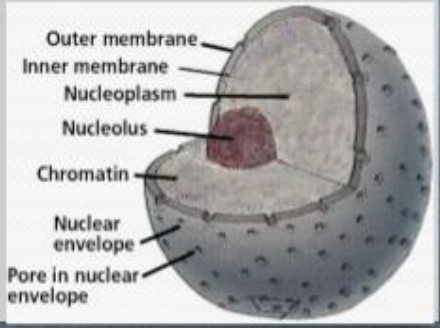
General Definition

- The nucleus is the genetic control center of a eukaryotic cell.
- In most cells, there is only one nucleus. It is spherical, and the most prominent part of the cell, making up 10% of the cell's volume.
- It has a unique structure and function that is essential the cell.

Components of Nucleus

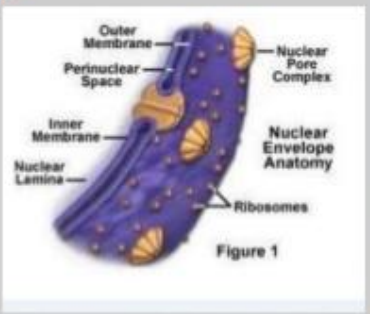
Average diameter of nucleus is 6 um, which occupies around 10% of cell volume.

1. Nuclear Envelope – pore riddled
2. Nucleoplasm – Fluid interior portion
3. Nucleolus – Dense cluster of RNA & Proteins – ribosomes
4. Chromatin – all DNA + Proteins

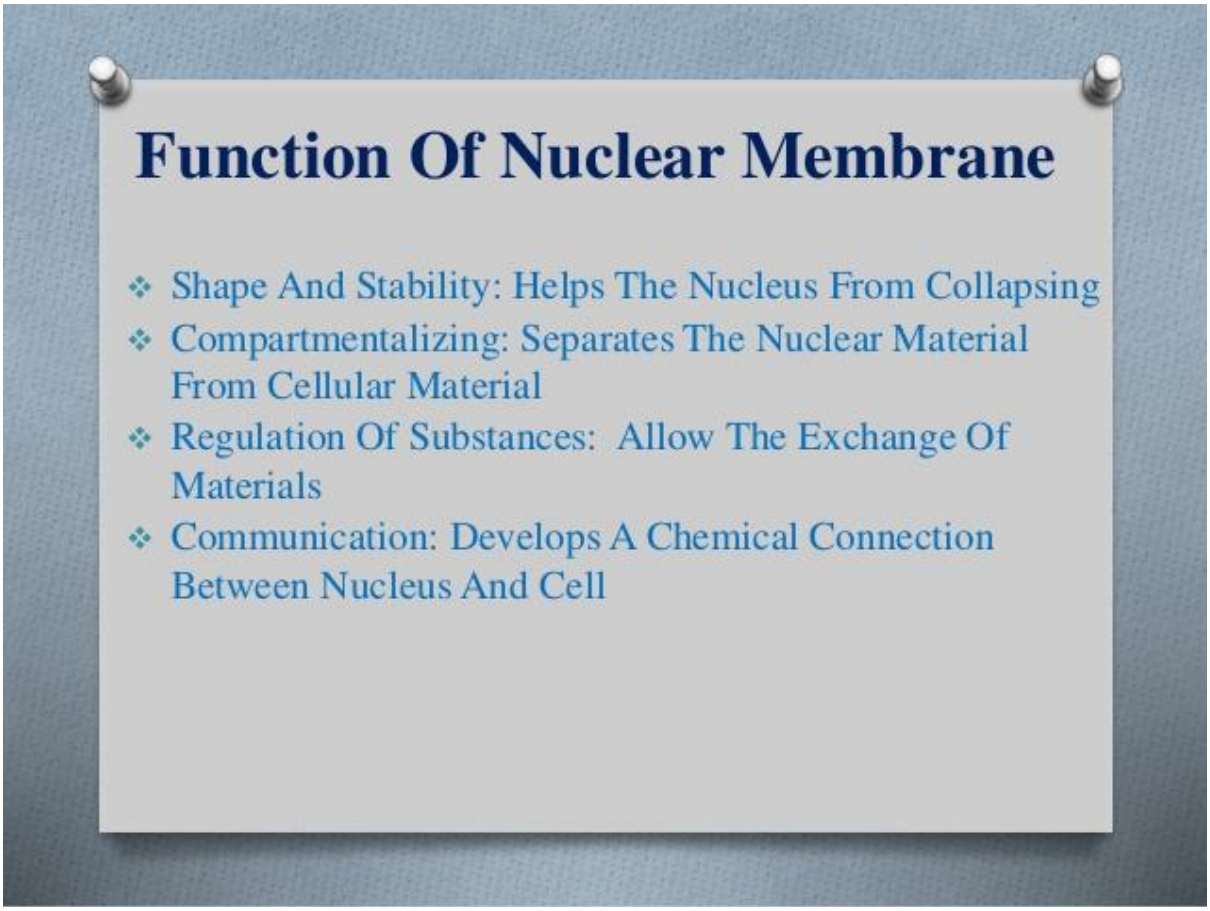


Nuclear Membrane

- Also known as nuclear envelope or nucleolemma
- Separates the nuclear material from cytoplasm
- Consists of two lipid bilayers
- Outer membrane
- Inner membrane



- The nuclear envelope is a double-layered membrane perforated with pores, which control the flow of material going in and out of the nucleus.
- The outer layer is connected to the endoplasmic reticulum, communicating with the cytoplasm of the cell. The exchange of the large molecules (protein and RNA) between the nucleus and cytoplasm happens here.



Ultrastructure

1. Nuclear envelope:

- Encloses DNA
- Formed from-

1. Spherical inner nuclear membrane (5-10 nm thick).

-Contains sp. Proteins act as binding site for IFs- nuclear lamina.

2. Outer Nuclear membrane.

- Continues with ER, studded with ribosomes- proteins.
- Perinuclear space: 10-50 nm diam.

-contain fibres, lipid droplets, crystalline deposits.

A) Nuclear lamina-

-Protein meshwork, 50-80 nm thick.

- Lines inside surface of inner nuclear membrane.

-Plays crucial role in assembly of interphase nuclei.

B) Nuclear Pores:

1) Structure:

-Circular, Diameter 10nm to 100nm.

-Nuclear pore complex (M.W.= 50-100 million daltons) have octagonal symmetry, contain two rings (R), large particle that forms central plug and radial spokes.

- Proteins=

i) Integral membrane protein, a glycoprotein of 120 K daltons.

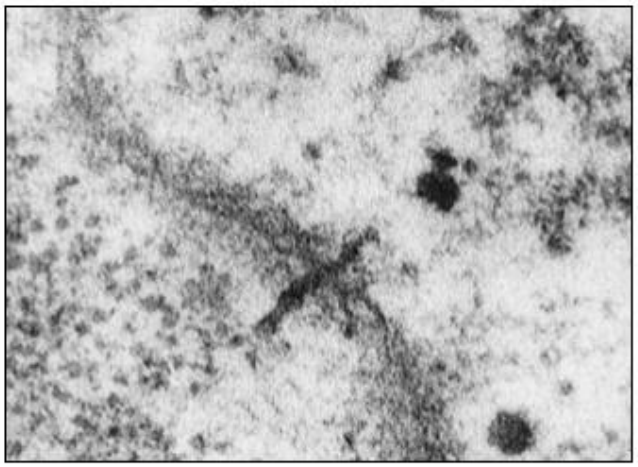
ii) Transporter Protein, 63 k daltons.

2) Pore Density:

- Correlated with transcriptional activity of cell.
- R.B.Cs and lymphocytes~ 3 pores/μm^2.
- Proliferating cells (liver)~ 15-20 pores/μm^2

3) Transport through Nuclear Pores:

- If cell is synthesizing DNA, it needs to import about 10^6 histone molecules from cytoplasm every 3 mins., for packaging DNA.
- mRNA complexed with special proteins forming ribonucleoprotein particles are actively export through nucleus.



[movement of granular material (presumed to be a ribosomal subunit) through a nuclear pore]

…….TO BE CONTINUED……