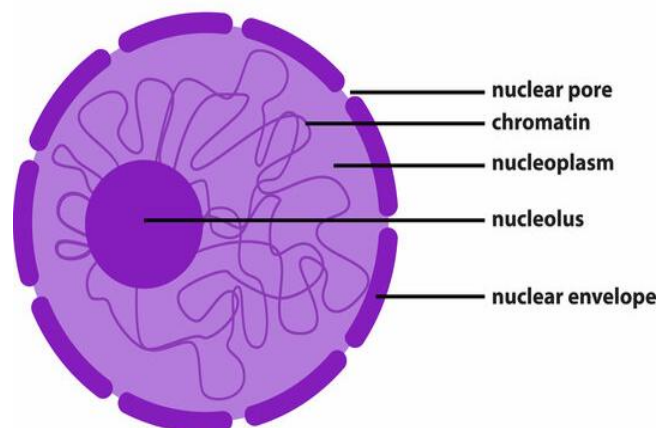


Nucleus

- Robert Brown (1831) discovered the nucleus in the cell.
- Nucleus is defined as a double-membraned eukaryotic cell organelle that contains the genetic material.
- The nucleus is found only in eukaryotes and is the defining characteristic feature of eukaryotic cells. However, some cells, such as RBCs do not possess a nucleus, though they originate from a eukaryotic organisms.
- Typically, it is the most evident organelle in the cell.
- It is encircled by a structure referred to as the nuclear envelope.
- The membrane distinguishes the cytoplasm from the contents of the nucleus
- The cell's chromosomes are also confined within it.
- DNA is present in the Chromosomes, and they provide the genetic information required for the creation of different cell components in addition to the reproduction of life.

Structure of Nucleus

The structure of a nucleus encompasses the nuclear membrane, nucleoplasm, chromosomes, and nucleolus.



Nuclear Membrane

- The nuclear membrane is a double-layered structure that encloses the contents of the nucleus.
The outer layer of the membrane is connected to the endoplasmic reticulum.

- Like the cell membrane, the nuclear envelope consists of **phospholipids** that form a lipid bilayer.
- The envelope helps to **maintain the shape** of the nucleus and assists in **regulating the flow of molecules** into and out of the nucleus through nuclear pores. The nucleus communicates with the remaining of the cell or the cytoplasm through several openings called nuclear pores.
- Such nuclear pores are the sites for the exchange of large molecules (proteins and RNA) between the nucleus and cytoplasm.
- A fluid-filled space or perinuclear space is present between the two layers of a nuclear membrane.

Nucleoplasm

- Nucleoplasm is the **gelatinous substance** within the nuclear envelope.
- Also called karyoplasm, this semi-aqueous material is similar to the cytoplasm and is composed mainly of water with dissolved **salts, enzymes, and organic molecules** suspended within.
- The **nucleolus and chromosomes are surrounded by nucleoplasm**, which functions to protect the contents of the nucleus.
- Nucleoplasm also supports the nucleus by helping to maintain its shape. Additionally, nucleoplasm provides a medium by which materials, such as enzymes and nucleotides (DNA and RNA subunits), can be transported throughout the nucleus. Substances are exchanged between the cytoplasm and nucleoplasm through nuclear pores.

Nucleolus

- Contained within the nucleus is a dense, membrane-less structure composed of RNA and proteins called the nucleolus.
- Some of the eukaryotic organisms have a nucleus that contains up to four nucleoli.
- The nucleolus contains nucleolar organizers, which are parts of chromosomes with the genes for ribosome synthesis on them. The nucleolus helps to synthesize ribosomes by transcribing and assembling ribosomal RNA subunits. These subunits join together to form a ribosome during protein synthesis.
- The nucleolus disappears when a cell undergoes division and is reformed after the completion of cell division.

Chromosomes

- The nucleus is the organelle that houses chromosomes.
- Chromosomes consist of DNA, which contains heredity information and instructions for cell growth, development, and reproduction.

- Chromosomes are present in the form of strings of DNA and histones (protein molecules) called chromatin.
- When a cell is “resting” i.e. not dividing, the chromosomes are organized into long entangled structures called chromatin.
- The chromatin is further classified into heterochromatin and euchromatin based on the functions. The former type is a highly condensed, transcriptionally inactive form, mostly present adjacent to the nuclear membrane. On the other hand, euchromatin is a delicate, less condensed organization of chromatin, which is found abundantly in a transcribing cell.

Nucleus Functions

- The nucleus provides a site for genetic transcription that is segregated from the location of translation in the cytoplasm, allowing levels of gene regulation that are not available to prokaryotes. The main function of the cell nucleus is to control gene expression and mediate the replication of DNA during the cell cycle.
- It controls the hereditary characteristics of an organism.
- The organelle is also responsible for cell division, growth, and differentiation.
- Storage of hereditary material, the genes in the form of long and thin DNA (deoxyribonucleic acid) strands, referred to as chromatin.
- Storage of proteins and RNA (ribonucleic acid) in the nucleolus.
- The nucleus is a site for transcription in which messenger RNA (mRNA) are produced for protein synthesis.
- During the cell division, chromatins are arranged into chromosomes in the nucleus.
- Production of ribosomes (protein factories) in the nucleolus.
- Selective transportation of regulatory factors and energy molecules through nuclear pores.