**Nucleus**- discovered by Robert Brown in 1831.

- Chromatin was discovered by Flemming.
- The interphase nucleus (not dividing) has chromatin, nuclear matrix and nucleolus.
- Outer membrane continuous with the endoplasmic reticulum bears ribosomes on it.
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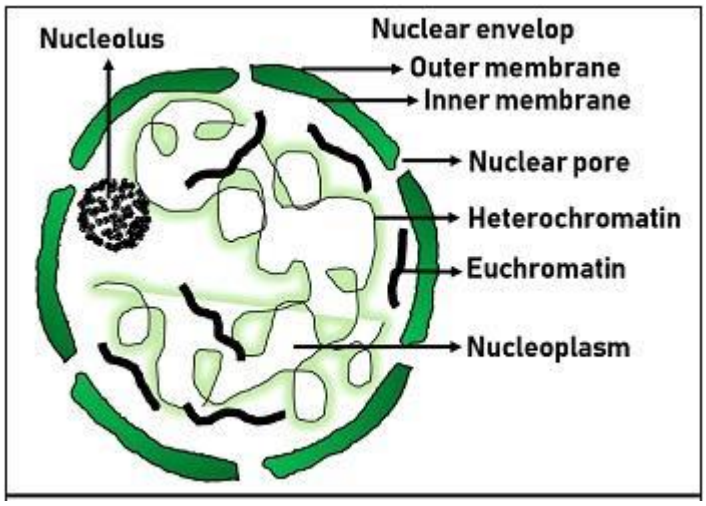
- Erythrocytes of many mammals and sieve tube cells of vascular plants.
- Generally, cell consist one nucleus but it can vary in various organisms.




**Nucleus is differentiated into following four parts**

**i. Nuclear Envelope**

It is a double membrane bound envelope that surround the nucleus and separates the latter from the cytoplasm.

- Minute pores in nuclear membrane-**Nuclear Pores**.
- Space between two parallel membranes of nucleus (10 to 50 nm) called the **Perinuclear Space**.

**ii. Nucleoplasm/ Nuclear Sap**- Fluid matrix present in the nucleus, which contains enzymes, metal ions and consist of nucleolus and chromatin.

**iii. Nucleolus-** A non-membranous highly stained, spherical structure present in nucleoplasm comprises of highly coiled genetic material.

- It is a site for ribosome and r-RNA synthesis.
- Its number may vary from cell to cell. High in cell actively participating in Protein synthesis.

**iv. Chromatin**

Uncoiled thread like network of DNA (coiled on Histone Protein) & RNA during Interphase (Non-dividing phase).
It has two distinct regions
(a) Euchromatin (lightly stained)- Genetically Active. Consist of Large amount of DNA.
(b) Heterochromatin (darkly stained)- Genetically Inert. Consist of large amount of RNA small amount of DNA.

**What are the different Functions of Nucleus?**

(i) It stores information that control cellular functions.
(ii) It controls the synthesis of structural proteins.
(iii) It also stores the genetic information for development reproduction and behaviour.
(iv) It also induces genetic variations.

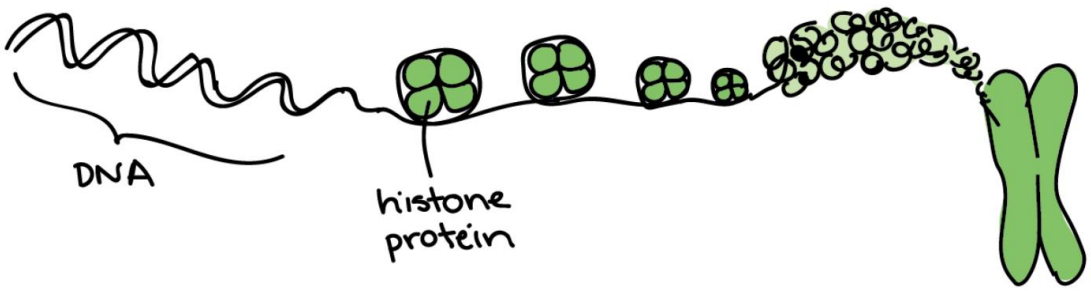
**Name the cells that have more than one nucleus.**

Liver cells, Skeletal muscles, osteoclasts, tapetum and many fungi.

**Chromosomes**

During cell division- chromatin network (DNA coiled on Histone Protein) condense to form a structure called Chromosomes.

- Chromosomes number is fixed and is same in all individuals of a species.
- A single human cell has approximately two-metre-long thread of DNA distributed among its 46 (23 pairs) chromosomes.
- Each and every chromosome is composed of a primary constriction called **centromere**.
- The disc-shaped structures present on Centromere known as **kinetochores**- (Site of attachment of spindle fibres)



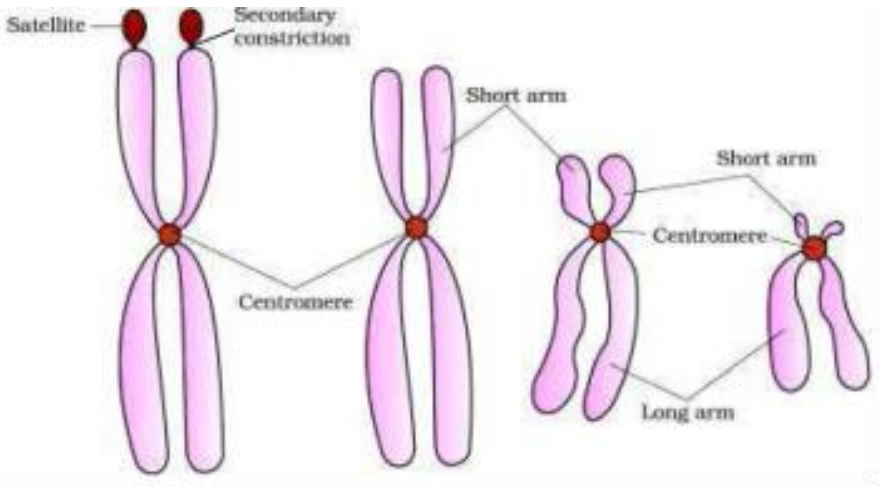
On the basis of the position of the centromere, the chromosomes can be classified into four following types

i. **Metacentric Chromosome**- Equal arms and centromere lies in the centre.

ii. **Sub-metacentric Chromosome**- One shorter arm & one longer arm with centromere slightly away from the middle.

iii. **Acrocentric**- One extremely short and one very long arm and centromere is located near the end.

iv. **Telocentric**- Terminal centromere placed at an extreme end.




- Telocentric chromosomes are not present in humans.
- Non-staining secondary constrictions present in few chromosomes at a constant location forms a small fragment called as **satellite**.
- Telomeres, the specific DNA–protein structures found at both ends of each chromosome, protect genome and play a central role in cell fate and aging.
- Centromere holds two chromatids of a chromosome.
- The chromatin materials change into chromosome during active cell division. It consists of DNA and histone proteins.
- Every chromosome has a primary constriction or the centromere, on the sides of which disc-shaped kinetochores are present.

**What are the functions of chromosomes?**

(i) Control cellular differentiation.

(ii) Contains all hereditary information located in the genes.

(iii) Forms a link between the offspring and the parents.

(iv) Introduce variations, through the process of crossing over.

(v) Control cell metabolism.

**Que: What are Microbodies?**

Ans: Membrane bound cytoplasmic elements that are composed of enzymes and other substances. Found in both plant cells and animal cells.

**Peroxisomes**- Contains powerful oxidative enzymes.

**Glyoxysomes**- Metabolise fats and lipids into carbohydrates.

**Que: Differentiate between Gram positive and Gram Negative Bacteria?**

(i) Gram positive (+ve) bacteria are those that take up the Gram stain and retain blue or purple colour, e.g., Bacillus subtilis, Clostridium, etc.

(ii) Gram negative (-ve) bacteria are those that do not take up Gram stain and loose the blue or purple colour, e.g., Escherichia coli, (E.coli), Acetobacter, etc.