

Nucleus & Nucleolus

By

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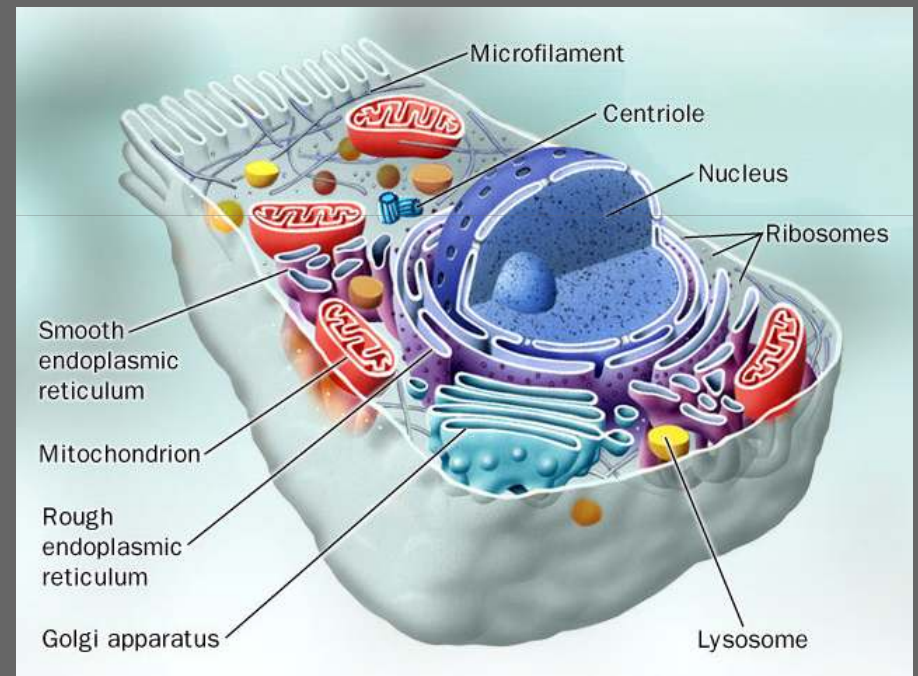
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introduction

- **Definition** – Nucleus is a specialized bound protoplasmic body which contain all the genetic information for controlling cellular metabolism and transmission to progeny.



Introduction cont . . .

History

- Robert Brown – was first to describe the nucleus seen in an orchid root cell in 1831.
- Joachim Hammerling – presence of hereditary information was provide by him an single cell alga *Acetabularia*.

Prokaryotic Nucleus

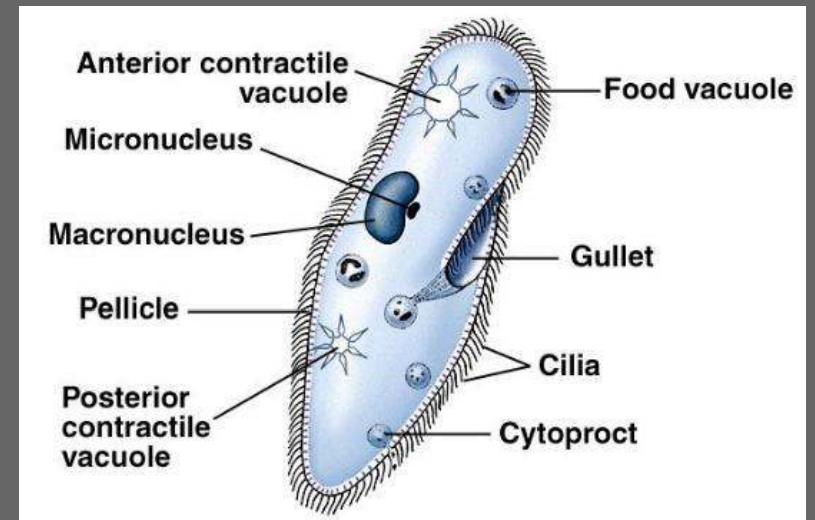
- Prokaryotic cells do not have an organized nucleus with a nuclear envelop.
- They have a nucleiod, folded circular DNA molecule without a membrane.

Number of Nucleus

- The nucleus is present in all eukaryotic cells, some cells are exceptions of this which do not contain nucleus.
- The mammalian red blood cells lose their nuclei.
- Phloem cells, called sieve tube of flowering plants also not contain nucleus.

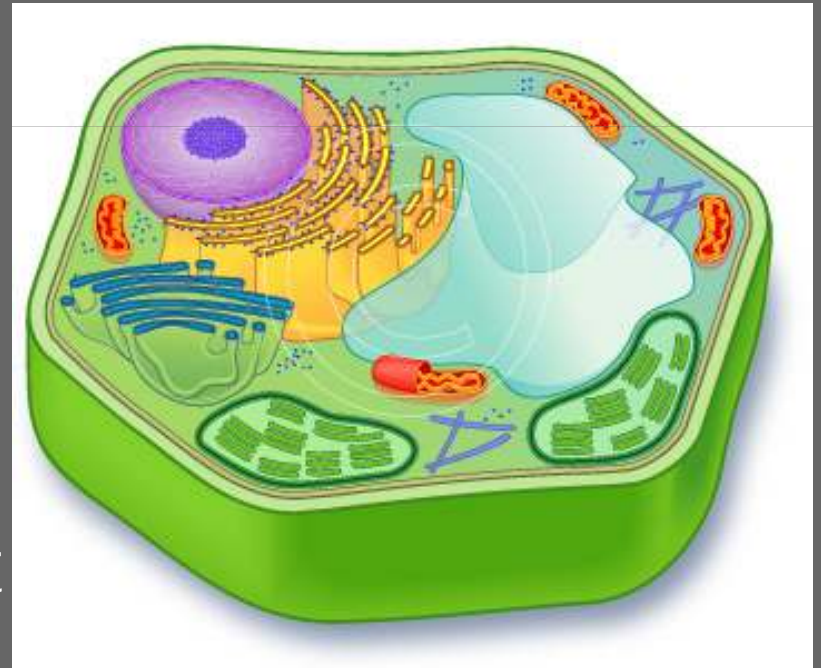
Number of Nucleus cont . . .

- **Uninucleate:** Have a single nucleus in cells
Paramecium caudatum
- **Binucleus:** Have two nucleus in cell
Opalina



Position of Nucleus

- Commonly it is situated in the geometric center of the cell.
- In plant cells it is pushed to peripheral position on one side due to the development of large central vacuole.



Shape & Size

Shape

- Oval or Elliptical – Plant cell having large central vacuoles
- Lobed – WBCs
- Irregular Branched – Silk spinning cells of insect.

Size

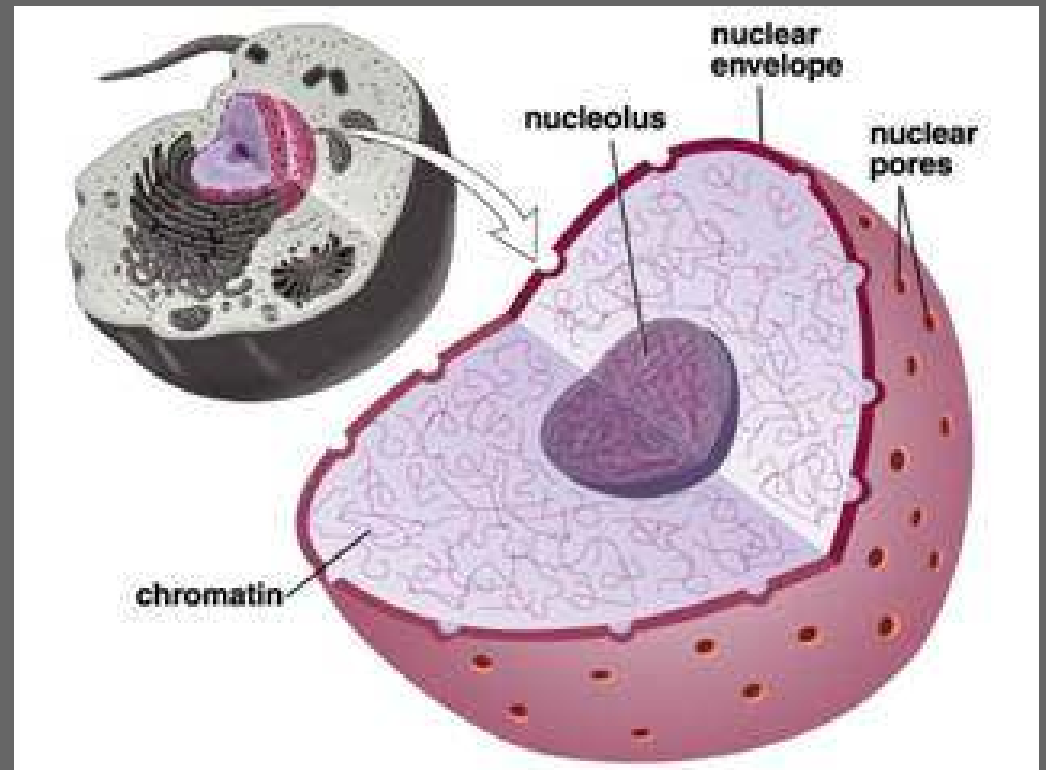
- 5-25 μ m

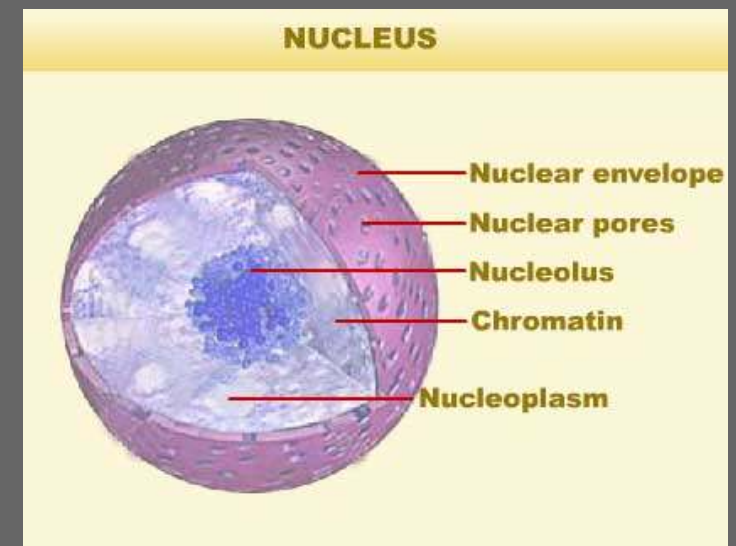
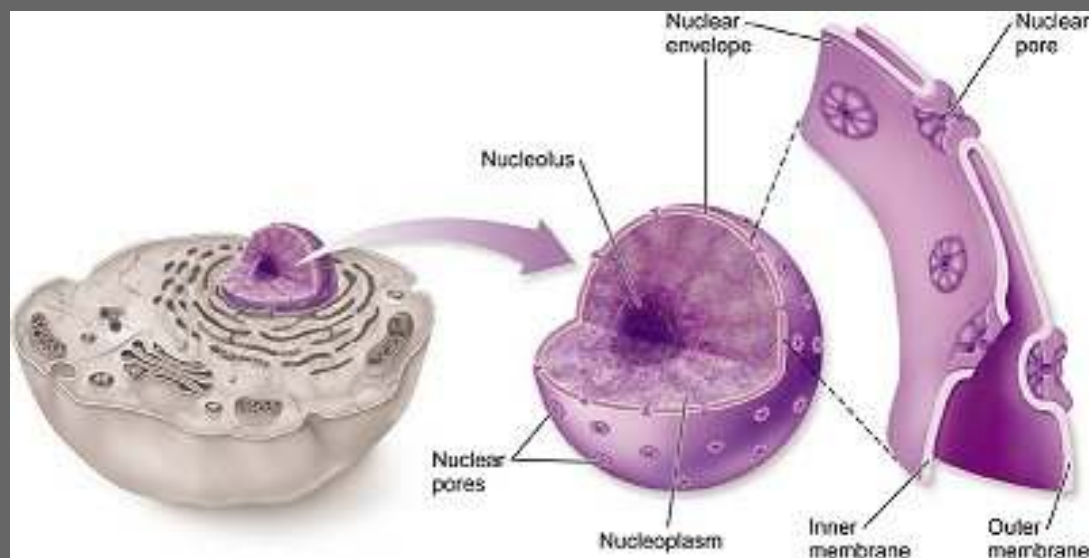
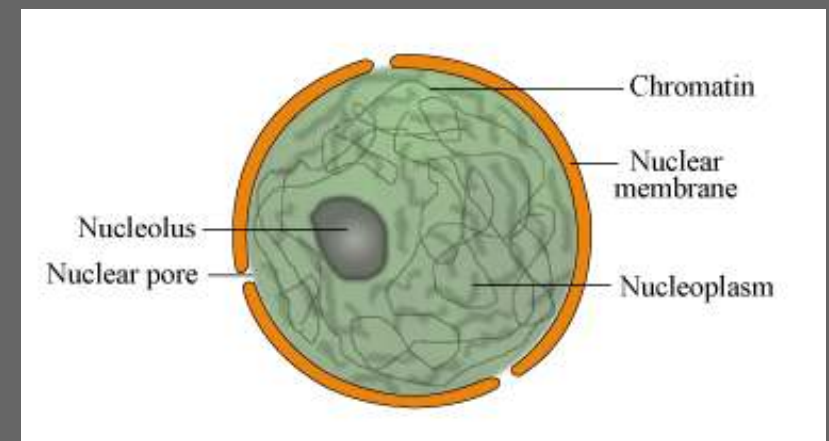
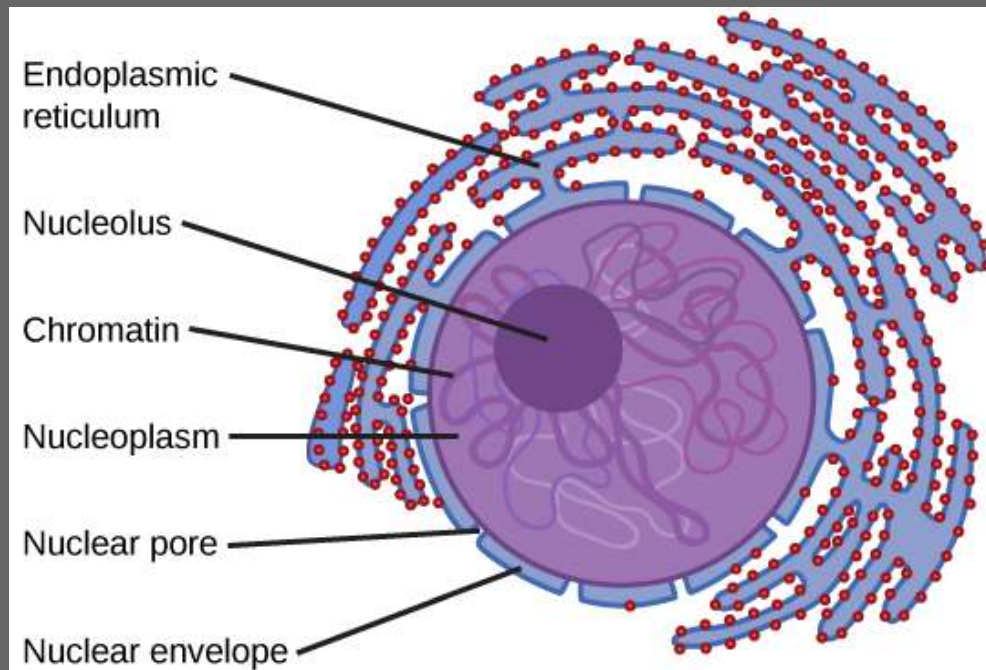
Chemical Composition of Nucleus

- DNA
- RNA
- Lipids
- Proteins
- Trace Elements – Ca, Mg, K, Na, P, Mn

Ultrastructure of Nucleus

- *Nuclear Envelop*
- *Nucleoplasm*
- *Chromatin*
- *Nucleolus*





Nuclear Envelop

- Nuclear envelop consists two membrane outer and inner.
- Between two membrane fluid- filled known as inter-membrane space.
- *Outer Membrane* – bears ribosome on its cytoplasmic surface and is rough. It is continuous with endoplasmic reticulum at certain places.

Nuclear Envelop cont . . .

- *Inner membrane* – it is free of ribosomes and is smooth. It has dense layer nuclear lamina.
- *Nuclear lamina* – it contain network of protein fiber. It connect chromatin to inner membrane.
- *Functions of nuclear envelop* – it maintain the shape of nucleus and regulates the flow of materials into and out of nucleus.

Nucleoplasm

- Also known as Nuclear sap or Karyolymph
- Nucleoplasm is clear and non staining fluid material in the nucleus.
- *It contains* – Nucleotides, DNA & RNA Polymerase, Nucleotide triphosphate, pyruvate kinase, Mn^{2+} and Mg^{2+} , Histone proteins, protein for formation of ribosomes.
- *Functions* – Place for synthesis of DNA & RNA

Chromatin

- Term chromatin means = colored material
- The chromatin occur in a non dividing interphase nucleus as fine filament termed as chromatin fibers.
- A chromatin fiber is a continues liner DNA associated with proteins, Histones are major protein found in chromatin.
- During prophase chromatin fiber condense to form thread like structure called chromosome.

Chromatin cont . . .

Euchromatin

- After cell division, chromosome change back in to chromatin fibers.
- They are uncoiled in interphase nucleus.
- It stained lightly.

Heterochromatin

- Some chromatin remain coiled and compact in interphase also.
- They lies close to nuclear lamina
- It stains deeply.

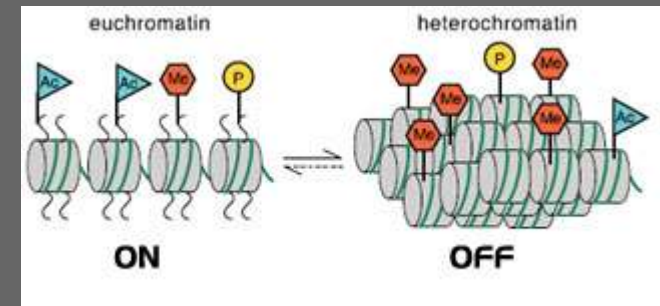
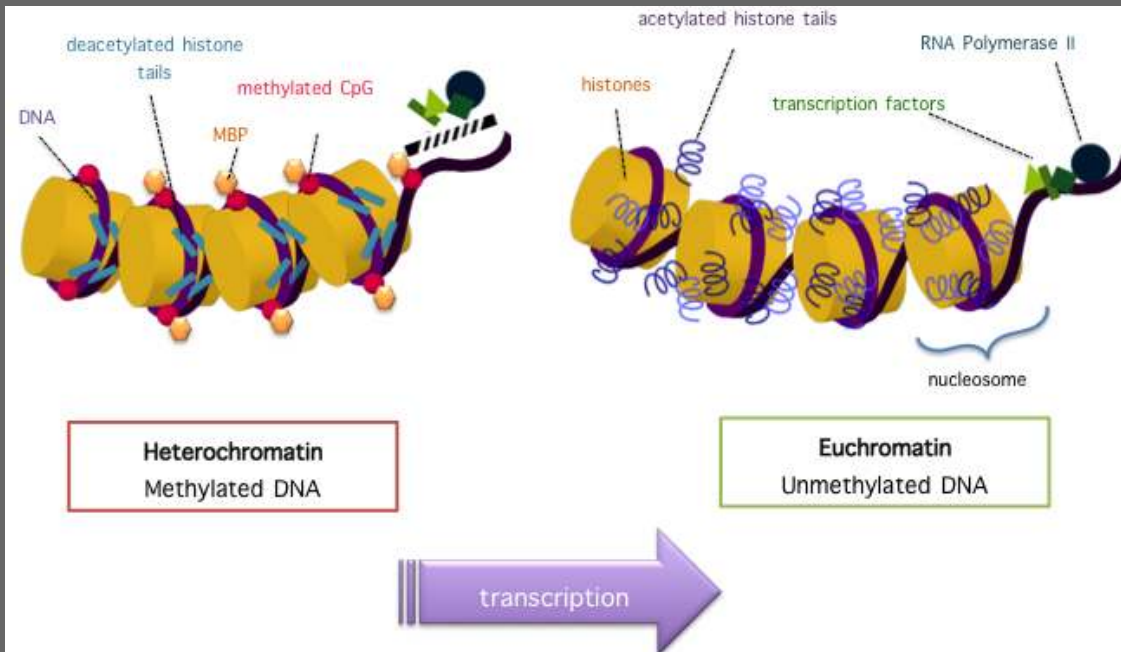
Chromatin

Euchromatin

- Loosely packed regions of chromatin which stains light
- Transcriptionally active chromatin

Heterochromatin

- Densely packed regions of chromatin which stains dark
- Transcriptionally inactive



Nucleolus

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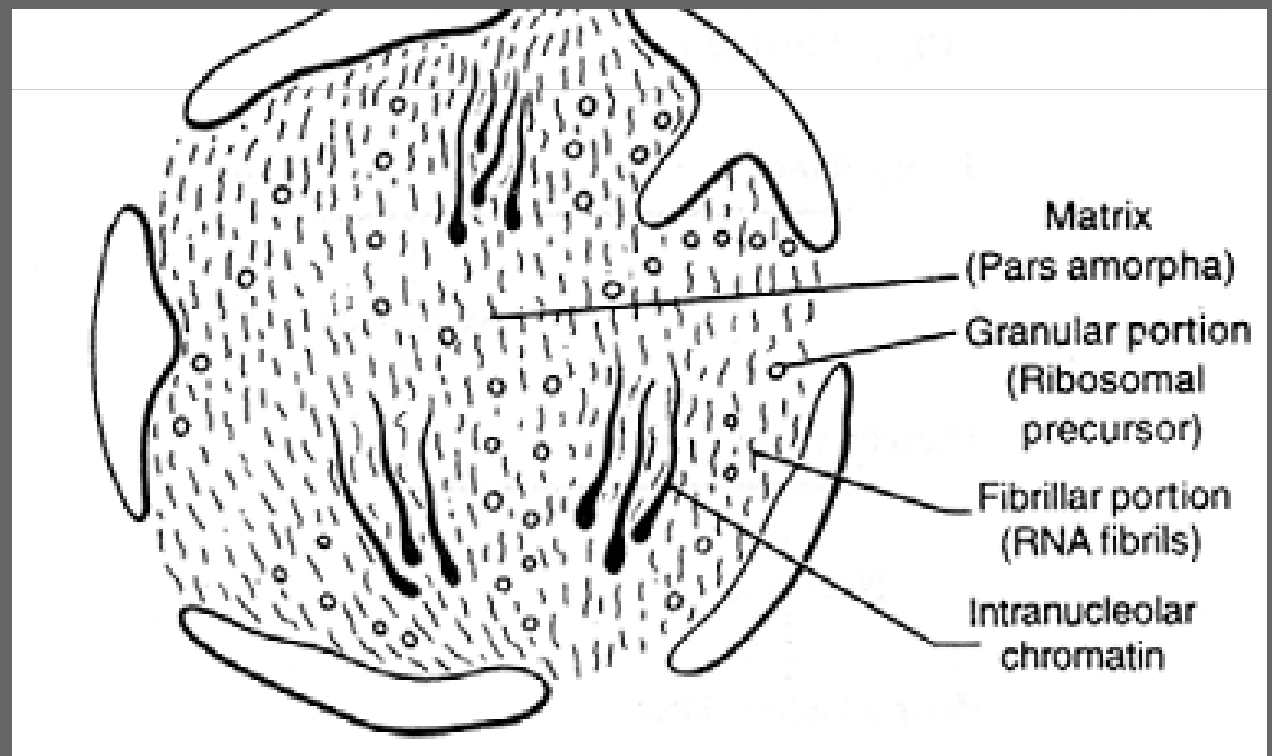
Introduction

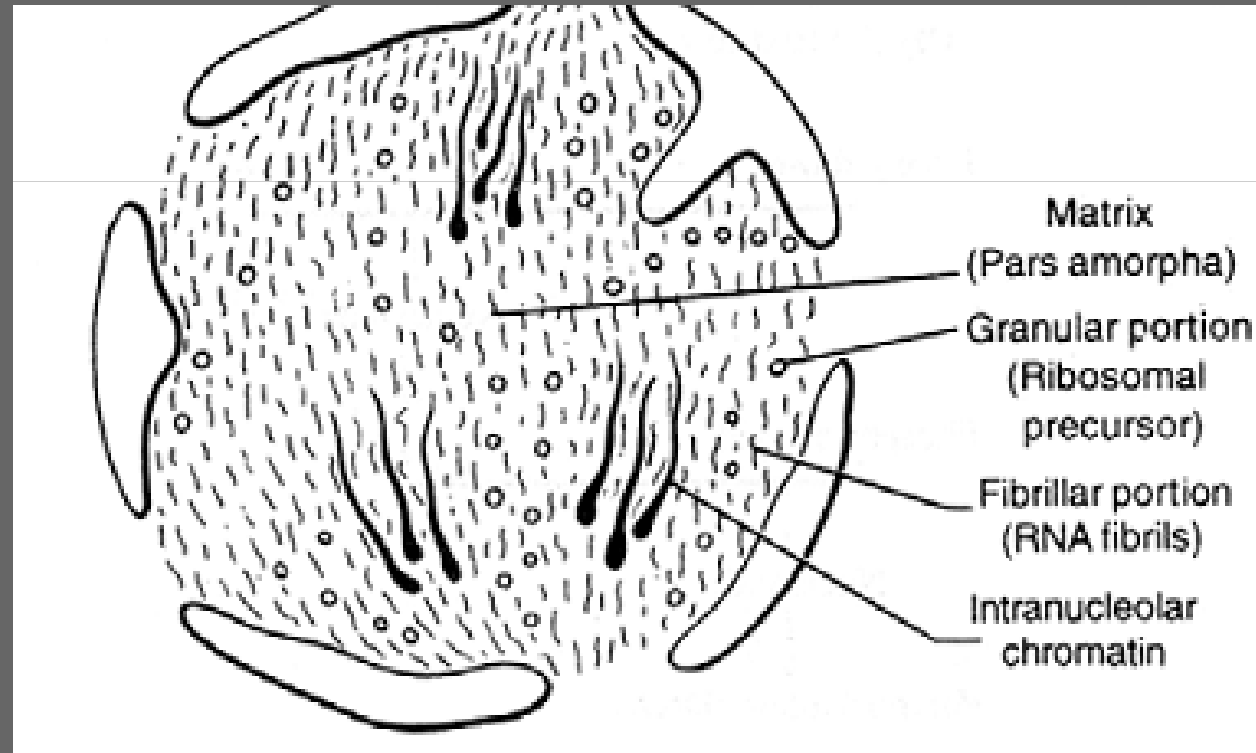
History

- Nucleolus was discovered in 1781 by Fontana.
- Described by – Wagner 1840
- Nucleolus named by – Bowman 1840
- Nucleolus is a dense, rounded, dark staining and granular structure inside the nucleus.

Composition

- RNA
- Protein
- Chromatin





Components of Nucleolus

Matrix

- It is amorphous, homogeneous, proteinaeous ground substance of nucleolus.

Granular region

- Contain ribosome subunit, rRNA and Ribosomal protein

Nucleolar chromatin

- Nucleolar chromatin are part of nucleolar chromosome
- It synthesis rRNA

Functions of Nucleolus

- Nucleolus synthesis and stores RNA
- It forms ribosomal subunit by wrapping the rRNA with ribosomal proteins.
- Ribosomal subunit later leave the nucleolus through nuclear pores.



Thank you