

Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (First Year)

Subject: Zoology

Paper Code: ZOC 101

Paper Title: Diversity of Non-Chordates and Cell Biology

Unit: Unit 13 - Nucleus

Module Name: Nucleolus

Name of the Presenter: Mrs. Vishwal B. Sinai Kunkolienkar

Notes

Nucleolus

Nucleolus was first recognised by Fontana, 1874.

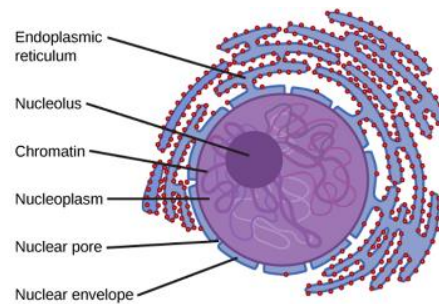
Nucleolus is one or more spherical colloidal acidophilic bodies in centre or periphery of nucleus. Earlier two main groups were identified – Plasmosomes and Karyosomes. **Plasmosomes** get stained with acidic dye, disappear during mitosis whereas **Karyosomes** get stained with basic dye and are just flakes of chromatin. Thus, presently, the term Nucleolus is referred only to Plasmosomes.

NUMBER OF NUCLEOLUS

No Nucleolus is present in cells of yeast and bacteria; some algae and undifferentiated embryonic cells; Certain mammalian cells like erythrocytes, reticulocytes and spermatozoa. Number of Nucleolus / Nucleoli depends on species and number of chromosomes (one, two or four). Most of the Ganglion cells possess single nucleolus, while Liver cells and certain lymphocytes have two nucleoli. Polyploid nucleus have more nucleoli than diploid nucleus.

POSITION OF NUCLEOLUS

Nucleolus is usually eccentric in position within the nucleus.



[Figure 04_03_04.jpg](#) by CNX OpenStax is retrieved from [https://commons.wikimedia.org/wiki/File:Figure 04_03_04.jpg](https://commons.wikimedia.org/wiki/File:Figure_04_03_04.jpg) is licensed under [CC-BY-4.0](#)

SIZE OF NUCLEOLUS

Size of the nucleolus is related to synthetic activity of the cell.

NUCLEOLAR ORGANIZER

It is the secondary constriction of Nucleolar organising chromosome. These are segments of chromosomes containing the genes for ribosomal RNA.

ULTRASTRUCTURE OF NUCLEOLUS

Nucleolus consist of four main parts - Amorphous matrix or Pars amorpha; Nucleolar associated chromatin; Fibrils and Granules.

Amorphous matrix or Pars amorpha is a homogeneous matrix and contains scattered granules and fibrils.

Fibrils – These are 80 – 100 Å in diameter and contain RNA. These are precursor of the granules.

Granules – Granules are ribonucleoprotein granules having 150 – 200 Å diameter. Protein to RNA ratio is 2:1. The size and staining properties similar to cytoplasmic ribosomes and are connected together by a thin filament, forming primary nucleolonema. The primary nucleolonema undergoes folding and form secondary nucleolonema. Nucleolonema may contain fibrils also. Granules and fibrils may be separate, or mixed forming fibrillo-granular areas.

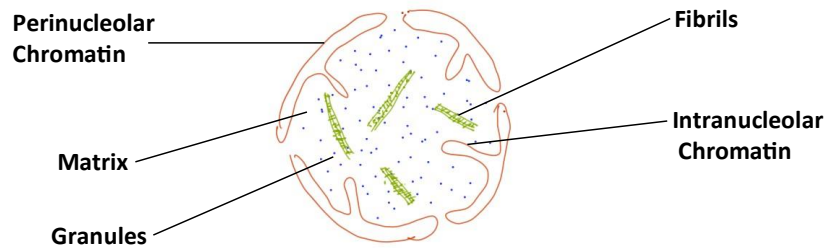
Nucleolar associated chromatin is the DNA which serves as a template for RNA synthesis.

Chromatin consist of **Perinucleolar chromatin** and **Intranucleolar chromatin**

Perinucleolar chromatin is the chromatin surrounding the nucleolus. It is continuous (as in endocrine cells) or thin with holes (as in kidney cells of monkey).

Intranucleolar chromatin forms septa - like trabeculae projecting into the nucleolus from perinucleolar chromatin.

Structure of Nucleolus



TYPES OF NUCLEOLUS – based on distribution of ribonucleoprotein granules and fibrils

1. **Nucleoli with nucleolonema** - found in most cells
2. **Compact nucleoli without nucleolonema** - found in salivary glands of sciarids and protozoan *Tetrahymena pyriformis*
3. **Ring shaped Nucleoli with peripheral nucleolonema** – found in endothelial cells, smooth muscle cells and lymphosarcoma cells.

FUNCTIONS OF NUCLEOLUS

- Biogenesis of Ribosomal subunits in eukaryotic cells i.e. 40s and 60s
- Nucleolar organizing regions (NORs) have ribosomal DNA genes and are the sites for formation of rRNA from rDNA by transcription.
- rRNA precursor transcript molecule is thus formed as a result of transcription; which then is cleaved to form 23S, 18S and 5.8S rRNA.
- Post-transcriptional modification occurs through interaction with small nucleolar ribonucleoproteins (snoRNPs) and additional protein processing factors.

REGIONS OF NUCLEOLUS

- **Fibrillar centre** consisting of RNA polymerase I transcription factors.
- **Dense Fibrillar component** having pre-RNA processing factors.
- **Cortical Granular component** having presence of transcribed rRNA maturation and assembly into ribosomes.