Hello students, myself

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professor in Zoology from PES Ravi S.

Naik College of Arts and Science,

and this is the program of Bachelors

of Science first year; subject

Zoology semester I; course Code ZOC 101

diversity of non chordates

and cell biology.

So today we'll be studying the module

nucleolus from unit no. 13 nucleus.

In this module, you will be looking

at the structure of the nucleolus

and functions of the nucleolus.

After going through this module,

you will be able to explain

the structure of the nucleolus.

You will be able to enlist the

functions of the nucleolus and

you will be able to describe the

different types of nucleolus.

So let us start. Nucleolus is

present within the nucleus

as you all know. It was first

recognized by Fontana in the year 1874.

It is one or more spherical colloidal

acidophilic bodies in the centre

or periphery of the nucleus.

Earlier 2 main groups of

nucleolus were identified.

Plasmosomes and Karyosomes.

Plasmosomes were stained with acidic

dye and they disappear during mitosis,

whereas Karyosomes stain with basic dye

and they are just flakes of chromatin.

If you see presently nucleolus is

referred only to Plasmosomes.

Now, regarding the number of nucleolus,

no nucleolus is present in

yeast and bacteria,

Some algae and undifferentiated

embryonic cells.

Certain mammalian cells like erythrocytes,

reticulocytes and spermatozoa.

Number of nucleolus depend on the

species and number of chromosomes

and it may vary from 1-2 or four.

Most of the ganglionic cells

have single nucleolus liver cells.

Certain lymphocytes possess 2 nuclei.

polyploid nucleus have more

nuclei than the diploid nucleus.

So, now let us see the position

of the nucleolus.

Usually. the nucleolus is present

eccentrically within the nucleus.

So here you can see this is the

nucleus and this is the nucleolus.

So, it is present eccentrically

within the nucleus.

Now, coming to the size of the nucleolus;

size of the nucleolus is related to

the synthetic activity of the cell.

Also, there is a presence

of nucleolar organizer,

which is a secondary construction

of nucleolar organizing chromosome.

These are the segments of chromosomes

containing the genes for ribosomal RNA.

Now let us look at the

ultrastructure of nucleolus.

Nucleolus mainly consists of four components,

amorphous metrix or pars

amorpha, nucleolar associated

chromatin fibrils and granules.

So first, let us see amorphous

metrics or pars amorpha.

This is a homogeneous matrix and it

contains scattered granules and fibrils.

The fibrils are made up of

RNA and they are usually

80 to 100 A^{o} in diameter.

This fibrils are precursor of the granules.

Now coming to the granules; granules are

ribonucleoprotein granules having 150 to

200 A^o diameter. Protein to RNA ratio

within this granule is 2 : 1.

The size and staining properties

of these granules are similar

to the cytoplasmic ribosomes.

This granules are connected together by

thin filament forming primary nucleolema.

This primary nucleolonema undergoes

folding and form secondary nucleolonema.

Nucleolonema

may contain fibrous also.

Granules and fibrils maybe separate,

within this nucleolonema or they may

be mixed forming fibril agranular areas.

Now, coming to the nuclear associated

chromatin, this is the DNA which

serves as a template for RNA synthesis,

and it is basically made up

of two types of chromatin.

You have Perinucleolar chromatin

and intra nucleolar chromatin.

So the perinucleolar chromatin

is surrounding the nucleolus.

It may be continuous as in case of

endocrine cells or maybe thin

with holes as in the kidney cells of monkey.

Intra nucleolar chromatin

forms septa like trabeculae,

which project into the nucleolus

and form intra nucleolar chromatin.

So let us now look at this structure.

So here you can see the

structure of the nucleolus.

This is the Peri nucleolar chromatin,

which surrounds the matrix.

Then, you can see the intra nucleolar chromatin

which is projecting into the matrix.

This is the pars amorpha or the

homogeneous matrix, which can be seen.

And you can see within the metrix

there are small granules which are

the ribonucleoprotein granules,

and these are the fibrils which

have formed the nucleolonema.

Now, depending on the distribution of

ribonucleoprotein granules and fibrils,

you get different types of nucleolus.

The first one is nuclear with nucleolonema,

which is found in most of the cells.

II is compact, nucleoli without nucleolonema ,

which is found in salivary glands of sciarids

and the protozoan

tetrahymena pyriformis.

And the third one is ring shaped

nuclei with peripheral nucleolonema

which is found in endothelial cells.

Smooth muscle cells and lymphosarcoma cells.

Now let us look at the various

functions of nucleolus.

The first and very important function

is Biogenesis of ribosomal subunits.

In eukaryotic cells,

that is 40s and 60s ribosomal subunits.

Also,

The nucleolar organizing regions have

ribosomal RNA, have ribosomal DNA genes,

and other sites for formation

of RNA from DNA.

by transcription.

The precursor transcript molecule is

thus formed as a result of transcription,

which is then cleaved to form 23s, 18s and 5.8s.

Post transcriptional modification

occurs through interaction with

small nucleolar ribonucleoproteins,

that is,

an additional protein processing factors.

Now, based on the various factors.

And the various RNAs which are

present within the Nucleolus 3

regions have been differentiated.

So you have a fibrillar center,

the dense fibrillar component and

cortical granular component. Fibrillar

center having presence of RNA

polymerase 1 transcription factors,

dense fibrillar component having

pre RNA processing factors,

and the cortical granular component

have transcribed RNA maturation

and assembly into the ribosomes.

So, these are the references for this module.

Thank you.