Hello students in continuation to cell and its components today I am going to discuss with you nucleus and its structure along with nuclear envelope and nucleoplasm. I am Dr. Uma Masur. Assistant professor from Parvatibai Chowgule College of Arts and Science Autonomous.

Outline of this session is going to be a nuclear envelope along with a nuclear pore complex, nuclear lamina nuclear matrix and nucleoplasm. At the end of the session you will be able to describe structure of nuclear envelope and nucleoplasm and differentiate between nuclear matrix and nucleoplasm. Before going into the details of nucleus.

I will just explain to you about a simple diagram of plant cell you are already aware that cell is surrounded by a cell wall then plasma membrane and then cytoplasm In the cytoplasm you will find the cell organelles which are suspended within it like chloroplast, mitochondria and nucleus along with vacuole. It is this nucleus which we are going to focus on for its structural details. You must have studied that nucleus is a membrane-bound cell organelle which Is responsible for various activities within the cell in the presence of nucleus. The cell is called a eukaryotic cell and that is how we can differentiate it from prokaryotic cells. If you have studied the evolution of the cell you must have studied that the eukaryotic cell has evolved from prokaryotes. That is the plasma membrane of prokaryotic cells invaginated into the cytoplasm giving rise to endoplasmic reticulum and then enclosing the entire genetic material into a full-fledged nucleus.

With the advancement of technology we could observe the nucleus with its final details and in this slide we are going to study those details like the nuclear envelope. This nuclear envelope is made up of two membranes outer membrane and inner membrane this nuclear envelope is also found to be having perforations which are called as nuclear pore. Inside the nuclear membrane you will find the presence of aqueous gel-like structure which is called a nuclear body. In the nucleoplasm you will find the Chromatin material suspended within this is the actual genetic material. Along with chromatin you will also see the presence of nucleolus. Nucleus is seen to be surrounded by the foldings of endoplasmic

reticulum showing the granular appearance because of ribosomes attached to it. Now let us focus on nuclear envelope

Nuclear envelope is also called the perinuclear cisterna. It is made up of two concentric unit membranes into outer membrane and inner membrane. Each one is about 5 to 10 nanometer in thickness. It resembles the membrane of the endoplasmic reticulum and you can relate it to the evolution of the cell while they are showing the biochemical resemblance to the endoplasmic reticulum outer membrane of a nucleus is studied with ribosomes engaged with protein synthesis. Protein synthesizers transferred through this outer membrane through the lumen which is present between the two membranes and towards the nucleoplasm the lumen which is there is also called as the perinuclear space, which is about 10 to 50 nanometer wide. This perinuclear space is filled with fibers, crystalline deposits, lipid droplets and electron dense material. The image which is presented over here also shows the presence of nuclear membrane pore. This pore is responsible for the further cyt nucleoplasmic transmission. The sides of the pores are anchored with the protein complexes which regulate the streaming of molecules from the cytoplasm to nucleus or vice versa.

Now let us look at this nuclear core complex when the section was taken through the region of nuclear pore. It was observed that it is made up of a fibrillar structure called annulus. Annulus is extended from the cytoplasm to the nucleoplasm. When Unwin and Mulligan in 1983 studied they discovered

that nuclear pore complex is of diameter between 10 nanometer to 100 nanometer. It has the aqueous channel for transportation and it appears to be plugged by large central granule. With the advancement of the technology we could understand the nuclear pore complex in a much better way with computerized image processing technique. It revealed that nuclear pore complex is made up of four elements that is nuclear envelope outer ring spokes and plug if you see the nuclear envelope the outer side of the nuclear envelope will show you the presence of cytoplasmic particles. There are eight cytoplasmic particles which are arranged in the form of green inside to this membrane you will find the nucleoplasmic elements and the nuclear lamina it is also seen that there are spokes which are emerging from the central block and extended towards the cytoplasmic particles towards outer side and nuclear elements towards the inner side this gives the appearance of a basket-like structure. The

outer part of the basket is attached to the cytoplasm and inner side of the basket is attached to the nucleoplasm. If you see the top view of the nuclear pore complex it gives you the view of cartwheel and that is also called as cartwheel model of nuclear pore complex. Now let us look at Nuclear lamina Nuclear lamina is a fibrous sheath of intermittent filaments lying immediately inside the inner nuclear membrane. They are made up of specific proteins called as Lamin a, Lamin b and Lamin c. They bind to the membrane and appear like a cushion inside the inner nuclear membrane. Nuclear lamina is found to be in direct contact with chromatin and nuclear Rnas in animal cell nuclear lamina has to play a very important role during mitotic cell division throughout the process of prophase to telophase and even interface specifically for assembly of nuclei nuclear matrix is another important thing. It is also called as nuclear skeleton and it is the non-chromatin ribonucleoprotein issues framework it is resistant to high ionic strength buffers, non-ionic detergents and nucleolitic enzymes because of this rigidity they are responsible for maintaining the shape of the nucleus and spatial organization of chromatin material. It participates in cellular processes like dna replication, dna repair, gene expression rna transport, cell signaling and cell cycle regulation.

Now let us look at nucleoplasm. As told earlier nucleoplasm is a aqueous material which is filled within the nucleus. It is the space between the nuclear envelope and the nucleolus and more specifically it is transparent, semi-solid granular and slightly acidophilic ground substance. It makes matrix which is called as nucleoplasm sometimes it is also called as nuclear sap or cardiology the nuclear components like chromatin threads and the nucleolus remains suspended within this nucleoplasm it has a complex chemical composition mainly it contains nuclear proteins and other organic and inorganic substances like nucleic acids proteins enzymes and minerals. The references I have used for these presentations are Verma and Agarwal VK, Patil CR and additional reference is a web reference

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Thank you very much.