

Quadrant II- Transcript and Related Material

Programme	: Bachelor of Science (First Year)
Subject	: Zoology
Semester	: I
Paper Code	: ZOC101
Paper Title	: Diversity of Non chordates and Cell Biology
Unit Number	: 10
Module Name	: General organization of Eukaryotic cells.
Module Number	: 21
Name of the Presenter	: Dr. Kulkarni Rajender Rao.

NOTES

Eukaryotic cell (Gr. Eu – true, karyotic – nucleated). In eukaryotic cell nuclear membrane is present. It is a double membrane envelope. It helps in separating protoplasm in to cytoplasm and nucleoplasm.

Cell shape in unicellular organisms may be variable as in *Amoeba* or fixed as in *Paramecium*. In multi cellular organisms it is determined by the function.

Cell size: Not related to the size of the organism. Generally it is between 10- 100 μm or more, *Amoeba proteus* 600-700 μm). Primary oocyte (2n) produces haploid - secondary oocyte (n) and polocytes-, which is just 4 μm in size , leaving all the cytoplasm to secondary oocyte, Biggest and largest known cell is ostrich egg (18 cm) longest cell is neuron cell which grow up to a meter long (axons).

Cell Volume: Constant for a cell type. It is independent of the animal size.

Small cells more active due to less volume: surface area ratio. Cell size in Elephant is equal to Goat and Rat.

Cell Number: may be Unicellular - entire organism made up of only one cell or Multicellular- organisms having more than one cell in the body.

Number of cells in the organism is related to the size of the animal. Larger animals will have more number of cells than smaller animals.

Eutely is having constant number of Cell or Nuclei in the body, which is noticed in Rotifers and Nematodes.

Caenorhabditis elegans. Male - contains exactly 1031 cells, whereas in hermaphrodite it is exactly 959 in number.

Tardigrades. (Water bears / moss piglets) contain exactly 40,000 cells in the body.

Plasma membrane is the outer Limiting membrane. It is living, dynamic and separates intra cellular and extra cellular environment and is selectively permeable.

Fluid Mosaic Model of Plasma membrane structure was proposed by Singer and Nicolson.

Important Biological Properties of plasma membrane are Irritability - ability of the living organisms to respond to changes in their environment. Conductivity is the ability of aqueous solutions to transfer an electrical current carried by ions, which increases with the concentration of ions present in solution, their mobility, and temperature of the water.

Cytoplasmic streaming is the seat for metabolism, provides raw materials for cell organelles. Glucose gets converted to Pyruvic acid. in Glycolysis, It takes place in the cytoplasm; From Amino acids proteins are synthesized in the cytoplasm. Assimilation also play important role in Growth and Division of the cell.

Nucleus is regarded as the Commander of Metabolism, Vault of genetic information. It may be single – in most cells (Mono or Uninucleate) or Binucleate as in *Paramecium* and Polynucleate (syncytial) in Skeletal muscle cells.

Mitochondria - is a double membrane respiratory organelle of the cell.

It is regarded as the Power house of the cell as it is responsible for the production of ATP by the process of electron transport chain.

Altmann and Schimber(1890) proposed Prokaryotic origin or Symbiont Hypothesis of Mitochondria. They are considered as endosymbiotic prokaryotes, which have entered into the cytoplasm of eukaryotic cells and have maintained the symbiotic relations millions of years back. Small size ribosomes, circular DNA, localized endomembranal respiratory chain support this theory.

Endoplasmic reticulum. Is a continuous membrane system within the cytoplasm of eukaryotic cells made up of two subunits – rough endoplasmic reticulum (RER), and smooth endoplasmic reticulum (SER) and acts as secretory, storage, synthetic, folding, modifying, and transporting organelle of the cell.

Ribosomes are the only organelle present in both prokaryotes (70S) and eukaryotes (80S). They are not membrane bound organelles.

Golgi complex is regarded as the traffic police of the cell as it helps in sorting and directing the materials received to its destination after processing. They are also described as the packaging centers of the cell as they are responsible for converting several precursors to active forms.

Lysosomes are tiny sacs filled with hydrolytic enzymes and are referred as suicidal bags because due to any reason membrane ruptures and releases its content, it results in digestion and disintegration of all organelles come in contact with its highly reactive acid hydrolase enzymes. They are also referred as cleaners and sweepers of the cell as they help in removing old, dead cells from the body.

Cytoskeleton The term cytoskeleton was first coined by Koltzoff in 1928. The three main structural components of the cytoskeleton are microtubules, microfilaments and intermediate filaments made up of proteins like tubulin, actin, desmin, myosin etc. Its main functions are to give the cell shape, provide support to organize and anchorage organelles within the cell, to provide a basis for movement and cell division.

Centrioles are non membranous, cylindrical, micro tubular structures, capable of self duplication, formation of spindle fibers during cell division and formation basal granules for anchoring cilia and flagella without DNA.

Vacuoles are membrane bound sacs of pinocytosis and phagocytosis.

Play important role in cellular digestion (autophagosomes), osmoregulation (Contractile vacuoles) and defence (phagolysosomes in leucocytes).

Comparison between prokaryotic and eukaryotic Cells

Size – mostly prokaryotic cells are small about 1-10 μm and eukaryotic cells are large 10-100 μm in size. In prokaryotes, **Cell wall** is mostly present and is made up of peptidoglycans. Among eukaryotes it is absent in animal cells and present in plant cells and is made up of Cellulose. **Nucleus** is absent and division is by Amitosis in prokaryotes. Nucleus is present and division is by mitosis in eukaryotes DNA mostly circular and linear without histones in prokaryotes and double helical with histones in eukaryotes.

Cell organelles (Membrane bound) absent in prokaryotes and present in eukaryotes. 70S ribosomes present and respiration is mainly anaerobic in prokaryotes and 80S ribosomes and aerobic respiration present in eukaryotes.

Flagella are simple in prokaryotes and complex in eukaryotes.

Exocytosis and endocytosis are absent in prokaryotes and present in eukaryotes.