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Diploma in Pharmacy 1st Year
Human Anatomy and Physiology
Chapter 2 : Cell

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Chapter 2

Cell

Cell is the basic structural & functional unit of all living organism. All the living organisms can be categorised into

I. Unicellular organisms eg. Protozoa, yeast, and bacteria
II. Multicellular organisms eg. Plants & humans.
III. A human cell consist 100 trillon of cells
- Size of the cell is 10 µm
- Mass of the cell is 1 nano gram

Cell are two Types

❖ **Prokaryotic Cells :** These cells do not have well developed nucleus,but organells are present.
Eg. Archaebacteria,

❖ **Eukaryotic Cells :** These cells have well developed nucleus & other organells.
Eg, plants, animals

A cell perform following function

1. **cell growth & Metabolism :**
   - Cell grow either by increasing its number or in size
   - Metabolism is the chemical reaction that occurs in our body cell its change food in energy
   - During metabolism, various anabolic & catabolic process occur

Catabolic process : Breakdown of complex molecule occurs within the cells to produce energy

Anabolic process : Cells utilise energy to synthesis complex biomolecule and perfrom other biologicalfunction

2. **Cell Division :** It involve the splitting of a single cell. Mother cell splits into two daughter Cells this result in the growth of multicellular organisms.
During the cell division, DNA also synthesised and the process is known as replication.

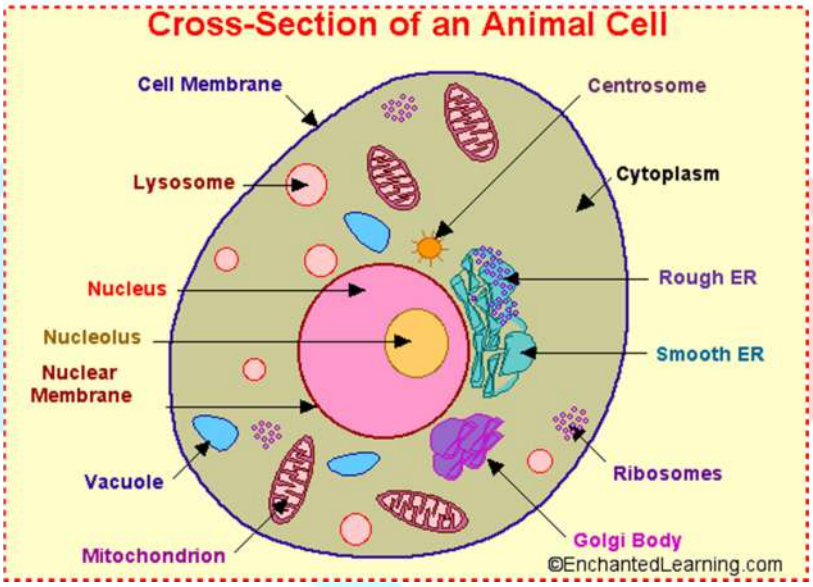
3. **Protein Synthesis :** It occurs within the cell, by two major steps
Transcription & Translation

4. **Molecule Transport :** The cell must be able to acquire nutrients and other molecule to survive

Components of cell

A cell Comprises of the following three basic components

- Cell membrane (or Plasma membrane)
- Cytoplasm
- Nucleus



1. Cell Membrane (or Plasma membrane)

→ The cell membrane is a selectively permeable biological membrane which allow only certainsubstance to pass through it.
→ It acts as a barrier between the inner and outer surface of the cell.
→ It also known as Plasma lemma.

Properties of cell membrane

- It guards the cell against the external environment.
- It allows cellular transport between cells.
- It helps in recognising a cell.
- It divides the cell into smaller section having different structure & function.
- It allows the fussion of cell membrane with other membrane of cell organellsthrough special point of attachment.
- It regulates the transfer of certain specific molecules through the cell membraneeg. Gap junction
- It enables motility of the cellular organells.

Structure (Fluid mosaic model)

- The fluid mosaic model is the most accepted one
- The fluid mosaic model of the plasma membrane was given by S.J Singer & G.L Nicholson

Function of cell

- ✓ **Protection of cells :** The receptors present on the cell membrane all chemical messages to passbetween the cell and the system, and thus provides protection to cells.
- ✓ **Separation from surrounding :** In an animal cell, it separates the internal environment fromthat of the external.
- ✓ **Tissue formation :** Groups of similar cells togetheer form tissues.
- ✓ **Contribution to enzyme acting :** It control the activity of enzyme Which further participate inmetabolism and immune system.
- ✓ **Particle Transportation :** This occurs by various Mechanism like ,carries proteins And ion pumps.

2. Cytoplasm

- The cell consists of cytoplasm enclosed with in the plasma membrane
- The cytoplasm includes various organells present inside a cell and therefore these organellsare also referred as a cytoplasmic organells
- Bassically The cytoplasm is the fluid in which cell organells remain suspended (mitochondria ' Golgi body, nucleus,etc

Structure of cytoplasm

The cytoplasm is divided into three parts Namely

1. Cytosol
2. Cytoplasmic organelles
3. Cytoplasmic Inclusion

- ➢ **Cytosol :** It is the fluid present inside the cell. The fluid bathes the cytoplasmic organelles Characterstic features of cytosol include.
  - ♦ Majority of the cell metabolism takes placem within the cytosol.
  - ♦ They also act as ribosomes and intracellular receptors.
- ➢ **Cytoplasmic organelles :** Cell consists the organelles (via Golgi body, mitochondra, etc) have some specific characteristics that help in the maintenanceof life.
- ➢ **Cytoplasmic Inclusion :** certain bodies are present within a cell but are unable to perform their own metabolic process. These Structure also lac membrane binding them.

Function of cytoplasm

- It provide the site for cell growth and expansion
- It provide space for organelles tp remain suspended in the medium
- It also helps in the movement of several elements within the cell
- Various biochemical reactions, importance for the maintenance of life, occur in the cytoplasm
- It has enzymes which help in the breaking the large macromolecule into smaller ones so thatother organelles can use them easily

3. Nucleus

- Mucleus is the spherical organelle that consists of a double layer membrane build up of phosopholipids & protein.
- It also known as the contro cell.
- It consist genetic material of cell.

Structure of Nucleus

The Nucleus structure is comparised of following compound.

- Nuclear Envelop : A large number of small circular or octagonal nuclear pores are present of specificpoint on the nuclear envelop.
  This nuclear pores regulated movement of the macromolecules from the nucleus to the cytoplasm andvice-versa.
- Nucleoplasm : The nuclear cavity of the nucleus is filled up by one of the specalised forms ofprotoplasm, Known as nucleoplasm.
- Chromatin material : The chromatic material saturated with DNA , transmits the coded structuraland functional information between the cell and organism.
- Interphase chromatin : During the interphase (the period of the cell cycle where the cell is notdividing) Two type of chromatin can br formed
  1. **Euchromatin :** It includes the active DNA.
  2. **Heterochromatin :** It mostly include the inactive DNA.
- Nucleolus : The nucleus of the cell has a nucleolus also known as nucleoi.
  It is a non-membrane bound structure containing protein and nucleic acids.
- Chromosome : The word Chromosome has been derived from the Greek word
  Chroma means ***colour***
  Soma means ***body***

  A chromosome can be defined as DNA-bound protein (histone protein) that carry geneticinformation from generation to other

Function Of Nucleus

- ❖ It consists most of the physiological activities of the cell
- ❖ It functions to encode all the genetic information that carries the hereditary characteristics inliving organisms
- ❖ It has direct Involvement in reproduction (cell division)

Other Organelles

➢ Mitochondria

- Most of the eukaryotic cells contain a membrane-bound cell organells called mitochondria.
- Diameter ranging from 0.5µm – 10.µm.
- Mitochondria are also know as the power house of the cell.
- Because they generate Adenosine Triphosphate (ATP) used as a source of chemical.
- Mitochondria are the chief source of energy in the cell.

Structure of mitochondria

Mitochondria are double membranous cell organelle having the following parts

1. **Outer membrane :** This membrane contain transport protein.
   - which are helpful in transporting ions and atoms across the organelle.
2. **Inner Menbrane :** This membrane is involved in the formation of cristae . Cristae are finger like projection in the matrix bearing small particle called F1 particle or oxysomes.
   Enzymes of the respiratory chain are present in cristae.
3. **Mitichonderial matrix :** matrix of the mitochondria is formed by fluid present within it
   - This fluid contains enzymes involved in kebe's cycle.
   - To oxidise fatty acids and pyruvic acid.

Function of mitochondria

- Regulates plasma membrane potential and cellular anabolism &catabolism.
- Synthesis of steroids.
- Aerobic Respiration to create energy for the functioning of cell.
- And The Main function of mitochondria , which are organelles also known as the power houseof the cell because it is produce energy.

➢ Golgi bodies

→ The golgi body comprises of folded and compresed membranous sacs piled up each other. All the cell contain golgi body however it is large in those cells facilitate the systhesis and export ofprotein via, endoplasmic reticulum to the golgi complex.

Structure of golgi body

→ The golgi body consists of membrane bounded stacks called cisternae each cisterna contist of flattenedmembrane disks that carry golgi enzymes.

Function of Golgi bodies

Golgi body is involved in the synthesis of a different number of macromolecule

- **Modifying, sorting, and packing :** The golgi complex plays an important role in sorting,mordifying and packing of substance for use with in the cell secretion.
- **Modification of protein :** proteins delivered by the endoplasmic recticulum are modified by the golgi body.
- **Transportation of substance :** enzymes present in the cisternae bond to the carbohydrates andphosphate group by the process of glycosylation and phosphorylation in order to modify substance by the transport of substance.
- **Formation of spindle :** The golgi body is involved in the formulation nof meiotic and mitoticspindles.
- **Excretion of water :** These organelles help in the excretion excess amount of water.

➢ Lysosomes

→ In 1949 a bwlgian cytoligist Christan de duve had discovered the cell organelle ' lysosomes 'The word lysosome derived from greek word

- ***Lysis*** means to ***separate***
- ***Some*** means ***body***

→ They are generally known as suicide-sacs or suicide bags.

Structure of lysosome

- Some non-green plant cells possess lysosomes.
- They are also called suicide bags as they cause intracellular digestion (destruct thecarbohydrates ,protein, DNA ,RNA etc) and thus destory the cell.

Characteristic feature of lysosome

➲They are present in high number n a single cell.

➲They possess nearly 40 different enzymes.

➲They are referred as suicidal bags since the enzymes present in them can digestthe whole cell in case of damage or death of the cell.

Function of lysosome

- Provide defence against invading micraorganisms via circulatating macrophages.
- Helps dissolve blood clots.
- Cause the sperm to penetrate the ovum.
- Decompose the mature RBC and dead cells.

- Help in reabsorption of water and small molecule in kidney and urinary bladder.

➢ Microsomes / Endoplasmic reticulum

- Microsome are a heterogeneous set of vesicles having diameter 20- 200 nm 7consisting of endoplasmic reticulum.
- This vesicles are isolated by differential centrifugation and formed threestructural features.
  i.e, rough vesicles smooth vesicles ribosomes.

Structure of microsomes / endoplasmic reticulum

➲ **Rough endoplasmic reticulum (RER) :** Small particles of RNA known as ribosomes are found inclose association with the membrane of the endoplasmic reticulum which gives a rough apperance to the membrane.

➲ **Smooth endoplasmic reticulum (SER) :** The membrane of SER do not contain ribosomes and help in the metabolism of carbohydrates and lipid they are involved in the synthesis of steroidhormones in adernals and tests.

➲ **Sarcoplasmic reticulum (SR) :** Most of the muscles condidts of a unique type of smooth er called sacroplasmic reticulum.

Function of Microsome / endoplasmic reticulum

- It acts as a structural framework of the cytoplasm.
- It exchanges material with the cytosol by active transport, osmosis, and diffusion.
- Protein synthesised by its surface- bound ribosomes are collected and stored byRER.
- It has different metabolic enzymes which helps in the synthesis ofphospholipid,cholestrol

➢ Ribosomes

→ Ribosomes are cell organelles where protein synthesis takes place. They are abundant in livingcells They are either found as free particles (in prokaryotic and eukaryotic cells or particle attached to membrane as in eukaryotic cells).

Structure of Ribosomes

- Ribosomes are ribonucleoproteins I,e. made from RNA Complex and proteinIt is divided into smaller parts called subunits.
- Which are made up of both protein and ribonucleic acid componentsSmaller sub unit & Larger sub unit.s

Function of Ribosomes

❖ The primary Function of ribosomes is protein synthesis.
❖ The information carried in the genetic code is converted into protein moleculewithin the ribosomes.