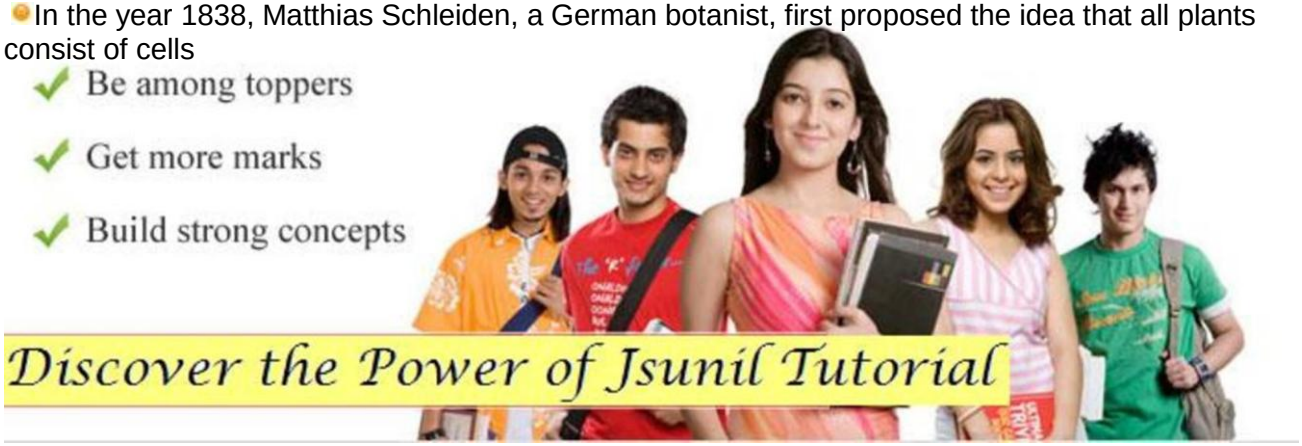
CLASS 9TH **CELL –BASIC AND STRUCTURAL UNIT**

Introduction

- The cells that make up our body are so small that you could fit over 200 of them on the full stop at the end of this sentence
- Before we plunge into the chapter, here are some interesting facts about cells. Read on...
- The word cell is derived from the Latin word “cellula” which means “a little room”
- It was the British botanist Robert Hooke who, in 1664, while examining a slice of bottle cork under a microscope, found its structure resembling the box-like living quarters of the monks in a monastery, and coined the word “cells”
- In the year 1838, Matthias Schleiden, a German botanist, first proposed the idea that all plants consist of cells



- The Dutch scientist A.V.Leeuwenhoek, in 1674, discovered the minute forms of life such as bacteria and single celled animals in a drop of water
- In 1839, Theodar Schwann, another German botanist, asserted that all plants and animals are made up of cells
- In 1831, Robert Brown discovered the nucleus in the cell
- J.E.Purkinje, in 1840, used the term protoplasm to describe the juicy, slimy gelatinous contents of the cell
- In 1885, Rudolf Virchow expressed that all cells arise from pre-existing cells
- In 1932, two German Scientists, Ruska and Knoll, invented the electron microscope
- Man is estimated to have about 100 trillion (10^{14}) cells in number

All living organisms, whether plants or animals, are made up of microscopic units called cells. The cell occupies the same central position in biology as the atom in the physical sciences. All living beings, plants and animals, start their life with a single cell. Some organisms exist as a single cell and carry out the various metabolic life processes such as assimilation, respiration, reproduction, excretion, etc., that are essential for their survival. These are known as unicellular organisms. Example: Yeast, bacteria, chlamydomonas, amoeba Some cells divide and give rise to organisms with more than one cell, these organisms are termed as multicellular. Hence, what is a cell? A cell is the structural and functional unit of all life forms.

Structure of Cell
Cells vary in shape and size. They may be oval, spherical, rectangular, polygonal, spindle shaped, star shaped, rod-shaped or totally irregular like the nerve cell. The diversity in cells is in accordance with the role or function it has to perform as part of the tissue or organ system. In general, there is no typical shape for cells.

Cell Membrane (Plasma Membrane)
Cell membrane is present in both plant and animal cells. It is living, elastic and made of proteins and lipids (fats). Its function is to provide a mechanical barrier for the protection of the inner cell contents and to regulate the movement of molecules in and out of the cell.

Cytoplasm
The part of the cell between the cell membrane and the nuclear membrane is called the cytoplasm. The cytoplasm consists of the matrix and the organelles. The matrix is a transparent semi fluid substance. When active, it is always in a state of movement. The organelles are found embedded in the cytoplasm. They have definite shape, structure and function. All the metabolic activities of the cell such as synthesis, secretion, digestion and energy generation, are performed by the different cell organelles. Cell organelles can be seen only with the help of an electron microscope.

Following are the Important Cell-organelles:
Endoplasmic Reticulum (ER) This is a complex network of tubes, the lumen of which is filled with fluid. Two types of endoplasmic reticula are seen.

They are:
- Tubes with a smooth surface are called smooth endoplasmic reticula. They secrete lipids.
- Tubes with spherical bodies (ribosomes) attached are known as rough endoplasmic reticula. The functions of the endoplasmic reticulum are to form the skeletal framework of the cell, to provide a pathway for the distribution of nuclear material from one cell to the other and to synthesize fats, steroids and cholesterol with the help of enzymes secreted by the cell.

Golgi Apparatus Also known as Golgi Complex or Golgi Bodies, they consist of tiny, elongated, flattened sacs (cisternae), which are stacked parallel to one another along with some vacuoles and clusters of vesicles.
The function of the golgi body is to secrete certain hormones and enzymes. It also forms lysosomes and peroxisomes. The golgi body is usually found close to the nucleus.

Lysosomes These are tiny, spherical, sac-like structures scattered all over the cytoplasm. Their main function is digestion. They contain powerful destructive enzymes capable of digesting all organic material, and hence called “digestive bags”.
Lysosomes present in white blood cells are capable of digesting bacteria and viruses. During starvation, lysosomes digest proteins, fats and glycogen in the cytoplasm, and supply energy to the cell. They are also capable of digesting worn out cell organelles, or even digesting the entire

damaged cell containing them. Hence, “suicide bag” is a sobriquet that is often used for Lysosomes.

Peroxisomes These organelles are found in the liver and kidney cells. They are small, membrane-bound sacs, and contain powerful oxidative enzymes.
Their chief function is to remove toxic substances.
Ribosomes These are spherical, granular particles which occur freely in the matrix or remain attached to the rough endoplasmic reticulum. Ribosomes contain RNA (ribonucleic acid) and proteins. Their function is to provide the surface for protein synthesis.

Centrosome This is found in the cytoplasm near the outer surface of the nucleus and contains two cylinders called centrioles. The centrosome is found only in the animal cell. The centrosome and the centrioles play an important role by forming the poles of the spindle during cell division.
Mitochondria These may be cylindrical, rod-shaped or spherical and distributed in the cytoplasm. Each mitochondrion is bound by a double membrane. The inner membrane is folded into ridges called cristae, which increase the surface area of the membrane. It is in the mitochondria that the sugar is finally burnt during cellular respiration. The energy thus released is stored as high-energy chemicals called ATP (adenosine triphosphate). Hence, mitochondria are termed as the “power house” or the “power plant” of the cell. The body cells use the energy stored in ATP for synthesis of new chemical compounds, the transport of these compounds and for mechanical work.

Plastids
These organelles are found only in plant cells.

Plastids are of three types: Chloroplasts Chromoplasts Leucoplasts
Chloroplasts They are green and found in leaves. The green colour is due to the presence of chlorophyll.
Chromoplasts They are yellow, orange and red, and found in flowers and fruits.
Leucoplasts They are colourless and found in roots, seeds and underground stem
The function of the chloroplast is to trap solar energy for photosynthesis. Chromoplasts impart colour to flowers to attract insects for pollination. Leucoplasts store food in the form of carbohydrates, fats and proteins. Nucleus This is a prominent, spherical or oval structure found at the centre of the cell. It is the controlling centre of all cell activities and has been described as the brain of the cell. It regulates all metabolic and hereditary activities of the cell. The nucleus is composed of the following structures: Nuclear Membrane Nucleoplasm Nucleolus Chromatin network

Nuclear Membrane This is a double-layered membrane which separates the nucleoplasm from the cytoplasm. The nuclear membrane has minute pores which allow the selective transfer of material between the nucleoplasm and the cytoplasm.

Nucleoplasm Within the nuclear membrane, completely filling up the space, is a clear, semi-solid, granular substance or matrix called the nucleoplasm. The nucleolus and the chromatin network lie suspended in the nucleoplasm.

Nucleolus This dense, spherical granule found in the nucleus contains RNA (ribonucleic acid) which is responsible for protein synthesis in the cytoplasm.

Chromatin Network These are very fine thread-like, coiled filaments uniformly distributed in the nucleoplasm. At the time of cell division, the chromatin becomes thick and ribbon like and are known as chromosomes. The chromosomes contain genes, which are composed of DNA (deoxy-ribonucleic acid). Genes are responsible for storing and transmitting hereditary characteristics from one generation to another. A gene is the functional unit of a chromosome. Genes are arranged in single linear order along the chromosome. One gene may be responsible for a single characteristic, or a single characteristic may be transmitted by a set of genes.

Prokaryotic and Eukaryotic Cells The structure of the cell that we have studied so far is that of a eukaryotic cell. How is a prokaryotic cell different from a eukaryotic cell? The main difference between these two cell types is that prokaryotic cells do not have a nuclear membrane. The nuclear material consists of a single chromosome and lies in the cytoplasm. The nuclear region in the cytoplasm is called nucleoid. Membrane-bound organelles are absent. Prokaryotic cells are found in bacteria and cynobacteria (blue-green algae).