

# CELL - HISTORICAL BACKGROUND

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- A cell is the biological unit of activity which exhibits the range of complexities and properties associated with the living matter.
- Except viruses, which is considered as quasi-living units (and according to some a virus is neither an organism nor a cell because it consists of nucleic acid and a protein coat and in the free state it is quite inert and becomes activated when it infects a living cell), the cell is defined as "the basic structural and functional unit of all living organisms."

It is delimited by a differentially permeable membrane and capable of self reproduction in a medium free of other living systems. The branch under which cell and its structure is studied is called cytology.

- Two groups of organisms have been recognised on the basis of their structural organisation. There are Prokaryotes and Eukaryotes. The prokaryotes (Monera) include all bacteria and blue-green algae, while eukaryotes consist of protists, animals and plants. The prokaryotes have a relatively simple internal structure while eukaryotes have an elaborate organisation including a number of membrane bound organelles.

## HISTORY:

1. The invention of microscope: Zacharias Janssen (1590) was credited for the invention of microscope. He was a spectacle maker; along with his father Hans Martens, Janssen was able to see the enlarged views of things with the help of hand lenses.

2. Discovery of cell: Robert Hooke, an English man who was a mathematician, physicist and an architect, examined many natural objects

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with help of much improved microscope. Among these were the thin sections of cork (bottle cork - Quercus suber). He published his findings in a book entitled "Micrographia" in 1665. The book contained large-scale, finely detailed illustrations of some of the specimens Hooke viewed under the microscope he designed. Thus he was the first person to see a cell. What he in fact saw was the cell wall that surrounded the cavities. The term "cell" was given by him to denote these little boxes or cavities into which the cork was regularly partitioned. [The word cell came from cellula, a Latin, meaning small compartment or chamber]. These walls, non-living structures surrounding the cavities or we may say there were empty cells.

3. observation of living cells: Antony Van Leeuwenhoek (1674), a Dutch dry-goods merchant, was probably the first person to see a living cell. He observed bacteria, yeast, protozoa, RBC, spermatozoa etc, with his simple microscope - a magnifying lens, which could magnify objects almost 300-fold. He observed many motile objects and reported the same to "The Royal Society", formally The Royal Society of London (the oldest national scientific institution in the world). He named "animalcules" to the organisms like protozoa, bacteria etc. [animalcule meaning little animal from Latin animal + the diminutive suffix -culum]. Leeuwenhoek actually referred to the microorganisms he observed in rainwater.

4. Cell Theory :

- The French scientist H.J. Dutrochet (1824), boiled the tissue in acid and separated the cells. On this basis he thought that all animals and plants are made of cells. This was the foundation of the cell theory.
- A German botanist M.J. Schleiden (1838) suggested that every structural part of a plant was made of cells as the result of cells. He also suggested that cells were made by a crystallisation process either within other cells or from outside. This crystallisation process is not accepted and thus no longer formed the part of modern cell theory.
- At the same time, a zoologist Theodor Schwann, also a German, in 1839 stated that along with plants, animals were composed of cells or the product of cells in their structure. This and the above work of Schleiden were major advancement in the field of biology.
- From all these findings about plants and animals, two of the three tenets of the cell theory (refuting Schleiden's assumption of cell formation through crystallisation) were postulated —
  - (i) All living organisms are composed of one or more cells.
  - (ii) The cell is the most basic unit of life.

• Rudolf Virchow (1858), also a German scientist, stated that the new cells originated from the pre-existing cells only, thus shown that crystallisation theory of Schleiden was incorrect and gave the concept of Omnis cellula e cellula (meaning every cell from a cell). The three tenets of the cell theory were given as follows —

- (i) All organisms are composed of one or more cells.
- (ii) The cell is the basic unit of structure and organisation in organisms.
- (iii) All cells arise from the pre-existing cells of the similar kind. Thus the continuity of life from one generation to another is through living cells.

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• Although Rudolf Virchow made important contribution towards the formulation of cell theory, the credit for the theory was given to Schleiden and Schwann, because of their basic works, and which attracted the attention of biologists of their time.

• The main features of the cell theory as it is known today and generally accepted as parts of modern cell theory are as follows —

- (i) All organisms are made of one or more cells.
- (ii) All living cells arise from pre-existing cells by division.
- (iii) The cell is the fundamental unit of structure and function in all living organisms.
- (iv) The chemical composition and metabolism of cells are basically alike and energy flow occurs within the cells.
- (v) The function of an organism as a whole is the outcome of the activities and interactions of the constituent cells.
- (vi) Hereditary information (DNA) is passed on from cell to cell.

5. Structures that make a cell: As microscopes continued to improve, more discoveries were made about cells. Several of the cell organelles were discovered by 1900 but their fine structure could be studied only with the discovery of electron microscope by Ernst Ruska and Max Knoll in 1931.

A cell can be studied by dividing it into three major structural parts —

- the cell wall
- vacuoles
- protoplasm.

Cell wall is the characteristic of plant cell only. A major part of matured plant cell is occupied by vacuoles, the space of which is filled with cell sap and surrounded by a membrane called tonoplast. Protoplasm consists of cytoplasm and the nucleus. Cytoplasm includes all the cellular structures outside the nucleus.