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CELL THEORY (CELL BIOLOGY- BBT-1002)

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LEARNING OUTCOMES

- Explain the key points of classical cell theory
- Explain the individual contributions of Hooke, Schleiden, Schwann and Virchow.
- Explain the key points of modern cell theory

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THE ORIGIN OF CELL THEORY



"By the help of microscopes, there is nothing so small, as to escape our inquiry; hence there is new visible world discovered to the understanding."



Robert Hooke

(1635-1703)

English natural philosopher

- The first person to see a cell under a microscope
- The first to describe the unit of life to be called a cell
- He invented the compound microscope
- He became a scientist in the year 1655 when he was only 20 years old
- When Robert Hooke was 27 years old he was appointed Curator of Experiments

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CONTRIBUTIONS OF MATTHIAS SCHLEIDEN AND THEODOR SCHWANN

- ◉ Nearly 200 years later, in 1838, Matthias **Schleiden** (1804–1881), a German botanist made extensive microscopic observations of plant tissues, described them as being composed of cells.
- ◉ Schleiden believed that cells formed through crystallization, rather than cell division.
- ◉ Theodor **Schwann** (1810–1882), a noted German physiologist, made similar microscopic observations of animal tissue.
- ◉ In 1839, after a conversation with Schleiden, Schwann realized that similarities existed between plant and animal tissues.
- ◉ This laid the foundation for the idea that cells are the fundamental components of plants and animals.

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CONTRIBUTIONS OF RUDOLF VIRCHOW

- ◉ Rudolf **Virchow** (1821–1902), a well-respected pathologist, published an editorial essay entitled “Cellular Pathology,” which popularized the concept of cell theory using the Latin phrase *omnis cellula a cellula* (“all cells arise from cells”), which is essentially the second tenet of modern cell theory.



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TENETS OF CLASSICAL CELL THEORY

- ◉ Proposed in 1839. There are three parts to this theory.
- ◉ The all organisms are made of cells.
- ◉ Cells are the basic units of life. These postulates were based on a conclusion made by Schwann and Matthias Schleiden in 1838, after comparing their observations of plant and animal cells.
- ◉ Cells come from preexisting cells that have multiplied, was described by Rudolf Virchow in 1858, when he stated *omnis cellula e cellula* (all cells come from cells).

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TENETS OF MODERN CELL THEORY

- ◉ Technology has improved, allowing for more detailed observations leading to new discoveries about cells.
- ◉ These findings led to the formation of the modern cell theory, which has three main additions:
- ◉ first, that DNA is passed between cells during cell division;
- ◉ second, that the cells of all organisms within a similar species are mostly the same, both structurally and chemically;
- ◉ and finally, that energy flow occurs within cells.

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STRUCTURES SHARED BY ALL CELLS

- ◉ Although cells are diverse, all cells have certain parts in common. These parts include a plasma membrane, cytoplasm, , ribosomes, and DNA.
- ◉ The **plasma membrane** (also called the cell membrane) is a thin coat of phospholipids that surrounds a cell. It forms the physical boundary between the cell and its environment.
- ◉ **Cytoplasm** refers to all of the cellular material inside the plasma membrane. The Cytoplasm consists of watery substance called cytosol and contains other cell structures such as ribosomes.
- ◉ **Ribosomes** are structures in the cytoplasm where proteins are made.
- ◉ **DNA** is a nucleic acid found in cells. It contains the genetic instructions that cells need to make proteins.
- ◉ These parts are common to all cells, from organisms as different as bacteria and human beings.

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EXCEPTIONS TO CELL THEORY

- ◉ Viruses are considered alive by some, yet they are not made up of cells. Viruses have many features of life, but by definition of the cell theory, they are not alive.
- ◉ The first cell did not originate from a pre-existing cell. There was no exact first cell since the definition of cell is imprecise.
- ◉ Mitochondria and chloroplasts have their own genetic material, and reproduce independently from the rest of the cell.

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FURTHER READINGS

<https://www.nationalgeographic.org/encyclopedia/cell-theory/>

<https://www.bemidjistate.edu/academics/departments/science/k12-science-units/Celll-theoy-and-organelles-biology.pdf>

[Cell and molecular biology by E M F De Robertis.](#)

Cooper G. M. (1997). The cell: a molecular approach. ASM press, Washington D.C., USA.