

Cell Theory



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Introduction

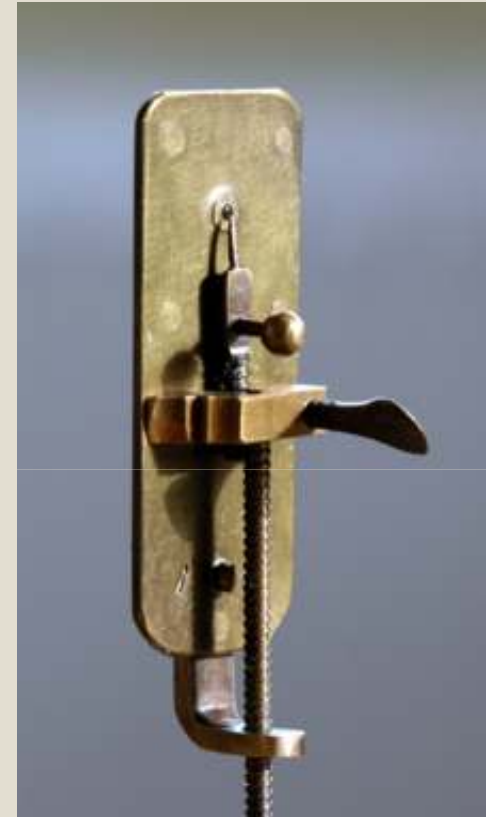
- ▶ Cell theory is a scientific theory which describes the properties of cells.
- ▶ These cells are the basic unit of structure in all organisms and also the basic unit of reproduction.
- ▶ With continual improvements made to microscopes over time, magnification technology advanced enough to discover cells in the 17th century.
- ▶ This discovery is largely attributed to Robert Hooke, and began the scientific study of cells, also known as cell biology.

Discovery of Cell

- ▶ The discovery of the cell was made possible through the invention of the microscope. In the first century BC, Romans were able to make glass, discovering that objects appeared to be larger under the glass.
- ▶ In Italy during the 12th century, Salvino D'Armato made a piece of glass to fit over one eye, allowing for a magnification effect to that eye.
- ▶ It was not until the 1590s when a Dutch spectacle maker Zacharias Jansen began to test lenses that progress had been made to microscopes. Jansen was able to obtain about 9x magnification, but the objects appeared to be blurry.
- ▶ In 1595, Jansen and his father built the first compound microscope. While simple glasses were able to magnify objects, they were not considered to be a microscope.

Discovery of Cell

- ▶ However, the first real invention and use of a microscope was by Anton van Leeuwenhoek. He was a Dutch draper that took interest in microscopes after seeing one while on an apprenticeship in Amsterdam in 1648.
- ▶ At some point in his life before 1668, he was able to learn how to grind lenses.
- ▶ This eventually led to Leeuwenhoek making his own microscope. This was a large progression since the magnification now 270X.



Anton van Leeuwenhoek's Microscope from the 17th century with a magnification of 270x.

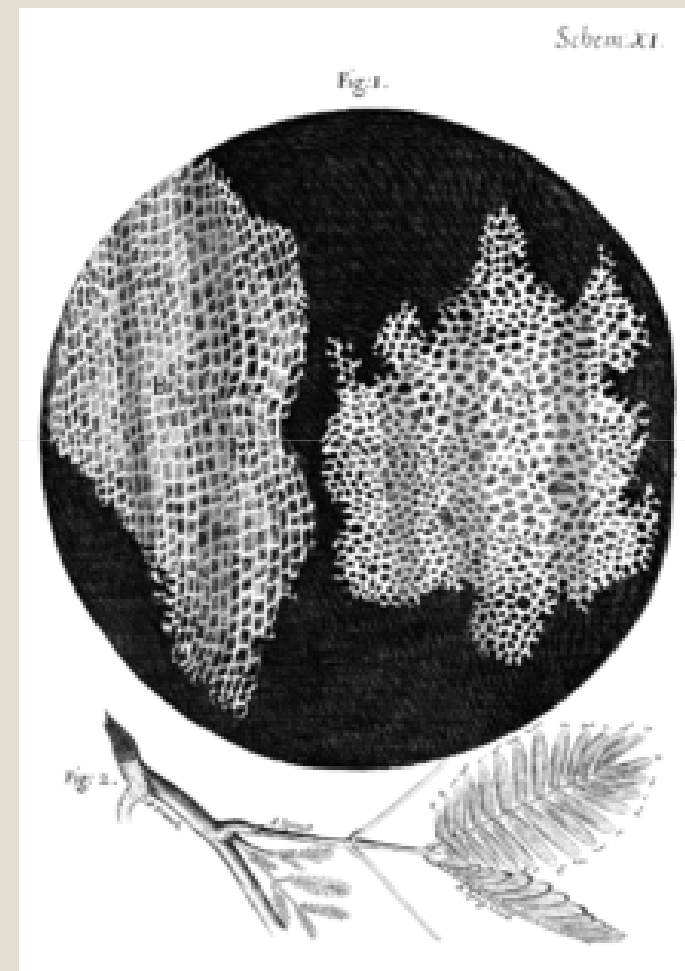
Discovery of Cell

- ▶ The cell was first discovered by Robert Hooke in 1665, which can be found to be described in his book *Micrographia*. In this book, he gave 60 'observations' in detail of various objects under a coarse, compound microscope.
- ▶ One observation was from very thin slices of bottle cork. Hooke discovered a multitude of tiny pores that he named "cells". This came from the Latin word *Cella*, meaning 'a small room'.



Discovery of Cell

- ▶ Hooke had thought were cells, were actually empty cell walls of plant tissues. With microscopes during this time having a low magnification, Hooke was unable to see that there were other internal components to the cells he was observing. Therefore, he did not think the "cellulae" was alive

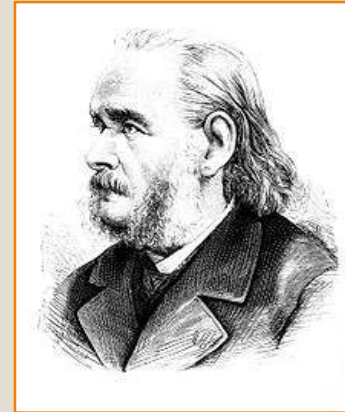
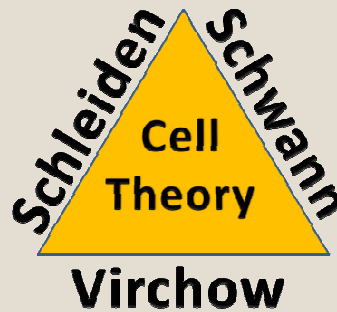


Discovery of Cell

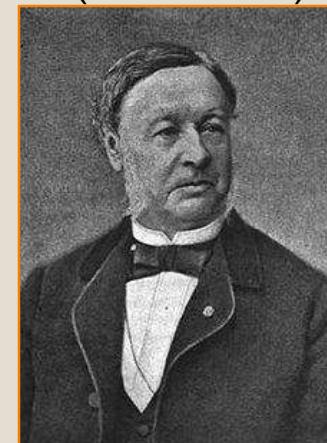
- ▶ Anton van Leeuwenhoek is another scientist who saw these cells soon after Hooke did. He made use of a microscope containing improved lenses that could magnify objects almost 300-fold, or 270x.
- ▶ Under these microscopes, Leeuwenhoek found motile objects. In a letter to The Royal Society on October 9, 1676, he states that motility is a quality of life therefore these were living organisms.
- ▶ Over time, he wrote many more papers in which described many specific forms of microorganisms. Leeuwenhoek named these “animalcules,” which included protozoa and other unicellular organisms, like bacteria.

Cell Theory

- ▶ Cell Theory was eventually formulated in 1838.
- ▶ This is usually credited to Matthias Schleiden and Theodor Schwann.
- ▶ However, many other scientists like Rudolf Virchow contributed to the theory.



Matthias Jakob Schleiden
(1804-1881)



Theodor Schwann
(1810-1882)

Cell Theory

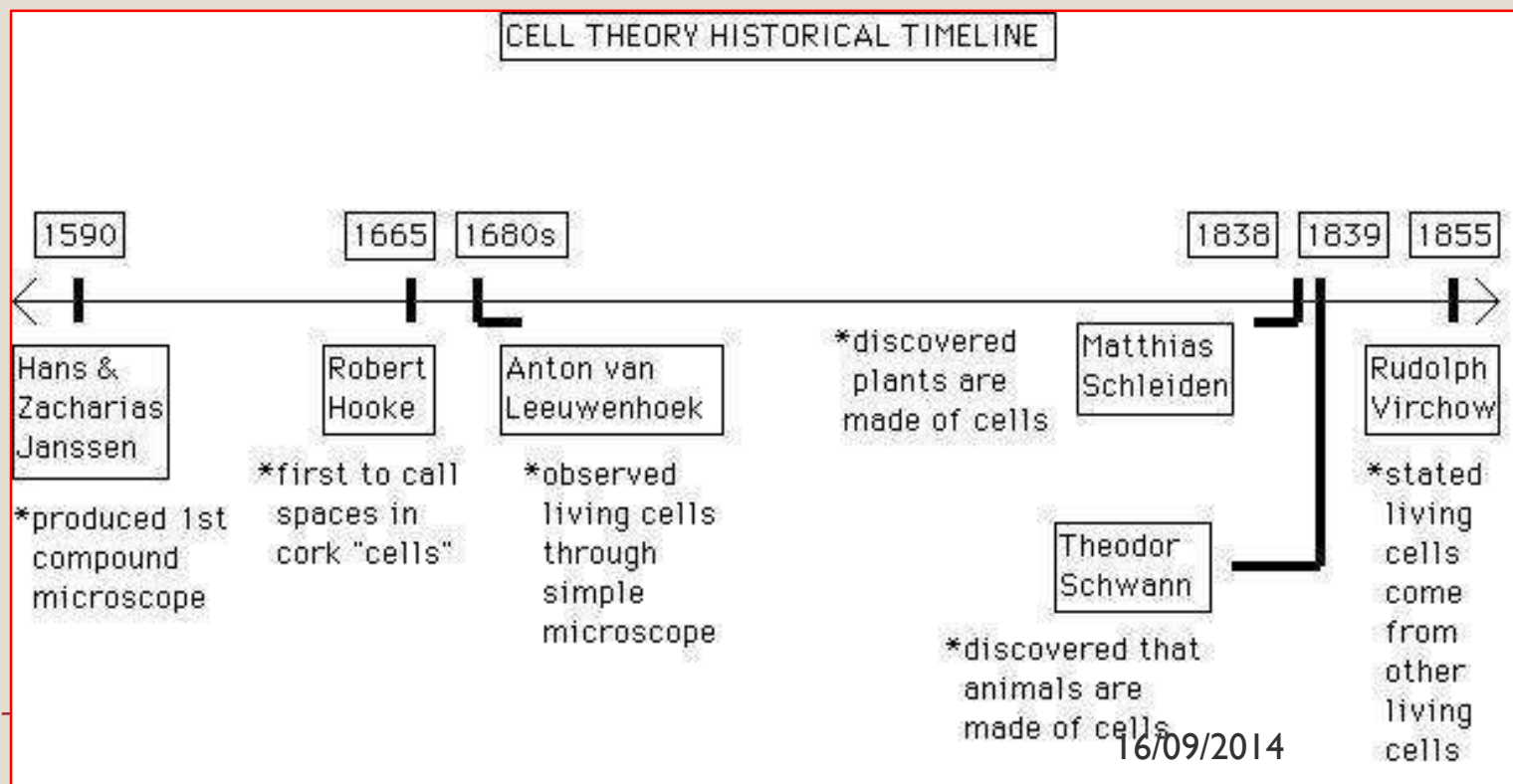
- ▶ In 1838, Schleiden suggested that every structural part of a plant was made up of cells or the result of cells.
- ▶ He also suggested that cells were made by a crystallization process either within other cells or from the outside.
- ▶ This crystallization process is no longer accepted with modern cell theory.
- ▶ In 1839, Theodor Schwann states that along with plants, animals are composed of cells or the product of cells in their structures.
- ▶ This was a major advancement in the field of biology since little was known about animal structure up to this point compared to plants.

Cell Theory

- ▶ From these conclusions about plants and animals, two of the three tenets of cell theory were postulated –
 - ▶ All living organisms are composed of one or more cells
 - ▶ The cell is the most basic unit of life
- ▶ Schleiden's theory of free cell formation through crystallization was refuted in the 1850s by Robert Remak, Rudolf Virchow, and Albert Kolliker.

Cell Theory

- ▶ In 1855, Rudolf Virchow added the third tenet to cell theory. In Latin, this tenet states *Omnis cellula e cellula*.
- ▶ This translated to: All cells arise only from pre-existing cells.



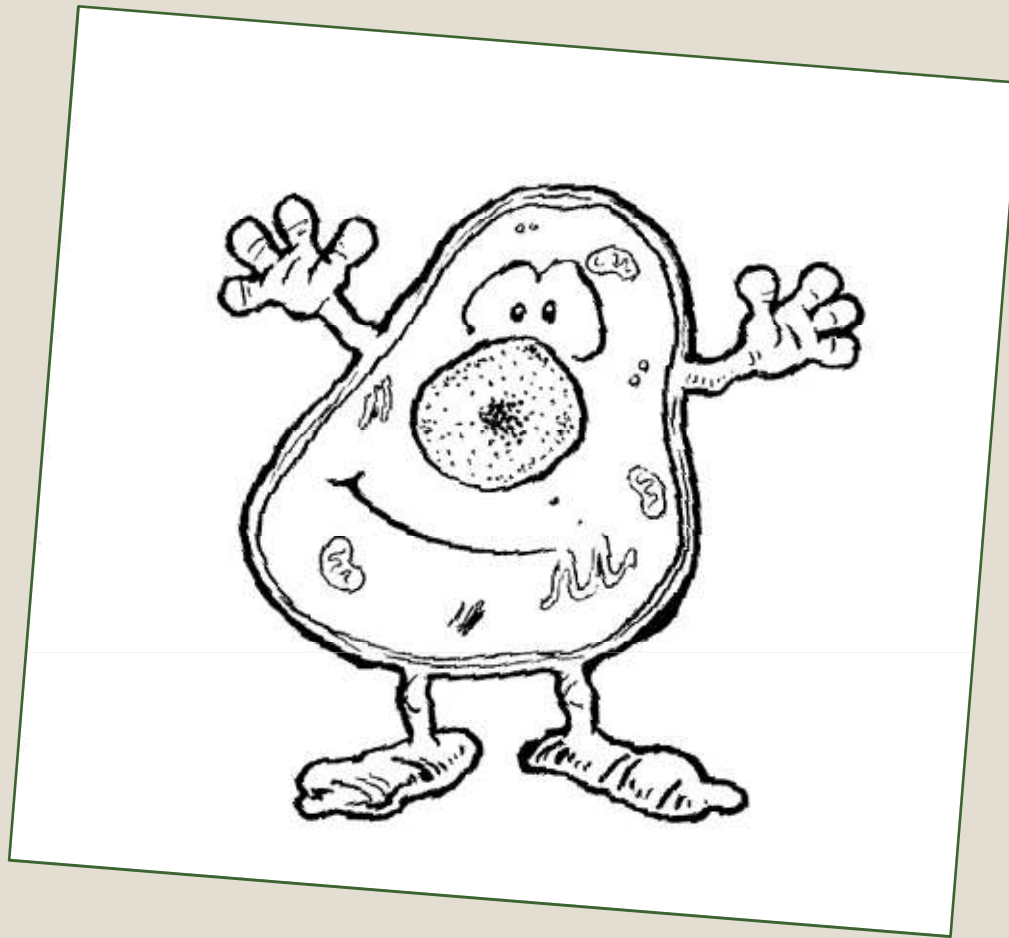
Modern Interpretation of Cell theory

The generally accepted parts of modern cell theory include:

- ▶ All known living things are made up of one or more cells
- ▶ All living cells arise from pre-existing cells by division.
- ▶ The cell is the fundamental unit of structure and function in all living organisms.
- ▶ The activity of an organism depends on the total activity of independent cells.
- ▶ Energy flow (metabolism and biochemistry) occurs within cells.
- ▶ Cells contain DNA which is found specifically in the chromosome and RNA found in the cell nucleus and cytoplasm.
- ▶ All cells are basically the same in chemical composition in organisms of similar species .

Exceptions of 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.



Thank you