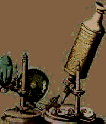
**Hooke**

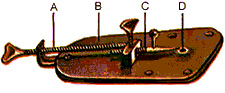
**1665**: English Scientist and Microscopist Robert Hooke described a honeycomb-like network of cellulae (Latin for little storage rooms) in cork slice using his primitive compound microscope. Robert Hooke used the term cells to describe units in plant tissue (thick cell walls could be observed). Of course he saw only cell walls because cork cells are dead and without protoplasm. He drew the cells he saw and also coined the word cell. The word cell is derived from the Latin word cellula, which means small compartment. Hooke published his findings in his famous work, Micrographia.

Hooke, Robert (1635-1703), English scientist, best known for his study of elasticity. Hooke also made original contributions to many other fields of science. Hooke was born on the Isle of Wight and educated at the University of Oxford. He served as assistant to the English physicist Robert Boyle and assisted him in the construction of the air pump. In 1662 Hooke was appointed curator of experiments of the Royal Society and served in this position until his death. He was elected a fellow of the Royal Society in 1663 and was appointed Gresham Professor of Geometry at Oxford in 1665. After the Great Fire of London in 1666, he was appointed surveyor of London, and he designed many buildings, including Montague House and Dethlehem Hospital. Hooke anticipated some of the most important discoveries and inventions of his time but failed to carry many of them through to completion. He formulated the theory of planetary motion as a problem in mechanics, and grasped, but did not develop mathematically, the fundamental theory on which the English physicist Sir Isaac Newton formulated the law of gravitation. Hooke's most important contributions include the correct formulation of the theory of elasticity, which states that an elastic body stretches in proportion to the force that acts upon it; and analysis of the nature of combustion. He was the first to use the balance spring for the regulation of watches, and devised improvements in pendulum clocks. Hooke was also a pioneer in microscopic research and published his observations, which included the discovery of plant cells.

**Antonie van Leeuwenhoek**



**1670**: Antonie van Leeuwenhoek (1632-1723) described cells in a drop of pond water using a microscope. A Dutch businessman and a contemporary of Hooke, he also used microscopes and was a physicist. He made his own fine quality lens for use in monocular microscopes and was the first person to observe bacteria and protozoa. Some of his lenses could magnify objects 250X.

Anton van Leeuwenhoek, born Oct. 24, 1632, was a Dutch biologist and microscopist. He became interested in science when, as a Dutch businessman, he began grinding lenses and building simple microscopes as a hobby. Each microscope consisted of a flat brass or copper plate in which a small, single glass lens was mounted. The lens was held up to the eye, and the object to be studied was placed on the head of a movable pin just on the other side of the lens. Leeuwenhoek made over 400 microscopes, many of which still exist. The most powerful of these instruments can magnify objects about 275 times.

Although future microscopes were to contain more than one lens (compound microscopes), Leeuwenhock's single lens was ground to such perfection that he was able to make great advances and to draw attention to his field. Leeuwenhoek was the first person to observe single-celled animals (protozoa) with a microscope. He described them in a letter to the Royal Society, which published his detailed pictures in 1683. Leeuwenhoek was also the first person, using a microscope, to observe clearly and to describe red blood cells in humans and other animals, as well as sperm cells. In addition, he studied the structure of plants, the compound eyes of insects, and the life cycles of fleas, aphids, and ants.

**Matthias Schleiden**

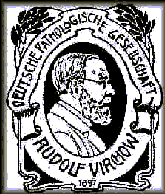
**1838**: Matthias Jakob Schleiden, a German botanist, concluded that all plant tissues are composed of cells and that an embryonic plant arose from a single cell.  He declared that the cell is the basic building block of all plant matter. This statement of Schleiden was the first generalizations concerning cells. Born in Hamburg and educated in law at Heidelberg, Schleiden left law practice to study botany, which he then taught at the University of Jena from 1839 to 1862. A man of disputatious nature he scorned the botanists of his day who limited themselves to merely naming and describing plants. Schlieden investigated plants microscopically and conceived that plants were made up of recognizable units, or cells. Plant growth, he stated in 1837, came about through the production of new cells, which, he speculated, where propagates from the nuclei of old cells. Although later discoveries proved him wrong about the role of the nucleus in mitosis, or cell division, his conception of the cell as the common structural unit of plants had the profound effect of shifting scientific attention to living processes as they happened on the cellular level-a change that initiated the field of embryology. A year after Schleiden published his cell theory on plants, his friend Schwann extended it to animals, thereby bringing botany and zoology together under one unifying theory.

**Theodor Schwann**

**1839**:   Theodor Schwann, a German biologist, reached the same conclusion as Schleiden about animal tissue being composed of cells, ending speculations that plants and animals were fundamentally different in structure.  Schwann described cellular structures in animal cartilage (rigid extracellular matrix).  He pulled existing observations together into theory that stated:  1. Cells are organisms and all organisms consist of one or more cells.  2. The cell is the basic unit of structure for all organisms and that plants and animals consist of combinations of these organisms, which are arranged in accordance with definite rules. In other words, **the cell is the basic unit of life.** This statement was the second generalization concerning cells and is the most important in the development of biology. It became known as the **cell theory**.

Schwann, Theodor (1810-82), German physiologist, generally considered the founder of modern histology, the study of the structure of plant and animal tissues. Schwann was born in Neuss and educated at the universities of Bonn, Warzburg, and Berlin. He was (1838-48) professor of anatomy at the University of Leuven in Belgium; there after until his death he was associated with the University of Libge, also in Belgium, serving as professor of anatomy from 1848 to 1858, when he became professor of physiology. Schwann achieved the physiochemical nature of life by applying the [cell theory](http://www.smithlifescience.com/cell_theory.html) of the German botanist [Matthias Jakob Schleiden](http://www.smithlifescience.com/matthias_jakob_schleiden.html) to the evolution of animal life. He also demonstrated that the mature tissues of all animals are traceable to embryonic cells. While assisting the German physiologist Johannes Miller in the Anatomical Museum of Berlin, Schwann discovered pepsin, the digestive enzyme, in the stomach epithelium, or membrane tissues, of animals. He also conducted valuable research on the processes of fermentation, purefaction, and muscular and arterial contraction. His principal work is Microscopic Investigations on the Accordance in the Structure and Growth of Plants and Animals (1839-1847).

**Rudolf Virchow**

**1855**:  Taking Brown's original description of nuclei and observations by Karl Nägeli on cell division, the German physiologist, physician, pathologist, and anthropologist Rudolf Virchow was able to add a third tenet to the cell theory:  Omnis cellula e cellula, or all cells develop only from existing cells. Virchow, Rudolf (1821-1902), German pathologist, archaeologist, and anthropologist, the founder of cellular pathology. Virchow was born in Schivelbein, Pomerania (now Swidwin, Poland), and educated at the University of Berlin. In 1843 he became prosecutor at the Charite Hospital in Berlin, and in 1847 a university lecturer. In 1849 he was invited to the medical school of Wurzburg as professor of pathological anatomy, having been dismissed from his Berlin posts because of revolutionary activities. In 1856 he returned to Berlin as professor and director of the university's pathological institute.

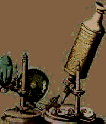
Virchow was the first to demonstrate that the [cell theory](http://www.smithlifescience.com/cell_theory.html) applies to diseased tissue as well as to healthy tissue-that is, that diseased cells derive from the healthy cells of normal tissue. He did not, however, accept Louis Pasteur's germ theory of disease. He is best known for his text Cellular Pathology as Based on Histology (1850-1860). He engaged also in extensive research in the fields of archaeology and anthropology, producing numerous writings, among them Crania Ethnica Americana (1892). Other publications include discussions of topical political and social questions. Virchow was influential in German politics and from 1880 to 1893 served as a Liberal in the German Reichstag, where he opposed the policies of the German chancellor Prince Otto von Bismarck. He was instrumental in the establishment of the Pathological Institute and Museum in Berlin.

**CELL THEORY SCIENTISTS**

**Zacharias Janssen** 1590

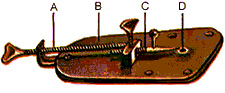
Janssen’s invention of the microscope , with the aid of his father Hans, allowed English scientist Robert Hooke to use a primitive microscope to view the cell walls of a piece of cork in 1663.

**Robert Hooke** 1663 - 1665

The cell was discovered by Robert Hooke in 1665. He examined very thin slices of cork and saw a multitude of tiny pores that he remarked looked like the walled compartments a monk would live in. Because of this association, Hooke called them cells, the name they still bear. However, Hooke did not know their real structure or function. Hooke’s description of these cells was published in Micrographia. His cell observations gave no indication of the nucleus and other organelles found in most living cells.

**Anton Van Leeuwenhoek** 1674 - 1683

Anton van Leeuwenhoek was inspired by the glasses used by drapers to inspect the quality of cloth. He taught himself new methods for grinding and polishing tiny lenses of great curvature, which gave magnifications up to 270x diameters, the finest known at that time.

These lenses led to the building of Anton Van Leeuwenhoek’s microscopes considered the first practical microscopes, and the biological discoveries for which he is famous. Anton Van Leeuwenhoek was the first to see and describe bacteria (1674), yeast plants, the teeming life in a drop of water, and the circulation of blood corpuscles in capillaries. During a long life he used his lenses to make pioneer studies on an extraordinary variety of things, both living and non-living, and reported his findings

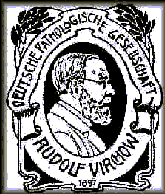
**Theodor Schwann** 1837 - 1839

Matthias Schleiden found that all plants are composed of cells, and communicated the finding to Schwann, who had found similar structures in the cells. Other researchers confirmed the similarity, as explained in his book, where he concluded, "All living things are composed of cells and cell products. This became the cell theory



**Matthias Schleiden** 1839

He stated that the different parts of the plant organism are composed of cells. Thus, Schleiden and Schwann became the first to formulate what was then an informal belief as a principle of biology equal in importance to the atomic theory of chemistry. He also recognized the importance of the cell nucleus, and sensed its connection with cell division..



**Rudolph Virchow** 1855

Rudolph Virchow suggested that all cells come from pre-existing cells. His aphorism’omnis cellula e cellula’ meaning “every cell from a pre-existing cell” became the foundations of division, even if the process was not fully understood then. He also stated that not all plants are made up of cells, which eventually lead to the creation of the cell theory.