

Comprehensive Timeline of Biological Discoveries†

500 B.C. – 1500A.D.

500 B.C. - Alcmaeon of Croton differentiates veins from arteries and discovers the optic nerve.

500 B.C. - Xenophanes examined fossils and speculated on the evolution of life.

350 B.C. - Aristotle founds zoology.

320 BC - Theophrastus founds botany.

300 B.C. - Herophilos dissects the human body.

300 B.C. - Diocles wrote the first known anatomy book and was the first to use the term anatomy.

130-200 - Claudius Galen writes treatises on human anatomy.

1500A.D. – 1800A.D.

?? - Jan Baptist van Helmont performs his famous tree plant experiment in which he shows that the substance of a plant derives from water and air, the first description of photosynthesis.

1628 - William Harvey publishes *An Anatomical Exercise on the Motion of the Heart and Blood in Animals*.

1651 - William Harvey concludes that all animals, including mammals, develop from eggs.

1663 - Robert Hooke sees cells in cork using a microscope.

1673 - Anton Leeuwenhoek describes microscopic life.

1682 – Nehemiah Grew establishes plant physiology.

1683 - Anton van Leeuwenhoek observes bacteria.

1694 - German botanist Rudolph Camerarius conclusively demonstrates the sexuality of flowering plants and sets the stage for the first agricultural revolution.

1735 – Carlos Linnaeus begins the modern description of life

1771 - Joseph Priestley demonstrates that plants produce a gas that animals and flames consume. Those two gases are carbon dioxide and oxygen.

1796 – Baron Cuvier founds the science of comparative anatomy.

1800A.D. to Present

1800 - The term biology in its modern sense is coined by Karl Friedrich Burdach

1802 – The Term biology is used independently by Gottfried Reinhold Treviranus Jean Baptiste Lamarck.

1809 – Jean Baptiste Lamarck proposes a modern theory of evolution based on the inheritance of acquired characteristics.

1817 - Pierre-Joseph Pelletier and Joseph-Bienaim Caventou isolate chlorophyll.

1826 - Karl von Baer shows that all animal life begins with an egg.

1838 - Matthias Schleiden proposes that all plants are composed of cells.

1839 - Theodor Schwann proposes that all animal tissues are composed of cells.

1856 - Louis Pasteur states that microorganisms produce fermentation.

1859 - Charles Darwin proposes his theory of biological evolution by means of natural selection.

1858 - Rudolf Virchow proposes that cells can only arise from pre-existing cells;

1864 - Louis Pasteur disproves the spontaneous generation of cellular life.

1866 - Gregor Mendel formulates his Laws of Inheritance.

1869 - Friedrich Miescher discovers nucleic acids in the nuclei of cells.

1876 - Oskar Hertwig and Hermann Fol independently describe the entry of sperm into the egg and the subsequent fusion of the egg and sperm nuclei to form a single new nucleus.

1878 – Louis Pasteur proves germ theory of disease.

1884 - Walther Fleming coins the term mitosis to describe mitosis.

1884 - Edward Strasbourg coins the term cytoplasm to describe the cell's central fluid and establishes the cell's structure.

1886- Scientists explain the nitrogen-fixing of the pea family

1898 - Martinus Beijerinck uses filtering experiments to show that tobacco mosaic disease is caused by something smaller than a bacterium, which he names a virus.

1902 - Walter Sutton and Theodor Boveri, independently propose that the chromosomes carry the hereditary information.

1905 - William Bateson coins the term "genetics" to describe the study of biological inheritance.

1905 – Scientists discover how specialized sex cells come about and describe meiosis.

1907 - Ivan Pavlov demonstrates conditioned responses with salivating dogs.

1909 - Wilhelm Johannsen coined the word "gene."

1911 - Thomas Hunt Morgan proposes that genes are arranged in a line on the chromosomes.

1920 - Nikolay Vavilov establishes the Earth's biomes

1927 - Austrian zoologist Karl von Frisch publishes *Dancing Bees*.

1928 - Alexander Fleming discovers penicillin.

1928 - Frederic Clements proposes the theory of plant succession.

1929 - Phoebus Levene discovers the sugar deoxyribose in nucleic acids.

1933 - Tadeus Reichstein artificially synthesizes vitamin C; first vitamin synthesis.

1937 - Konrad Lorenz describes the imprinting behavior of young birds.

1944 - Oswald Avery shows that DNA carries the genetic code in pneumococcus bacteria.

1946 - American chemist Melvin Calvin explains photosynthesis.

1949 – Aldo Leopold's book *A Sand County Almanac* becomes the inspiration for the environmental movement

1952 - Alfred Hershey and Martha Chase show that DNA is the genetic material in bacteriophage viruses.

1952 - Rosalind Franklin concludes that DNA is a double helix

1953 - After examining Franklin's unpublished data, James D. Watson and Francis Crick publish a double-helix structure for DNA.

1953 - Eugene P. Odum publishes the first textbook in the field: *Fundamentals of Ecology* and puts environmental studies on a scientific basis.

1955 - Marianne Grunberg-Manago and Severo Ochoa discover the first nucleic-acid-synthesizing enzyme (polynucleotide phosphorylase), which links nucleotides together into polynucleotides.

1955 - Arthur Kornberg discovers DNA polymerase enzymes.

1957 – Ecology's concept of niche is defined by G.E. Hutchinson.

1960 - Robert Woodward synthesizes chlorophyll.

1963 - Nikolaas Tinbergen lays out the four whys of animal behavior

1967 - American biologist Lynn Margulis describes the symbiotic cell and how cooperation is one of the bases for all life on the planet.

1969 - American ecologist Robert Whittaker proposes five kingdoms of life.

1972 - Stephen Jay Gould and Niles Eldredge propose an idea of evolution they call "punctuated equilibrium."

1979 – James Lovelock proposes Gaia Hypothesis.

1986 – E.O. Wilson coins the term biodiversity.

1995 - Publication of the first complete genome of a free-living organism.

1996 - Dolly the sheep is first clone of an adult mammal.

1998 - Jack Bradbury and Sandra Vehrencamp published their *Principles of Animal Communication*

2001 - Publication of the first drafts of the complete human genome.

2002 - First virus produced 'from scratch,' an artificial polio virus that paralyzes and kills

† **Bold indicates segments in Program Core Biology:**