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Liberal Arts and Sciences

Microbiology Department

Carl Woese Papers, 1911-2013

Biographical Notes

Carl Woese (1928-2012), who revolutionized the science of microbiology, has been called “the Darwin of the 20th century.” Darwin’s theory of evolution dealt with multicellular organisms; Woese brought the single-celled bacteria into the evolutionary fold. The Syracuse-born Woese began his early career as a newly minted Yale Ph.D. studying viruses but he soon joined in the global effort to crack the genetic code. His 1967 book *The Genetic Code: The Molecular Basis for Genetic Expression* became a standard in the field. Woese hoped to discover the evolutionary relationships of microorganisms, and he believed that an RNA molecule located within the ribosome—the cell’s protein factory—offered him a way to get at these connections. A few years after becoming a professor of microbiology at the University of Illinois in 1964, Woese launched an ambitious sequencing program that would ultimately catalog partial ribosomal RNA sequences of hundreds of microorganisms. Woese’s work showed that bacteria evolve, and his perfected RNA “fingerprinting” technique provided the first definitive means of classifying bacteria. In 1976, in the course of this painstaking cataloging effort, Woese came across a ribosomal RNA “fingerprint” from a strange methane-producing organism that did not look like the bacterial sequences he knew so well. As it turned out, Woese had discovered a third form of life—a form of life distinct from the bacteria and from the eukaryotes (organisms, like humans, whose cells have nuclei); he christened these creatures “the archaebacteria” only to later rename them “the archaea” to better differentiate them from the bacteria. In 1980, four years after his discovery of the archaea, Woese unveiled the “Big Tree”—the first tree of life based entirely on ribosomal RNA data. Woese’s tree attempted to trace the evolutionary relationships of the three forms of life going back to their divergence from a common ancestor over three billion years ago. Continuing to probe the origins of life for the rest of his career, Woese would help develop such seminal concepts as the RNA World and the progenote—a hypothetical communal state of life predating the first cell. In 1990 Woese proposed that all life be grouped into three domains: the Archaea, the Bacteria, and the Eucarya. This idea met a great deal of resistance from many of his fellow biologists but is now largely enshrined in the textbooks. Carl Woese died on December 30, 2012, in Urbana, Illinois.

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Timeline

July 15, 1928	Born Syracuse, New York - son of Carl and Gertrude Woese
1942-46	Deerfield Academy, Deerfield, Massachusetts
1950	A.B., Amherst College, Math and Physics
1953	Ph.D., Yale University, Biophysics. Thesis: "Physical Studies on Animal Viruses"
August 20, 1953	Married Gabriella Haws
1953-55	Medical School, University of Rochester
1955-60	Research Associate, Biophysics, Yale University
1960-63	Biophysicist, General Electric Research Laboratory, Schenectady, New York
1963	Biophysicist, Institute Pasteur
1964-2012	Professor of Microbiology, University of Illinois
1965	"On the Evolution of the Genetic Code" published
1967	<i>The Genetic Code: The Molecular Basis for Genetic Expression</i> published
1970	"Molecular Mechanics of Translation: A Reciprocating Ratchet Mechanism" published
1976	Discovered "third form of life" he christened "archaebacteria"
1977	Discovery announced in <i>Proceedings of the National Academy of Sciences</i> article "Phylogenetic Structure of the Prokaryotic Domain: The Primary Kingdoms"
1980	Tree of life—the "Big Tree"—based on ribosomal RNA sequences published
1983	Received Bergey Award
1984	Received John D. and Catherine T. MacArthur Award
1987	Landmark paper "Bacterial Evolution" published
1988	Elected to the National Academy of Sciences
1989	Appointed to University of Illinois' Center for Advanced Study
1990	Proposed division of life into three domains: Archaea, Bacteria, and Eucarya
1992	Awarded the Leeuwenhoek Medal
1996	Selected as first Stanley O. Ikenberry Endowed Chair
1998	"The Universal Ancestor" published
2000	Received National Medal of Science
2003	Awarded the Crafoord Prize in Biosciences
2004	"A New Biology for a New Century" published
2007	Joined Institute for Genomic Biology, University of Illinois
2009	"How the Microbial World Saved Evolution from the Scylla of Molecular Biology and the Charybdis of the Modern Synthesis" published
December 30, 2012	Died, Urbana, Illinois