

Recipient of the 2004 International Prize for Biology

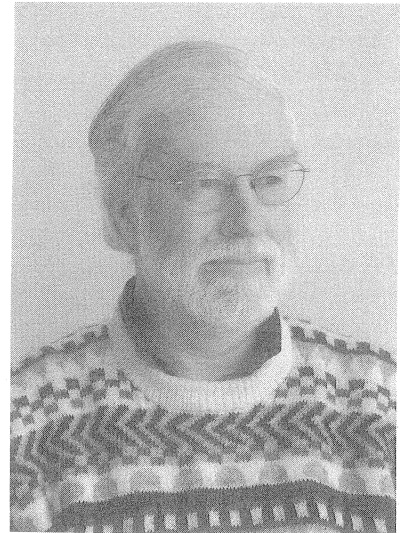
Professor Thomas Cavalier-Smith

Date of Birth: October 21, 1942

Nationality: British and Canadian

Position: Professor of Zoology
University of Oxford

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Education and Career:

1964	BA (Natural Sciences), Cambridge University, UK
1967	PhD (Biophysics), University of London King's College, UK
1967-1969	Guest Investigator, Department of Cell Biology, Rockefeller University, NY, USA
1969-1982	Lecturer in Biophysics, University of London King's College, UK
1982-1989	Reader in Biophysics, University of London King's College, UK
1989-1999	Professor of Botany, University of British Columbia, Vancouver, BC, Canada
1999-Present	Professor of Zoology, University of Oxford, UK

Awards and Distinctions:

1980	Fellow of the Linnean Society (FLS)
1983	Fellow of the Institute of Biology (FIBiol)
1987	Fellow of the Royal Society of Arts (FRSA)
1988	Fellow of the Canadian Institute for Advanced Research (FCIAR)
1997	Fellow of the Royal Society of Canada (FRSC)
1998	Fellow of the Royal Society of London (FRS)

RESEARCH ACHIEVEMENTS

The study of the high-order phylogeny of living things has made very rapid progress in the last three decades, largely due to the growing knowledge of cell structure through electron microscopy, and to advances in molecular phylogenetic analysis. This has led to a review of the higher taxa, such as classes and phyla, in each major group. There were only a limited number of researchers able to carry out the task of organizing this influx of knowledge along systematic lines and describing new higher taxa according to the rules of nomenclature for each group. One of them was Prof. Thomas Cavalier-Smith, who has organized and systematized the classification of the living world, taking a bold yet detailed approach on the basis of his special expertise in cell biology, electron microscopy, and molecular biology, backed by his knowledge of the latest developments in every field of biological science, including physiology and biochemistry. In barely twenty years, he described over eighty classes and almost twenty phyla. Focusing on the evolution of cells by endosymbiosis, he has helped create a more natural classification system, primarily by proposing the “six kingdom theory,” which added the kingdom Chromista to the five kingdoms (the Monera, Protista, Plantae, Fungi, and Animalia) that had been generally accepted for some time.

Research on the Origin and Evolution of Cells

In the evolutionary debate on the origin of the cell, the basic unit of vital processes in living organisms, Prof. Cavalier-Smith argued for a hypothetical “obcell” as the precursor of the earliest cells. In investigating the origin of eukaryotes, he has studied the origins of the nuclear membrane, the intracellular membrane system, the cytoskeleton, flagella, mitosis, exocytosis, histone proteins, nucleosomes, introns, splicing, and other important eukaryote structures and functions, and has demonstrated that most do not have endosymbiotic origins. He has further shown that the endosymbiotic acquisition of chloroplasts occurred as a single event in the case of primary endosymbiosis, and as a single event in each of two lineages, the Chlorophyta and Rhodophyta, in the case of secondary endosymbiosis.

Research on the Higher Taxa of Living Things

In the 1970s and 1980s, the generally accepted view of the megasystematics of living things was the “five kingdom theory” proposed by Whittaker, Margulis, and others, which explained the evolution of life on the basis of a classification into the kingdom Monera, consisting of prokaryotes, the kingdoms Plantae, Animalia, and Fungi, consisting of multicellular eukaryotes, and the Protista, which linked the latter with the prokaryotes. This system came under challenge, however, because the phylogenetically very heterogeneous nature of the kingdom Protista was not consistent with current ideas about phylogenetic taxonomy. In 1981, Prof. Cavalier-Smith postulated that only those groups of organisms which acquired chloroplasts by “primary endosymbiosis” and which have a double chloroplast envelope, namely, the three plant divisions Chlorophyta, Rhodophyta, and Glaucophyta, should constitute the true plant kingdom. He proposed classifying as a sixth kingdom, independent of the plants, those algae whose chloroplasts, acquired by “secondary endosymbiosis,” possess three or four bounding membranes; this new kingdom is known as the Chromista. Although this “six kingdom theory” may bear a superficial resemblance to the taxonomies of Whittaker, Mayr, and others, it is far more reflective of phylogenetic relationships, and today it has the support of many researchers. Later, Prof. Cavalier-Smith proposed combining the Chromista and the Alveolata, which include dinoflagellates, to form a new category known as chromalveolates.

Prof. Cavalier-Smith’s system for the classification of prokaryotes, unlike those of Woese and Mayr, divides the bacteria into two subkingdoms, Negibacteria (bounded by a double cell membrane) and Unibacteria (bounded by a single cell membrane; includes the phyla Archaeobacteria and Posibacteria). Archaeobacteria in the clade which he has named “neomura” have a great many characters in common with the eukaryotes, but he has concluded that the two are sister groups rather than representing an evolutionary pathway from the archaeobacteria to the eukaryotes. He has also developed a model of unprecedented simplicity to trace the stages of cellular evolution from prokaryotes to eukaryotes. The origin of eukaryotes is a longstanding question, and in recent years active use has been made of molecular phylogenetic analysis, among other techniques, to solve this problem. Prof. Cavalier-Smith and his coworkers have also proposed a theory on the origin of eukaryotes, focusing on the structural evolution of genes in the form of gene fusion in addition to the molecular family tree..