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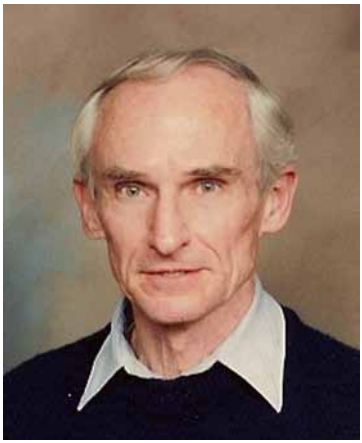
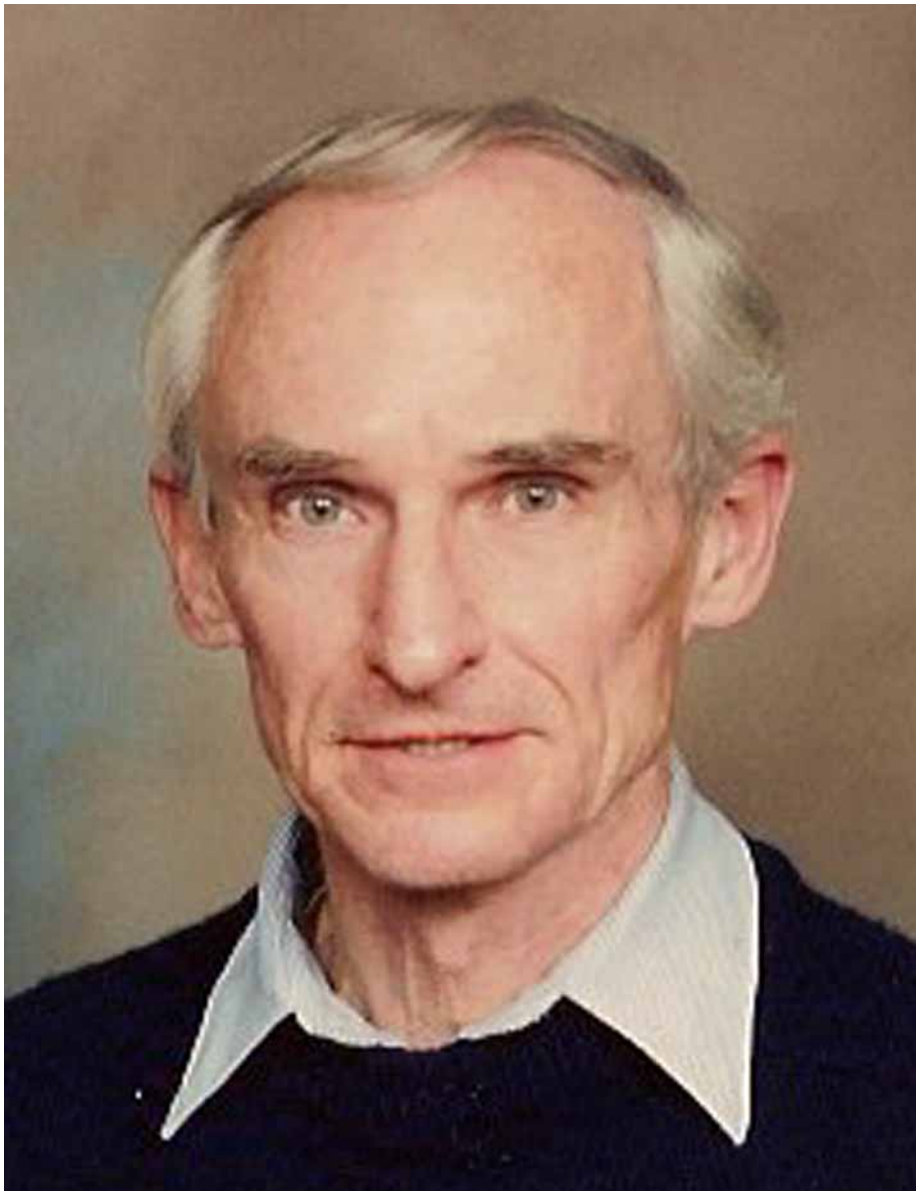


DAVID PRESCOTT

1926-2011

A Biographical Memoir by

LAWRENCE A. KLOBUTCHER
AND J. RICHARD McINTOSH



DAVID PRESCOTT

August 3, 1926–February 19, 2011

BY LAWRENCE A. KLOBUTCHER
AND J. RICHARD McINTOSH

David Marshall Prescott made many major contributions in a scientific career that spanned six decades and influenced multiple generations of students and investigators. His work addressed fundamental problems in cell biology and molecular genetics, and he typically employed unicellular eukaryotes as models for his studies. In the last few decades he focused on stichotrichous ciliates, such as *Oxytricha (Sterkiella) nova*, but overall he employed many other experimental systems in a manner seldom seen today. He approached science by identifying and pursuing interesting and often unique questions, frequently developing novel experimental approaches to answer them.

David was born on August 3, 1926, in Clearwater, Florida. His family moved to Connecticut when he was young, and it was there that he received his

early education, ultimately graduating from Crosby High School in Waterbury, Connecticut. His further studies were interrupted by World War II, during which he served in the Merchant Marine as a radio operator. He spoke with pride of his service and experiences in the Merchant Marine, also noting that he saved most of his money during this period with the intention of either buying a car or going to college. It is to our great benefit that following his honorable discharge, he decided to spend his money by enrolling at Wesleyan University (Connecticut), where he completed his B.A. degree in 1950.

After a brief period of travel in Europe (see below), he went on to pursue his Ph.D. degree in zoology at the University of California, Berkeley, working with Daniel Mazia, who no doubt initiated David's lifelong interests in microscopy and the inner workings of the cell. He completed his studies in 1954, producing a thesis entitled "Some Quantitative Studies on the Growth of *Amoeba proteus*." David then pursued postdoctoral studies at the Carlsberg Laboratory in Copenhagen, Denmark, as an American Cancer Society fellow. In 1955 he returned to the United States and obtained a position as assistant professor in the Department of Anatomy at the Medical School of the University of California, Los Angeles.

In 1959 he moved to Oak Ridge National Laboratory in Tennessee, and then on to the University of Colorado Medical School, where he served as chair and professor of anatomy (1963-1966). He ultimately put down roots at the University of Colorado, Boulder, where he would spend the remainder of his career. He initially joined the university as a professor in the Institute of Developmental Biology, but was then instrumental in obtaining funding and attracting the founding faculty for a new Department of Molecular, Cellular, and Developmental Biology in 1968. He served as chair of the department during the period 1974-1975 and was named a distinguished professor of the University of Colorado in 1980.

During his career, David published more than 200 research and review articles, edited many volumes, and authored three books. David made so many significant findings that it is difficult to do justice to his many accomplishments. His early work provided insights into fundamental aspects of cell biology that we now take for granted. One of the experiments early in his career, for which he gained renown, used a "Cartesian diver" to weigh a single amoeba throughout its cell cycle (Prescott, 1955), providing basic information on growth during the cell cycle and evidence that cell division was not triggered simply by reaching a critical cell size. This work received broad attention and was featured in *Life* magazine (Farbman, 1954).

David was also was one of the pioneers in the use of radioisotopes in combination with single cell

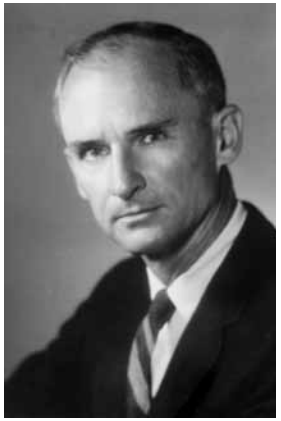
In the early 1970s David's laboratory made the astounding discovery that the macronuclear genome of stichotrichous ciliates, such as *Stylonychia* and *Oxytricha*, consisted of thousands of small gene-size DNA molecules, most recently referred to as "nano-chromosomes."

micromanipulation and/or autoradiography. For example, he used such approaches to demonstrate that the nucleus was the primary site of RNA synthesis (Prescott, 1957) and in collaboration with Lester Goldstein he identified the transport of proteins both into and out of the nucleus (Goldstein and Prescott, 1967). Again, with Goldstein, David carried out nuclear transplantation experiments that provided fundamental insights into nuclear cytoplasmic interactions in the control of the cell cycle (Prescott and Goldstein, 1967), and an elegant study performed with Peter Kuempel demonstrated that DNA replication is bidirectional in *Escherichia coli* (Prescott and Kuempel, 1972).

In the early 1970s David's laboratory made the astounding discovery that the macronuclear genome of stichotrichous ciliates, such as *Stylonychia* and *Oxytricha*, consisted of thousands of small gene-size DNA molecules (Prescott et al., 1971), most recently referred to as "nano-chromosomes." This discovery formed the focus of much of the work during the remainder of his career and led to a series of contributions on the organization of macronuclear DNA molecules, as well as the structure of their telomeres and interacting proteins. He also investigated how these macronuclear DNA molecules were derived from the more conventional micronuclear chromosomes during sexual reproduction and conjugation, which led to insights in regard to chromosome fragmentation, *de novo* telomere formation, and DNA splicing.

David's work extended into the area of evolution; there he made contributions to the field of ciliate phylogeny and the evolution of DNA rearrangement processes. Most recently, he uncovered the wholly unexpected phenomenon of DNA scrambling in the stichotrichs (Greslin et al., 1989), in which the segments of DNA that will ultimately form a macronuclear DNA molecule are not only interrupted but also disordered, and sometimes inverted relative to each other, in the micronuclear genome. He focused on disentangling this DNA scrambling process through the end of his career, continuing with theoretical work even after his retirement and the closure of his laboratory (e.g., Ehrenfeucht et al., 2007).

These research contributions were well recognized by the scientific community and led to numerous awards and leadership positions where David further expanded his contributions to the scientific enterprise. David was elected as a fellow in the American Academy of Arts and Sciences in 1970, and as a member of the National Academy of Sciences in 1974. He was the recipient of a Senior U.S. Scientist Prize from the Alexander von Humboldt Foundation (1979-1980), and was named a fellow by the John Simon Guggenheim Memorial Foundation in 1990. He was active in numerous scientific societies, including serving terms as president of the



David Prescott in 1968 (Photo by House of Boulder Photography, Boulder, Colorado.).

American Society of Cell Biology (1965-1966) and the Society of Protozoologists (1996-1997). He served as editor of the journals *BioScience* (1966-1969) and *Experimental Cell Research* (1980-1989), and was a member of the editorial boards of numerous journals throughout his career. David was the founding editor for the still popular and influential series *Methods in Cell Biology* (originally *Methods in Cell Physiology*), which provided detailed descriptions of current protocols to generations of cell biologists, and he served as editor for the first 15 titles in the series. Along with Lester Goldstein, he initiated the series Cell Biology: A Comprehensive Treatise. He served terms on various study sections and review panels, including those of the National Science Foundation, National Institutes of Health, and the American Cancer Society.

In addition to his research accomplishments, David was a distinguished educator at multiple levels. Through his research program he trained multiple generations of graduate students and postdoctoral fellows, many of whom went on to establish their own successful research programs.He hosted visiting scientists from around the world, which enhanced the laboratory environment and resulted in a productive cross-fertilization of ideas and approaches. David was also very engaged in classroom teaching at the undergraduate level. For years David taught one semester of freshman biology, and he designed a very well-received course entitled "Biology of the Cancer Cell." He also hosted scores of undergraduate students in his laboratory. It was not uncommon to have five or six undergraduates performing research in the summer, and, once one made it past the frequently broken equipment, minor radiation spills, and collateral damage, it was indeed a lively and engaging environment. His impact on undergraduate students was most evident at his retirement symposium in 2002, where a number of undergraduate students expressed heartfelt affection for David and testified to his ability to stimulate and guide their interest in science.

David's undergraduate teaching accomplishments were recognized by a number of formal awards, including two Student Organization Achievement and Recognition Awards (SOAR) (1981, 1992) from undergraduate students, the University of Colorado William E. Briggs Award (1999) for mentorship of undergraduate research, and the 1994 Hazel Barnes Prize, which recognizes a faculty member who demonstrates "the enriching interrelationship between teaching and research." He was also named a University of Colorado President's Teaching Scholar in 1993.

David's teaching expertise extended beyond the classroom and laboratory. He was an accomplished speaker, and his many engaging and mesmerizing seminars served both to attract many researchers to his areas of research, one of us (L.A.K.) included, and to

David Prescott and family in 1994

popularize the field of ciliate molecular biology. He was also committed to communicating science to the broader public, particularly on the topic of cancer. His aforementioned undergraduate course on cancer was one manifestation of this interest, but he also frequently gave talks on cancer to lay audiences and, in collaboration with Abraham Flexer, authored *Cancer: The Misguided Cell*. This book, which targeted the general public, was well received and was published in three editions.

While it is simple to convey a list of David's accomplishments, it is more difficult to describe his motivations and approach to science. While very interactive and giving of his time and energy, he was also in many ways an individual who valued his privacy. Some insights into his scientific philosophy come from his writings. In his 1999 commencement address at the University of Colorado ("On Learning, Wisdom, and the Game of Pinball"), David suggested his life had been circuitous and meandering, resembling the erratic motion, stops, and starts of a pinball. As evidence he recounts a story concerning a year he spent in Europe during his student days.

He was living in a hostel in Copenhagen with winter approaching, and someone had stolen his winter coat. With little money to buy a new coat he decided that he should perhaps move to a warmer clime, and set off on foot for Spain. While leaving the city, he decided to stop and visit a professor of zoology, Erik Zeuthen, whom he had met the year before. David caught him as he was leaving for the day. The outcome of that chance encounter was a winter coat, a position in the Zeuthen lab for a year, and the guidance that ultimately led to David's enrollment in the graduate program at the University of California, Berkeley.

We don't think David, in presenting this vignette and the pinball analogy, intended to suggest that we should careen through our careers propelled by life's

flippers, slingshots, and saucers. Instead it serves to illustrate David's view that everything cannot be planned, and even if this could be true, one's resulting life would be boring. For a truly interesting and productive life one must allow for the chance occurrence or observation and be prepared to move in a new and potentially productive direction.

David took the greatest delight in finding the unexpected in life and in the lab. He was most happy when he had an experimental result that went against the grain, something that forced a reevaluation of one's preconceived notions. For example, he loved to tell the story of how his initial grant application to study the gene-size DNA in *Oxyticha* was rejected over concerns that it was an experimental artifact. He subsequently submitted essentially the same grant to another study section and received its top score. David noted, "Prejudice is not an adequate criterion for determining fact, and that it is well to keep an open mind" (Prescott et al., 1962). Two quotes that he utilized in published reviews (Prescott, 1998, 1992) perhaps serve to further illustrate his philosophy:

> The capacity to blunder slightly is the real marvel of DNA. Without this special attribute, we would still be anaerobic bacteria and there would be no music." —Lewis Thomas (The Medusa and the Snail)

> There are more things in heaven and earth, Horatio, than are dreamt of in your philosophy." —William Shakespeare (Hamlet, Prince of Denmark, Act I, Scene V)

It must be mentioned that in addition to science, David greatly enjoyed and was dedicated to his family. He is survived by his loving and devoted wife, Gayle; his daughter, Lavonne; his sons, Jason and Ryan; and four grandchildren (Hayden, Henry, Alexandra, and Zack). The field of protistology and science in general has lost one of its heroes, and he will be missed by many.

Contributions in David's memory can be made to the Prescott Scholarship for undergraduate Arts and Sciences students at the University of Colorado Foundation, 4740 Walnut St., Boulder, CO 80301. The authors thank the many colleagues who provided information and their impressions of David, and apologize to the many individuals whose work has not been mentioned. Gayle Prescott, Carolyn Jahn, and Ann Cowan are gratefully acknowledged for their thoughtful comments on the manuscript, and we thank John Heumann and Brian Spear for their help in compiling the bibliography. The photographs were provided by Gayle Prescott.

NOTES

Early in his career, David and his family were photographed for *Life Magazine*. The images can be viewed at: http://books.google.com/books?id=oFIEAAAAMBAJ&pg=PA109&lpg=PA109&dq=David+Prescott+Life+magazine&source=bl&ots=g2jWgoOXrR&sig=6nx1A9HB9ckqeoo6zskWm9Oo2aI&hl=en&ei=83O4Te-0gHZuqXrDw&sa=X&oi=book_result&ct=result&resnum=4&ved=0CC4Q6AEwAw#v=onepage&q&f=false

This biography is based on a memorial piece previously published in *The Journal of Eukaryotic Microbiology* (In Memoriam: David Marshall Prescott (1926-2011), 58(4)(2011):394-396). Used with permission

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