Obituary for Leonard Mortenson

Leonard (Len) E. Mortenson enjoyed a long career doing pioneering research on bacterial nitrogen-fixation as well as educating students and postdoctoral associates, both in academia and in industrial laboratories. Len passed away peacefully at his home in Willow Street, PA on October 30. He was 89.

Len began his association with two nitrogen-fixing bacteria, the aerobic *Azotobacter vinelandii* and the anaerobic *Clostridium pasteurianum*, during his graduate study (1950-54) at the University of Wisconsin, Madison. Throughout his career, his research has centered on the nitrogen-fixing enzyme nitrogenase of these two organisms. After receiving his Ph.D., Len took a research position at the Central Research Department, E. I. du Pont de Nemours and Co., Wilminton, DE. An important accomplishment there was the development of techniques for preparing consistently active nitrogen-fixing cell-free extracts, which enabled Len and his future students and postdoctoral associates to purify nitrogenase and to study its structure and its mechanism of action.

In 1962, Len and two colleagues at DuPont introduced the name ferredoxin for the electron-transferring protein they purified from *C. pasteurianum* during their study of biological nitrogen fixation. The identification of this non-heme iron protein, now known as an iron-sulfur protein, is significant to multiple areas of biochemistry and microbiology. Ferredoxin not only serves as the electron donor for the nitrogen-fixing enzyme but also as an electron carrier in numerous aerobic and anaerobic metabolic reactions. After the period (1954-1961) at DuPont, Len realized a need to move to academia so that he could have continuity to pursue the research he started at DuPont. At the invitation of Henry Koffler, then the head of the Department of Biological Sciences at Purdue University, Len moved there in 1962 to become an associate professor. From 1962 (Purdue University) through his retirement in 1993 (University of Georgia), Len remained focused on using the best available methods to elucidate the structure-function relationship in nitrogenase.

Nitrogenase is a complex metalloenzyme with unusual oxygen-sensitivity. It was a challenge to preserve its activity outside the cell. Len and coworkers developed effective anaerobic techniques for the purification of nitrogenase from *C. pasteurianum*, and a similar strategy allowed the purification of the oxygen-sensitive hydrogenase from the same organism in his laboratory. Len and his collaborators were able to reveal novel metalloclusters in ferredoxin, nitrogenase, and hydrogenase of *C. pasteurinum*, making this anaerobe a treasure trove for the discovery of new types of metalloproteins. However, *C. pasteurianum* is not amenable to efficient site-directed recombination experiments. At the University of Georgia, Len decided to go back to *A. vinelandii*, the organism he used in his Ph.D. study and for which methods for genetic manipulation had been developed, to further research on the structure-function relationship in nitrogenase. This switch proved fruitful, and it was at a high point of his career when he

retired. Researchers across many fields are grateful to Len for having started and shepherded a research field.

During the forty years of his professional career, Len worked at DuPont (1954-1961), Purdue University (1962-1981), EXXON Research and Engineering Company (1981-1985), and finally the University of Georgia (1985-1993). Besides being named a Foundation of Microbiology Lecturer in 1970-71 and again in 1980-81, Len received the Hoblitzelle National Medal and Award for the discovery of ferredoxin and was elected a Corresponding Member of the French Academy of Sciences in 1965. He was named a fellow of the American Institute of Chemists in 1968. He was a Visiting Scholar at the Stanford University Chemistry Department in 1975-76. In 1978, he was an Invited Research Scientist at CNRS Laboratore de Chimie Bacterienne, Marseille, France, and in 1979 he received the Purdue Herbert Newby McCoy Award for Outstanding research. Additionally, in 1980 he was awarded the Rudi Lemberg Traveling Fellowship from the Australian National Academy of Science and was elected to the Nominating Committee of the Division of Biochemistry, American Chemical Society. Len was a member of the American Society for Microbiology, American Chemical Society, American Society of Biological Chemists, Sigma Xi, and a corresponding member of the French Academy of Sciences. Len also served as a program director at the National Science Foundation (Biochemistry) and the United States Department of Agriculture (Competitive Research Grants), respectively. In 2001, Len was awarded an honorary PhD from Purdue University. At his retirement, Len was the Fuller E. Callaway Distinguished Professor of Biochemistry, Chairman of the Division of Biological Sciences, and Director of the Metalloenzyme Center, University of Georgia, Athens.

Len was born in 1928 in Melrose, Massachusetts. He received a B.S. degree in 1950 in microbiology and chemistry from the Rhode Island State College. He received an M.S. degree (1952) and the Ph.D. (1954) in bacterial biochemistry from the University of Wisconsin, Madison.