Ray J. Wu

August 14, 1928 — February 10, 2008

Ray J. Wu, Professor in the Department of Molecular Biology and Genetics died in Ithaca on February 10, 2008. He was 79.

Ray was born in Beijing, China in 1928, one of five children. His parents, Hsien Wu and Daisy Yen Wu, were biochemists whose collaboration resulted in China's first nutrition textbook, which was still in print as late as the 1990s. Hsien Wu also was recognized as the co-developer of the first blood test (Folin-Wu reagent) for sugar. Ray's parents helped instill in him values that he kept his whole life, including the importance of education. He attended Yenching University in Beijing for two years. In 1949, the family moved to Birmingham, Alabama, where Ray's father became chair of the Biochemistry Department at the University of Alabama, and where all five children completed their undergraduate education. Ray received his B.S. degree in Chemistry there in 1950, and then went on to earn his Ph.D. degree in Biochemistry at the University of Pennsylvania in 1955.

As a Damon Runyon Postdoctoral Fellow working under Efraim Racker, then at the Public Health Research Institute of the City of New York, Ray studied regulatory mechanisms in carbohydrate metabolism in mammalian cells. It was during these years that he married Christina Chan, and they had their son and daughter, Albert and Alice.

After Efraim Racker came to Cornell to become chair of the Section of Biochemistry under the Division of Biological Sciences, Ray followed in 1966 to join the Cornell faculty as an Associate Professor of Biochemistry and Molecular Biology. He was promoted to Professor in 1972. He served as Chairman of the Section of Biochemistry, Molecular and Cell Biology from 1976-78. Ray received numerous awards over his lifetime, most recently the Frank Annunzio Award (2002), which recognizes innovative research of Americans who devote their careers to improving the lives of humankind through their work in science and technology, and the Outstanding Faculty/ Staff Award in the College of Agriculture and Life Sciences (2005). In 2004, he was named the Liberty Hyde Bailey Professor of Molecular Biology and Genetics. Ray's work had lasting international impact in three areas—developing recombinant DNA technology, creating transgenic plants, and furthering graduate student exchanges with China. He was the first scientist to sequence DNA, and the tools he and his coworkers developed underlie many of the techniques used in science and medicine today. His laboratory created transgenic rice strains that

could be grown in hostile climates, a step that will boost food production in areas of the world where it is needed most. He spearheaded the creation of a system to bring promising students from his native China to the United States for training, thus fostering collaborations and influencing generations of researchers.

The technology to determine nucleotide sequence of genomes is one of the most important breakthroughs in modern biology because it allows the possibility of understanding the genetic blueprints of life at the nucleotide level. Ray made significant contributions to this front. In 1970, he developed the first method for determining the nucleotide sequence of DNA using DNA polymerase, which has the ability to add nucleotides one at a time to a preexisting chain by reading off a template. This enzymatic method was adopted and made more efficient by Frederick Sanger, who received the 1980 Nobel Prize in Chemistry for his efforts. Even today, as the next generation of sequencing technologies is being developed, DNA polymerase remains the centerpiece of these new high throughput sequencing strategies. The DNA sequence determination of the entire genomes of rice and human, among other organisms has revolutionalized basic and applied modern biology.

When he was in his 50s, Ray turned his attention to world hunger, specifically the problem that much of the world's climate and soils are too hostile to grow rice and other food staples. His first step was to develop efficient transformation systems for rice. In the mid-1990s, Wu and his group genetically engineered and successfully field-tested pest-resistant rice plants, marking the first time that useful genes could be successfully transferred from a dicotyledonous potato plant to a monocotyledonous rice plant. The potato gene in rice plants produces a protein that interferes with the digestive system of the pests. As a result, the stunted growth of insects such as the pink stem borer minimized plant damage. Using a similar approach, a barley gene conferring salt- and drought-resistance turned rice plants into hardy strains in saline and drought conditions.

In 2002, Wu and colleagues made another advance by bolstering yields of genetically engineered rice tolerant of drought, salt and temperature stresses. This feat was achieved by introducing the genes for trehalose (sugar) synthesis into Indica rice varieties, which represent 80 percent of rice grown worldwide including the widely consumed basmati rice. This strategy could apply to Japonica rice varieties and other crops, including corn, wheat, millet, soybeans and sugar cane.

In addition to his own lab work, Ray Wu was also a longtime scientific adviser to governments both in China and Taiwan. He was instrumental in establishing the Institute of Molecular Biology and the Institute of Bioagricultural Sciences at the Academica Sinica in Taiwan, and the National Institute of Biological Sciences in Beijing. He also served as an honorary professor at Peking University and a dozen other Chinese universities.

In the early 1980s, Ray devised a process to identify promising Chinese college students who wanted to continue in graduate school to study advanced molecular biology. Over eight years, the program he founded (China-United States Biochemistry and Molecular Biology Examination and Application, or CUSBEA) brought more than 400 top Chinese students to the United States for graduate training, 100 of who are now faculty members in major universities. These scientists, with colleagues from the Chinese Academy of Sciences, formed the Ray Wu society (now called Chinese Biological Investigators Society), which meets annually to promote advancements in the frontiers of life sciences. A scientific symposium to honor Ray Wu and the CUSBEA students who received graduate education in the U.S. was held in October 2008 at Cornell.

Ray Wu co-authored more than 300 scientific articles and held five patents. The volumes on Recombinant DNA that he edited in the series called *Methods in Enzymology* were classics. Until a few weeks before his death, Ray continued to be active in research, still working full-time at Cornell, running his lab, submitting grant proposals, and flying to various countries to present papers and serve on scientific advisory committees.

Ray believed in organization and planning, setting goals for himself for each year and phase of his life. In addition, he had great personal discipline. Yet, as hard as he worked, he always kept his life in balance, taking breaks to enjoy family, friends, music and photography. He was generous with his time, devoting many hours to advising colleagues, friends and family. He is remembered for his kindness, thoughtful advice and even-handed judgments. Colleagues admired him, as much for his humble, generous nature as for his can-do spirit and many scientific achievements. He was a gentleman and a scholar.

His wife of 51 years, Christina; a son, Albert, ‘80, M.D. ‘84; a daughter, Alice, ‘82, M.S. ‘86; and four grandchildren survive Ray Wu.

Bik Tye, Chairperson; Maureen Hanson, Volker Vogt