Statistician and animal scientist, Charles R. Henderson, a leading developer of methods for mixed linear models and a pioneer in methods for the genetic improvement of dairy cattle, died March 14 in Urbana, Illinois after a brief illness. He was 77 years old.

Henderson was born in Coin, Iowa. He earned a bachelor's degree in 1933, a master's degree in 1935, and a doctoral degree in 1948, all from Iowa State University. Henderson was employed by the Iowa Extension Service from 1935 to 1940, was an instructor at Ohio University in 1941 and 1942, and served as a first lieutenant, captain, and major in the US Army from 1942 to 1946.

From 1948 until his retirement in 1976, when he was named Professor Emeritus, he was Professor in the Department of Animal Science in the New York State College of Agricultural and Life Sciences at Cornell, where he headed the division of animal breeding. He continued his research and teaching following his formal retirement from Cornell and had been a visiting professor at the University of Illinois since 1984.

For the last four decades, Henderson was the inspiration for and the developer of a whole area of statistical research: the analysis of mixed linear models (models with both fixed and random variables) with unbalanced data, including variance and covariance estimation and prediction of random variables. This work involved the merger and application of two very different methodologies, namely, the work of Sewall Wright and J. L. Lush on path coefficient and selection index methods and the pioneering work of R. A. Fisher and F. Yates on unbalanced, fixed linear models. These methods have been used by researchers in a wide range of disciplines, from econometrics and sociology to epidemiology and nutrition. His own primary application was in animal breeding, where as a statistical geneticist he was regarded as the leading world authority on sire evaluation for production traits in livestock. This work resulted in large increases in milk production at lower costs to farmers, resulting in better nutrition at lower costs for consumers.

In 1953, he published a landmark article in *Biometrics* on the estimation of variance and covariance components. Listed by the Institute for Scientific Information as one of the most frequently cited publications in scientific literature, it was the first to present methods for estimation with unbalanced data, and from this article emanated a body of knowledge of importance to mathematical statisticians that was the basis for the ongoing development of methods. Methods given in that paper are still used today. Henderson was continuing to develop other estimation methods until the time of his death.

From 1950 to 1973, he developed the mixed model equation, publishing the work in a series of articles; these equations form the basis of much of the current work in mixed models. From a single set of equations he obtained best linear unbiased estimators of fixed effects and also best linear unbiased predictors of random effects, with this formulation serving as the foundation for his development of best linear unbiased prediction. These equations were also central to his methods for the elimination of bias due to systematic selection of, for example, animals in a breeding program.

In another significant contribution to his field, he developed a rapid method to obtain the inverse of the matrix of relationships among relatives without having to compute the relationship matrix itself, thus making possible analyses using all available data. From the mid-1950's to the present, he was a primary force behind the use of state-of-the-art computing to make possible the implementation of statistical methods in the analysis of data.

In 1985, he was elected to the National Academy of Sciences, one of the highest honors accorded an American scientist. He received several awards from the American Dairy Science Association: the Borden Award in 1964, the National Association of Animal Breeders Award in 1977, and the J. L. Lush Award, sponsored by American Breeders Service, in 1982. He was a Fellow of the American
Statistical Association and the recipient of numerous awards in recognition of his research, including the Hermann von Nathusius Medal from the German Society of Animal Production and the Animal Breeding and Genetics Award (1964) and the Morrison Award (1971) from the American Society of Animal Science.

Henderson has published more than 240 journal articles and was the author of one book, *Applications of Linear Models in Animal Breeding*. He directed the doctoral and postdoctoral research of nearly 70 students, many of whom are now leaders in the field of animal breeding and several of whom are now counted among the most prominent statisticians in the area of mixed models.

He married Marian Mae Martin in 1940 in Chariton, Iowa; she survives. Other survivors include two sons, Charles R. Henderson, Jr., and James M. Henderson, both of Ithaca; a daughter, Elizabeth Ann Henderson of Cambridge, Massachusetts; and two brothers, Milton Henderson of Mount Ayr, Iowa, and Bruce Henderson, Peoria, Illinois.