W. J. YOUDEN, 1900–1971

By Churchill Eisenhart and Joan R. Rosenblatt

National Bureau of Standards

William John Youden died suddenly from a heart attack on Wednesday, March 31, 1971, in Washington, D.C. His contributions to statistics, appearing in a steady stream since 1937, included the origination of new families of experiment designs and new techniques of statistical analysis, innovations in the application of experiment designs and statistical techniques in the experimental sciences and engineering, and "missionary work" in acquainting scientists and engineers with the effective use of modern tools of statistical design and experiment analysis.

Born in Australia in 1900, Youden came to America in 1907. He was educated at the University of Rochester (B.S., chemical engineering) and Columbia University (M.A. and Ph. D., chemistry). From 1924 to 1948 he was on the staff of the Boyce Thompson Institute for Plant Research in Yonkers, New York, except for two short leaves of absence and one three-year stint as an operations analyst with the U.S. Army Air Force. In 1948, Youden joined the Applied Mathematics Division of the National Bureau of Standards. In 1965 he retired from full-time employment, but stayed on at NBS as a Guest Worker, a post he still held at the time of his death. A more detailed biography has been published in the *American Statistician* [1]; a biography and a complete list of Youden's publications are to appear in a memorial issue of the *Journal of Quality Technology* [2]. A summary of his contributions to statistics follows.

1. New families of experiment designs.

Youden squares. The formulation of the statistical principles of the design of experiments and the initial development of a number of distinct classes of experiment designs were inspired largely by the needs of agricultural field experiments. The first decade of this work stemmed from R. A. Fisher and his co-worker Frank Yates, at the Rothamsted Experiment Station in England. One of the first "outside" contributions came early in 1937, when Youden, then with the Boyce Thompson Institute for Plant Research, published a paper on "Use of incomplete block replications in estimating tobacco mosaic virus" [4], in which he gave examples and illustrated the application of a new class of symmetrical balanced incomplete block designs that possessed the characteristic "double control" of Latin square designs, without the restriction that the number of replications must equal the number of treatments.

In an earlier ". . . statistical study of the local lesion method for estimating tobacco-mosaic virus" [3], Youden had found Latin square arrangement of the solutions under test to be advantageous: individual plants were identified with