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Chester Ittner Bliss, 1899-1979

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## CHESTER ITTNER BLISS

1899–1979

Chester Bliss was a biologist, whose statistics throughout his life were largely self-taught. The major theme in his statistical research publications—over 130 in number—was the difficult business of biological assay, estimating the active amount of some ingredient in a specimen from dosage-response experiments on the effects of different multiples or fractions of the dose. His publications contain papers on the biological assay of vitamins A, B<sub>6</sub>, B<sub>12</sub>, C, D, as well as of analgesics, insulin, digitalis, penicillin, thiamins, radiation, parathyroid extract, adrenal cortex extract, cardiac glucosides, insecticides and anthelmintics. His publications dealt also with analyses of various bodies of biological data that interested him. If the statistical methods required did not seem to be available in the literature, he worked them out himself.

As a result, he made a number of useful methodological contributions to statistics. Perhaps the most important of these was the development, with some help from Ronald Fisher, of an iterative method of finding maximum likelihood estimates in the probit method of bioassay. Additional contributions in biological assay were work on the analysis of time-mortality data and of slope-ratio assays, and two early papers on the study of the joint effects of different poisons and the concept of synergism.

Other methodological contributions were papers on the fitting of the negative binomial distribution and the rectangular hyperbola, the major papers that we have on periodic regressions, the standard table of the angular (arcsine) transformation for the analysis of variance of proportions, a paper on the combination of the analysis of covariance with the discriminant function, and a quick test for an outlying variance in a set of independent estimates of variance made from ranges. Mainly as a result of these contributions, Dr. Bliss gained an international reputation as a biometrician and was elected an honorary life member of the Biometric Society, an honorary fellow of the Royal Statistical Society, and a Fellow of the Institute of Mathematical Statistics and of the American Statistical Association.

Dr. Bliss was born in Springfield, Ohio, in 1899. He took his B.A. in entomology at Ohio State in 1921, and his M.A. (1922) and Ph.D. (1926) at Columbia, working there as a Fellow in Zoology under T. H. Morgan on *Drosophila melanogaster*. From 1926 to 1933 he was an entomologist with the U.S. Department of Agriculture, mainly in field work on the control of camphor scale and red scale and on the biology of the Mexican fruit fly. In 1933, when the depression closed down the entomological work, he moved to London to attend lectures and do research under R. A. Fisher for two years. It was at this time that he worked out the probit method of bioassay. In 1936 he moved to the Institute for Plant Protection, Leningrad, spending two years lecturing, consulting, and investigating toxic action.

In 1938 he joined the Connecticut Agricultural Experiment Station as biometrician, a position that he held until his retirement in 1971. It was fortunate that the Station had decided to try out one of the new breed of biometricians just when Chester called there. In 1942 he was appointed Lecturer at Yale, this role continuing for 25 years. At Yale he created a two-semester course in biometrics, at first given in the Pharmacology Department and later in the Biology Department. The course was both challenging and time-consuming. The best stu-

dents got an unusually thorough grounding in biometrical methods and their uses; the less interested found they faced more than they bargained for.

Chester did more than anyone else towards the founding of the Biometric Society in 1947. (He has described the steps in the article, "The First Decade of the Biometric Society", *Biometrics* 14, 1958, 309–329.) Earlier, the American Statistical Association had formed a Biometrics Section in 1938. This section held a number of joint sessions, arranged by Chester, at annual meetings of biological associations. In 1945, Chester appointed a committee to consider the creation of an American Biometric Society. I believe the thought in some minds was that quantitative biologists, whose participation was essential to good work in biometry, might be reluctant to join a statistical association, but might join one in biometry. When the committee reported, it was decided early in 1946 to postpone for the time being any further consideration of a move to form this society.

What changed matters was Chester's reaction to the preliminary program for the meeting of the International Statistical Institute in Washington, D.C. in September, 1947—the first post-war meetings. The program contained practically nothing in biometry. As Chester puts it: "It seemed to me outrageous that the field which led all others should have been treated so shabbily." Soon after this he had a chance meeting in a train from New York to Princeton with Dr. Charles Roos of the International Econometric Society, which had itself been founded some years earlier. Dr. Roos encouraged Chester to organize an international biometric society. September 1947 seemed a good date for a founding biometric conference, since many biometricians from overseas were likely to be in the U.S. for the I.S.I. meetings.

The time was already late, but a whirlwind of activity arranged and financed the first International Biometric Conference at the Marine Biological Laboratory in Woods Hole on Cape Cod, September 5–6, 1947. At that meeting, Dr. Bliss was elected Secretary of the Society and soon afterwards became Secretary-Treasurer. Along with Gertrude Cox, editor of *Biometrics*, he nursed the infant society to vigorous growth.

For many years he was the principal statistical advisor to the successive editions of the *U.S. Pharmacopeia*. They could not have had a better man to supervise the statistical aspects of their revisions—he was clear, sensible, and meticulously accurate, and was a biologist writing for biologists.

He gave a good deal of time and attention to the collection of bodies of biometric data interesting and informative to analyse and had, I think, the best collection of such data in the business. His book, *The Statistics of Bioassay*, was published in 1952. Fortunately, in the 1950's he also decided to prepare a connected series of three books on *Statistics in Biology*, full of analyses of his examples. Writing the books proceeded slowly, partly because of Chester's very high standards of accuracy. Drafts of his chapters that looked to me ready to go to the printer were, in his judgement, preliminary drafts that needed a complete revision and retyping. The first volume appeared in 1967 and the second in 1970. His death March 14, 1979, occurred before the appearance of the third volume, and I do not know whether plans have yet been made for its publication.

He was kindly and considerate, always ready to help others. He never married, but avoided becoming too wrapped up in himself. He greatly enjoyed the theatre in New Haven, lectures on foreign policy in New York, and international travel, as well as boxes of chocolates, from shops specializing in their preparation, that Chester regarded as rare finds.

He would not, I think, have objected to a family anecdote. In the summer he used to spend a few days with us on Cape Cod. During one of these visits he and I were sitting on the front steps of our porch, Chester describing some test of significance that he was trying to construct. My older daughter, still a child, came out of the house. She said "Dr. Bliss, I am preparing lunch. For the children I am making cottage cheese and fruit salad. Father and

Mother don't like these, but I wondered if you might." Chester stopped to consider this possibility carefully. "Yes", he said. "I like cottage cheese. And I like fruit salad. But don't mix them. Give me them in two separate bowls." I saw my daughter's face fall and guessed what she had done. She went back to the kitchen, picked the pieces of fruit salad out of the mixture, and ran water on them to clean off the cottage cheese. Then she took some cottage cheese and tried to remove from it the fruit salad juice. When the two ingredients seemed separated, she called us in to lunch. Chester came in, still full of the narrative about the test of significance. He sat down at table, lifted the bowl of fruit salad, poured it on the cottage cheese, and stirred vigorously.

I hope that Biometric Society members realize how much they owe to Chester Bliss and Gertrude Cox—two members who, with vigorous concerns of their own, were always ready to give large amounts of time and hard work to the Society's affairs.

WILLIAM G. COCHRAN

Chester Bliss was one of a number of able biologists who became outstanding biometricians under the influence of R. A. Fisher. Over a long period he was a close personal friend of Fisher, to whom he brought many interesting questions for study and whose ideas he helped to translate into techniques applicable to the analysis of biometric data. Probably the best known of all are the papers concerned with probits; the earliest showed the clear Fisherian stamp, and indeed were among the first published examples of the classical iterative technique for maximum likelihood. But Bliss was an innovator and not only a disciple. He developed probit methods in the handling of many biological problems, especially in respect to potency estimation for drugs and insecticides. His interest then extended into all forms of drug potency estimation: he became an expert on biological assay, wrote an excellent and influential chapter for the *U.S. Pharmacopeia* and was widely consulted both by the U.S.P. and by the pharmaceutical industry.

Some years later, when my own interests in probits, maximum likelihood, and bioassay began, I came to know Chester Bliss well through correspondence. We argued and exchanged ideas in long letters; at times we disagreed violently but we never fought! When first I met him in 1949, we were in fact old friends and I greatly enjoyed his hospitable welcome to New Haven. I have two clear pictures in mind. One is of him taking his daily brief siesta in an elaborate chair that had enough positions to satisfy a dentist. The other was of a long day spent driving to Princeton, talking at length with John Tukey and others, returning late to New York where we were to stay that night, and Chester then insisting on taking me out again to sample his favourite hot fudge sundaes.

In addition to his bioassay work, he published extensively on many problems concerned with entomology, frequency distributions, estimation, and the biometric topics. The two volumes of his book are a mine of ideas on the analysis and interpretation of data, scarcely a teacher's text but to be dipped into for enjoyment and stimulation: what a pity that his insistence on revision after revision delayed too long the appearance of the third volume! He was of course one of the founders of the Biometric Society and in over 20 years on the Editorial Board helped to give *Biometrics* its distinctive role in science. The many who valued his friendship, the greater number who knew and used his work or appreciated his tremendous contribution to this Society, all will be saddened by his going and all will remember him with gratitude.

DAVID J. FINNEY