

## **On the History of the Department of Statistics and Actuarial Science at the University of Iowa**

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### **1918-1942: The Rietz and Craig Years**

The roots of the Department of Statistics and Actuarial Science at the University of Iowa can be traced back to the hiring of Henry L. Rietz as Head of the Department of Mathematics in 1918. Although statistics courses had been taught previously at the University --- the first one, "The Method of Least Squares," was offered as early as 1895 and the second, "The Theory of Statistics" was introduced in 1906 --- no faculty member before Rietz could rightfully claim to be a statistician. In fact, Rietz himself was not originally a statistician, but an algebraist; his Ph.D. thesis, written in 1902 at Cornell University, was on primitive groups (Crathorne, 1944). But around 1905, while he was on the faculty of the Department of Mathematics at the University of Illinois, he apparently became interested in statistics. Between 1905 and 1910 he published several statistical papers through the Agricultural Experiment Station at Illinois, with titles like "Variability of Corn," "Principles of Breeding," and so on. In 1911 he published "On the Theory of Risk," the first of his many publications in actuarial science. In fact, it may have been his expertise in actuarial science as much as that in statistics or other areas of mathematics that got Rietz the job at Iowa, for by 1918 three actuarial courses and only one or two statistics courses were being taught every semester. In any case, by the time Rietz arrived at Iowa he had established himself as a leading scholar in both statistics and actuarial science. He went on to become a vigorous promoter of both disciplines, writing 156 articles, reviews, or discussions, and 11 books over the course of his career. His 1927 book, Mathematical Statistics, was used as the text for many university courses in the years that followed.

For over a decade, Rietz was the only statistician on the Mathematics faculty. But being Head of the Department had its advantages, and he was able to attract many good students. One was Frank Weida, who went to George Washington University after graduating from Iowa and in 1935 established there the first Department of Statistics in a Liberal Arts and/or Science college. Another was Frank Satterthwaite, who is known for his eponymous approximation to the distribution of a linear combination of mean squares. But perhaps the two best of Rietz's students were Samuel Wilks, from Texas, and Allen Craig, from Florida, both of whom earned the Ph.D. in 1931. Upon Wilks' graduation, he spent a year on a National Research Council (NRC) Fellowship at Columbia with Harold Hotelling (Mosteller, 1964), then another year in England as an NRC International Research Fellow, where he worked with Karl Pearson and John Wishart. During these fellowship years he developed and published the multivariate test

criterion now well known as "Wilks' lambda," which generalizes the F test of the univariate analysis of variance. In 1933 Wilks joined the Princeton faculty, where he remained for the rest of his professional life. Craig, on the other hand, was hired on at Iowa in 1931 and stayed until his retirement in 1970. So throughout the 1930's and early 1940's, mathematical statistics at the University of Iowa was taught by Rietz and Craig. Craig earned a reputation as a highly polished lecturer. It was said that he would begin writing his lecture in the upper left-hand corner of the blackboard, fill the board three or four times with beautifully crafted sentences, and just as the bell rang, put a period on his last sentence in the lower right corner with a flourish and walk out of the room, leaving his students in awe. Craig made many important research contributions as well. Perhaps the most important, which is now widely known as Craig's Theorem, gives necessary and sufficient conditions for the independence of quadratic forms in normal random vectors; see Driscoll and Gundberg (1986) for a history of this theorem.

No account of University of Iowa statisticians in those pre-war years is complete without a description of their major role in the formation and early leadership of the Institute of Mathematical Statistics (IMS). In the late 1920's, Harry Carver, a statistician at the University of Michigan, saw a need for a good publication outlet for mathematical statistics research. So in 1930, as Wilks and Craig were nearing completion of their studies at Iowa, Carver began publishing, at his own expense, the *Annals of Mathematical Statistics*. Now Rietz, at about the same time, thought that the mathematical statisticians in the U.S. ought to form an independent organization. In early 1935 he had Craig write to 100 or so statisticians about this, and in the summer of 1935, 60 or 70 came to a summer meeting of the American Mathematical Society in Ann Arbor and agreed to form the Institute of Mathematical Statistics. The group elected three officers: Henry Rietz as President, Walter Shewhart as Vice President, and Allen Craig as Secretary/Treasurer. In 1938, Carver turned the *Annals* over to IMS as their official journal. Sam Wilks was appointed its editor, serving through 1949, and Allen Craig and Jerzy Neyman were appointed its two associate editors. So the influence that Iowa statisticians had in shaping the IMS during its early development was quite remarkable.

### **1943-1965: The Craig and Hogg Years**

In the late 1930's Rietz's health began to fail. He retired in 1942 and died late the next year, just after he learned that the 1943 volume of the *Annals* would be published in his honor. (Incidentally, Rietz continues to be memorialized by the Rietz Lectures, which began in 1947 and are now given every third year at the annual IMS Meeting.) Meanwhile, with World War II going on, Craig had volunteered for the Navy and left to serve as an officer on a destroyer. At war's end he returned to Iowa and picked up his research and teaching where he had left off. With Rietz gone, Craig necessarily carried the teaching load for statistics by himself. Overall, statistics and actuarial science course offerings in the Department of Mathematics numbered around ten per year during the late 1940s and 1950s, about two-thirds of them in statistics. In order to keep the actuarial science program going strong, the Department had wisely hired Lloyd Knowler, another of Rietz's students, in 1939. In 1946, Knowler became Head of the Mathematics Department, a position he held until 1959. Besides teaching actuarial science,

Knowler did several things that helped develop Statistics at Iowa. In the fall of 1944, he gave the first short course in Statistical Quality Control to industry people on campus. He eventually gave this course more than 40 times during his career, and he developed it into a course for students at the University as well. For this and his contributions to the founding of the American Society for Quality Control, he was awarded the Shewhart Medal in 1962. Also, in 1945, recognizing the importance of statistical methods in medicine and the health sciences, he began teaching courses in biostatistics for the College of Medicine. He taught these until the College of Medicine hired its own biostatisticians in the mid-1960s.

During the early post-war period, Craig had several graduate students. One of them was Robert ("Bob") Hogg, a native of Hannibal, Missouri who came to Iowa in 1947 to study actuarial science. Hogg, like Craig, had served in the Navy during the war and then gotten his bachelor's degree in Mathematics from the University of Illinois. While pursuing his actuarial studies at Iowa, he took a class on statistical theory from Craig, and the two of them hit it off so well that Hogg decided to stay on and do a Ph.D. under Craig's supervision, which he received in 1950. At that time the Mathematics faculty numbered twelve people, with Craig the only statistician, and it was decided that they needed another. So they hired Hogg. Thus began a productive research, teaching, and writing partnership --- and personal friendship --- between Craig and Hogg that both men cherished (Randles, 2007). Being single at the time, they often spent three or four nights a week at their offices working together on research on various topics, especially independence and sufficient statistics. Furthermore, Hogg and Craig were teaching a three-course sequence in probability and mathematical statistics at the senior/first-year graduate level. Finding themselves unsatisfied with existing textbooks at this level, they began to write up the material they were teaching. This project culminated in the publication of Introduction to Mathematical Statistics, a.k.a. "Hogg and Craig," in 1958. This book, which is now in its 6th edition, is undoubtedly one of the most popular mathematical statistics textbooks ever written. It has sold more than 125,000 copies, allowing Hogg to refer to himself, with a wink and a grin, as "the other famous author from Hannibal, Missouri."

### **1965-1983: The Formation and Expansion of the Department of Statistics**

By the early 1960's, many other statistical programs were expanding rapidly and forming into departments, and in 1962, at Hogg's urging, the University created an "interdepartmental program in statistics" that could grant graduate degrees. The committee overseeing the program continued to make the case to university administrators for creating a department of Statistics. Ted Bancroft, the Head of the Department of Statistics at Iowa State University, was quite helpful in this regard, as there was a question of duplication with that fine department to the west of Iowa City. But when the question of creating of another Statistics department in the state was put to him, Bancroft said he couldn't imagine a major research university without one. That laid the issue to rest, and the program was granted Department status in 1965, with five founding members: Hogg (as Chair); two other statisticians, Craig and John Birch; and two actuaries, Lloyd Knowler and James Hickman. Birch had been hired the previous year after receiving his Ph.D. under David Blackwell. Hickman had earned his Ph.D. in actuarial science at Iowa and

joined the faculty in 1961. The actuarial science program thus moved with Statistics into the new Department, where it has resided ever since.

The late 1960's were characterized by rapid growth of the young Department. The National Defense Education Act had been passed by Congress in 1958, primarily due to the success of the Soviet Union's Sputnik, so money for science, engineering, and the mathematical sciences was flowing. By 1969 the department had more than doubled in size with the hiring of Tim Robertson, Jon Cryer, Fred Leone, Tim Wright, and Ron Randles, among others. Several outstanding Ph.D. students graduated during this period, including Richard Dykstra, Thomas Hettmansperger, Douglas Wolfe, and Edward Wegman. All became prominent professors at leading institutions: Dykstra at the University of Missouri, Hettmansperger at Penn State, Wolfe at Ohio State, and Wegman at North Carolina. Expansion slowed considerably in the 1970's; notable hires in that decade were George Woodworth, James Broffitt, Stuart Klugman, Russell Lenth, and Johannes Ledolter. With these the Department expanded its course offerings to include more applied statistics and broadened its research focus from mainly mathematical statistics to include applications of statistics in areas such as law and justice, engineering, and economics. Of course, along with new hires there were retirements and departures. Craig retired in 1970 and Knowler in 1976. Hickman left in 1970 for the University of Wisconsin College of Business, where he eventually became Dean; Leone left in 1973 to become Executive Director of the American Statistical Association, and Tim Wright and Ron Randles left for more southern climes (University of Missouri-Rolla and University of Florida in 1975 and 1981, respectively). In the early 1980's Dykstra returned to the Department as Professor and Ralph Russo was hired, bringing the number of faculty to 13 in 1983. Research areas of distinction for the faculty during this period were robustness, nonparametric statistics, and order-restricted inference.

### **1983 to the Present**

Hogg stepped down as Chair in 1983, but he remained very active in the profession for a long time. He served as President of the American Statistical Association in 1988 and was a tireless promoter of statistical education and statistical quality management for many years thereafter. He finally retired in 2001. The Department Chairs that followed Hogg served comparatively short terms with the exception of James Broffitt, who chaired from 1993-2004 (see Appendix for a complete list) and skillfully directed the Department's move from MacLean Hall to Schaeffer Hall in 1997. From 1983 to 1994 the Department again expanded considerably; in one year (1985), four new faculty were added, including Joseph Sedransk, who was the first Chair to be hired externally. The number of regular faculty reached its all-time high of 20 in 1992. Current Statistics faculty who were hired during this period were Dale Zimmerman, Kung-Sik Chan, Joseph Lang, Jian Huang, and Osnat Stramer. With these and other hires the Department added considerable strength in spatial statistics, time series analysis, categorical data analysis, survival analysis, and stochastic processes, and completed its transition from a department with a very strong emphasis on mathematical statistics to one with expertise throughout the full spectrum of modern applied and theoretical statistics. Elias Shiu joined the Department in 1991 as the Principal Financial Group Professor and became the leader of the actuarial program.

Unfortunately, the growth that took place into the early 1990's proved to be unsustainable. As the University's budget was subjected to a series of cuts and reversions, so was the Department's ability to retain faculty and replace those that retired or left for other reasons. Gradual attrition left the Department with a faculty of 17 members in 2010. Among the faculty hired after 1994 were Kate Cowles, John Geweke (who left in 2010), Luke Tierney, N.D. Shyamalkumar, Qihe Tang, Rhonda DeCook, Jerome Pansera, Aixin Tan, and Joyee Ghosh. These people added particularly to the Department's strength in actuarial science and Bayesian and computational statistics. Tierney, who was hired as the Ralph E. Wareham Professor in 2002, also served as Chair of the Department from 2004-2010. In 2010 Dale Zimmerman became Chair and was named the inaugural Robert V. Hogg Professor.

## **Actuarial Science**

The actuarial science program has been an integral part of mathematical sciences at the University of Iowa for over a century. In fact, of the 14 doctoral students supervised by Henry Rietz, 8 wrote dissertations on actuarial science topics. It is no doubt due to Henry Rietz's enthusiasm for both actuarial science and statistics, and the passing down of this attitude to Allen Craig, Lloyd Knowler, and Robert Hogg that the actuarial science program allied itself with the Department of Statistics when it formed in 1965. In 1980, in order to formally recognize the importance of actuarial science to the Department's overall mission, the department name was changed to Statistics and Actuarial Science. It is the only academic department in the United States with "Actuarial Science" in its name (there are others in Canada and elsewhere). More than 1200 students have graduated from the actuarial science program at Iowa. Many of these have served as leaders of the actuarial profession as well as CEOs of their companies or organizations. Five former presidents of The Society of Actuaries are Iowa graduates --- Victor E. Henningsen, Robert J. Myers, Edwin B. Lancaster, Charles L. Trowbridge, and Neil Parmenter. Myers was Chief Actuary of the Social Security Administration from 1947-1970, and holds the record for the number of times (175) that a person has testified before the U.S. Congress.

In 2009, on the basis of its job placement record, exam pass rates, and credentialed graduate rates among other factors, the actuarial program was designated by the Society of Actuaries as one of 21 Centers of Actuarial Excellence in the U.S. and Canada. Approximately 2.3% of new Fellows of the Society of Actuaries from 2000-2010 were University of Iowa alumni.

## **Other Statisticians at Iowa**

The Department of Statistics and Actuarial Science has historically been the largest, but by no means the only, academic unit at Iowa that had statisticians and taught statistics courses. Due largely to the efforts of E. F. Lindquist, a professor in the College of Education who founded

American College Testing (ACT), the Education College developed a very strong Educational Measurement and Statistics program by the late 1960's. Some of its members were given secondary appointments in the new Department of Statistics and taught many of its applied course offerings in its early years of existence. These folks included Leonard Feldt, H. D. Hoover, Paul Blommers, Mel Novick, Bob Forsythe, Bob Brennan, and Michael Kolen. Another significant concentration of statisticians on campus resides in the Biostatistics Department within the College of Public Health. This unit formed initially as the Division of Biostatistics in the College of Medicine's Department of Preventive Medicine and Environmental Health in 1974, with Paul Leaverton as its first Director, and other original members Leon Burmeister, Judy Bean, William Clarke, and Robert (Skip) Woolson. Peter (Tony) Lachenbruch was recruited from the University of North Carolina in 1976 to become the second Director. When Lachenbruch left in 1985, Woolson became the third Director. The Biostatistics Division became the Department of Biostatistics in the newly created College of Public Health in 1999, with Woolson as its founding chair. Other founding members of this department were Leon Burmeister, Trudy Burns, William Clarke, Charles Davis, Jeffrey Dawson, Michael Jones, Jon Lemke, and Veronica Vieland. Kathryn Chaloner joined the faculty and became Chair of the Department in 2002. Current faculty members not already mentioned are Joseph Cavanaugh, Christopher Coffey, Dawei Liu, Jacob Olesen, Jane Pendergast, Brian Smith, Kai Wang, Gideon Zamba, Ying Zhang, and M. Bridget Zimmerman. Cooperation between the Statistics and Biostatistics Departments has been strong, especially in recent years. Several Statistics faculty have secondary appointments in Biostatistics and vice versa, and graduate students in each department often take courses from the other.

### **Selected Books Authored by the Faculty**

Kung-Sik Chan and Howell Tong, "Chaos: A Statistical Perspective" (Springer, 2001).

Jonathan D. Cryer, "Time Series Analysis" (Wadsworth, 1986).

R.L. Dykstra, Tim Robertson and F.T. Wright, "Order Restricted Statistical Inference" (Wiley, 1988).

Robert V. Hogg and Stuart A. Klugman, "Loss Distributions" (Wiley, 1984).

Robert V. Hogg, Joseph W. McKean and Allen T. Craig, "Introduction to Mathematical Statistics" 6th ed (Prentice Hall, 2005).

Robert V. Hogg and Johannes Ledolter, "Applied Statistics for Engineers and Physical Scientists" (Prentice-Hall, 1992)

Robert V. Hogg and Elliot A. Tanis, "Probability and Statistical Inference" 7th ed (Prentice Hall, 2005).

Luke Tierney, “LISP-STAT: An Object-Oriented Environment for Statistical Computing and Dynamic Graphics” (Wiley, 1990).

George G. Woodworth, “Biostatistics: A Bayesian Introduction” (Wiley, 2004).

Dale L. Zimmerman and Vicente Núñez-Antón, “Antedependence Models for Longitudinal Data” (Chapman & Hall/CRC Press, 2010).

### **Department Chairs**

Bob Hogg, 1965-1983

John Birch, 1983-1986

Joe Sedransk, 1986-1989

Dick Dykstra, 1989-1992

Bob Hogg, 1992-1993

Jim Broffitt, 1993-2004

Luke Tierney, 2004-2010

Dale Zimmerman, 2010-2011

### **Regular Faculty, in Order of Appointment**

1965 Bob Hogg

Tim Robertson

Allen Craig

1966 Jon Cryer

John Birch

1967 Fred Leone

Lloyd Knowler

James Cole

James Hickman

Peter Wang

1968	Farroll T. Wright	Joseph Pignatiello
	Ronald Randles	Louis Rizzo
	John Ramberg	1990 Martin Appel
1970	James Broffitt	1991 Kung-Sik Chan
1971	George Woodworth	Elias Shiu
1974	Stuart Klugman	1992 Bruce Jones
1975	Russell Lenth	Joseph Lang
1976	Richard Ziock	Jens Praestgaard
1978	Stephen Brier	1994 Jian Huang
1979	Johannes Ledolter	Osnat Stramer
1981	George Runger	1997 Mary Kathryn (Kate) Cowles
1982	Richard Dykstra	Sheldon Lin
	Jane-Ling Wang	1998 Grace Chan
1983	Ralph Russo	1999 John Geweke
1984	Glenn Meyers	2002 Luke Tierney
1985	James Calvin	2003 Jun Yan
	Mark Conaway	2004 N.D. Shyamalkumar
	James Sconing	2006 Qihe Tang
	Joseph Sedransk	2007 Rhonda DeCook
1986	Dale Zimmerman	2008 Jerome Pansera
1988	Marianthi Markatou	2009 Aixin Tan
1989	Jacques Carriere	2010 Joyee Ghosh



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## References

Crathorne, A. R. (1944). Henry Lewis Rietz -- in memoriam. *The Annals of Mathematical Statistics*, **15**, 102-108.

Driscoll, M. F. and Gundberg, W. R. (1986). A history of the development of Craig's Theorem. *The American Statistician*, **40**, 65-70.

Mosteller, F. (1964). Samuel S. Wilks: Statesman of Statistics. *The American Statistician*, **18**, 11-17.

Randles, R. H. (2007). A conversation with Robert V. Hogg. *Statistical Science*, **22**, 137-152.



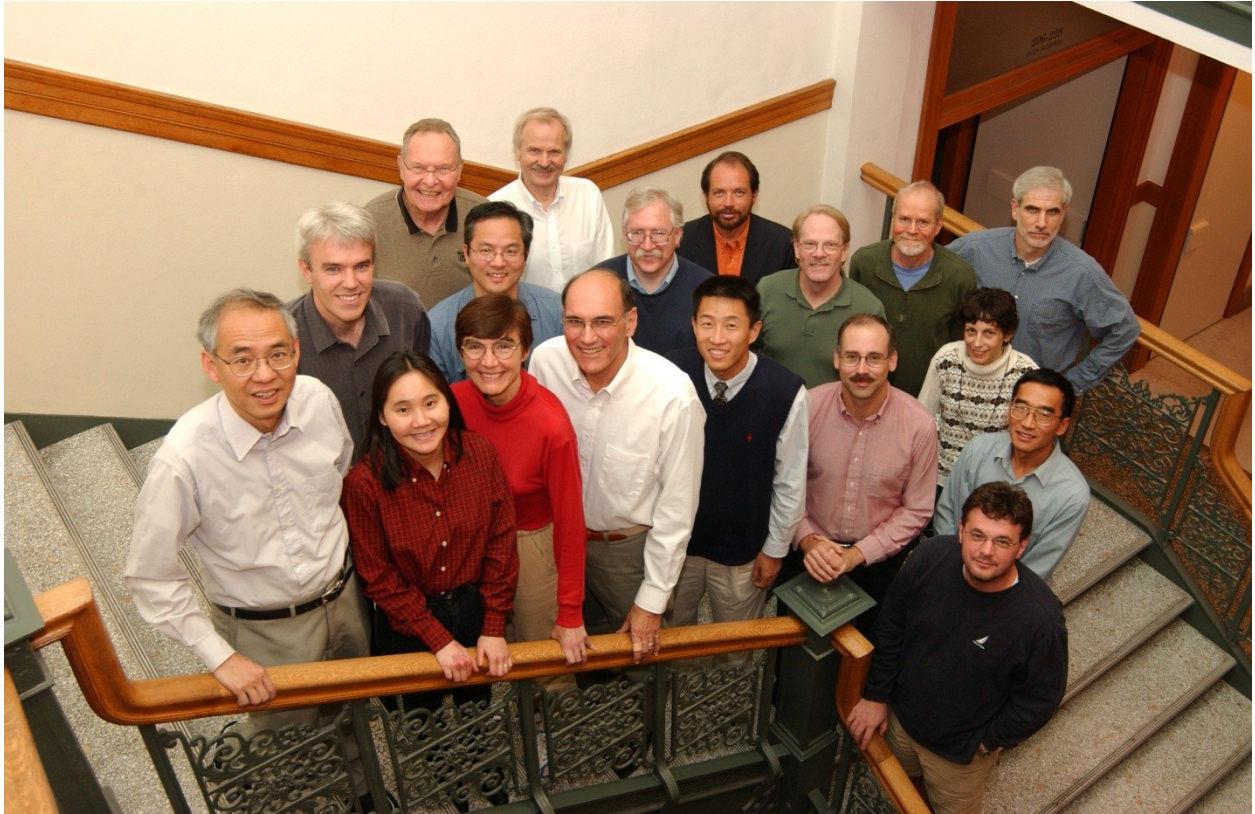
Henry L. Rietz, 1943



Allen T. Craig, 1965



Robert V. Hogg, 1971



Departmental Faculty, 2003. Back row: Bob Hogg, Johannes Ledolter, Gordon Klein, George Woodworth, and Ralph Russo. Middle row: Joe Lang, Kung-Sik Chan, Luke Tierney, Russ Lenth, and Osnat Stramer. Front row: Elias Shiu, Grace Chan, Kate Cowles, Jim Broffitt, Jun Yan, Dale Zimmerman, Jian Huang, and Matt Bognar. Not pictured: Richard Dykstra, John Geweke, Tim Robertson.

