# University of Pennsylvania Department of Statistics

**Edward I. George, Abba M. Krieger, Donald F. Morrison
and Paul Shaman**

It was one of the very first statistics departments in the United States. Established in 1931 as a spin-off from the Department of Economics, it was called the Department of Economic and Social Statistics, a name that remained until 1964. Along with the social science departments at the University of Pennsylvania, the Departments of Economics, Sociology, and Political Science, its home was in the Wharton School of Finance and Commerce. But unlike those departments, which eventually moved to the School of Arts and Sciences, it remained in Wharton and never moved.

Both the research and teaching missions of the department evolved considerably over its long history. During its first 25 years, excellent service teaching was the primary mission, and research focused mainly on the study of economic and social time series. Moreover, in these early years, the department looked inward for talent by hiring its own graduates, a practice which continued through the 1950s. This began to change in the 1950s as faculty and doctoral students gradually turned their research attention to statistical theory and methodology. By the next decade, all faculty hires were coming from outside the university.

In 1964, the department was renamed the Department of Statistics and Operations Research when an operations research group left the Case Institute of Technology for the University of Pennsylvania and merged with the department. At that point, the mission of the graduate program was revised to firmly incorporate theoretical statistics, which became the department's principal research focus by the 1970s. But the alliance with the operations researchers was not to last, as they soon left to form another department. A new curriculum for the Statistics

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Doctoral Program, one that stressed theoretical statistics, was approved by the University, and shortly thereafter, in 1975, the department was finally renamed the Department of Statistics. With the steady incorporation of theoretical statistics during the 1970 and 1980s, the foundations were now set for the department that it was to become. The subsequent 20 years saw the assembly of a thriving diversified modern statistics department, with research spanning the development of theory and methodology, with increasing attention to applications and interdisciplinary work, with continuing emphasis upon innovative high quality teaching at all levels, and with a rigorous full-fledged doctoral program.

## Early History

The initial faculty members in 1931 were three: Stuart A. Rice, Simon Kuznets, and J. Parker Bursk. Rice had been Professor of Sociology from 1926 to 1930, and Professor of Sociology and Statistics from 1930 to 1940, but took a succession of leaves during 1931–1936, when he was appointed Chairman of the United States Central Statistical Board. In 1933, Rice served as president of the American Statistical Association, and from 1947 to 1953, he served as president of the International Statistical Institute. Kuznets had earned a doctorate at Columbia in 1926, studying economic patterns in prices while a Research Fellow at the Social Science Research Council. This work led to publication in 1930 of his book Secular Movements in Production and Prices. A part-time member of the department from 1930 to 1936, Kuznets became Professor of Statistics from 1936 to 1954. Kuznets served as president of the American Statistical Association in 1949, as president of the American Economic Association in 1954, and was elected as a member of the National Academy of Sciences, the American Academy of Arts and Sciences, the American Philosophical Society, and the British Academy. Bursk graduated with the Wharton undergraduate class of 1923, received his PhD in 1931 as a dissertation student of Kuznets, and became an Assistant Professor at the creation. Bursk became Chairman in 1932 and would hold this position for 31 years. E. Douglass Burdick received his PhD under Kuznets in 1935, and joined the department faculty, rising through the ranks to Professor until his sudden death in January 1961. Donald S. Murray, also a Kuznets dissertation student, finished his PhD studies in 1944, and became a faculty member. Figure 1 shows early members of the department. He taught in the department for many years before moving to the central university administration. Morris Hamburg, also a Kuznets student, received his doctorate in 1952, becoming a faculty member in 1953. Hamburg avoided formal administrative roles, but served in leadership roles in the most distinguished way. He continued until his retirement in 1992.

Kuznets was the department's clear scholarly presence (Fig. 2). During his tenure, he directed 12 dissertations while conducting research on national income data, work that would be recognized by his selection in 1971 as a Nobel laureate, the third year of existence of the Economic Sciences Prize. Bursk, conversely, was a charismatic teacher with eclectic interests and a keen concern for the practical

**Fig. 1** The four early members of the department. From left to right: Doug Burdick, Don Murray, Simon Kuznets, and Parker Bursk



**Fig. 2** A small group of students discusses formation of national income with a world authority, Simon Kuznets

application of statistical methods to economic and social data. An excellent instructor, he expected the same from all his colleagues and always received it, from the teaching fellows to the standing faculty. It was this excellence of teaching that distinguished the department across the university in the earlier decades when research contributions to statistical theory and methods were scant.

## The Middle Years

In the 1950s an action at the university occurred that would greatly affect the department, if not immediately, at least a generation later. President Gaylord Harnwell commissioned the Educational Survey of the University of Pennsylvania, an intensive examination of every academic department and program. The Survey employed both internal committees and eminent scholars from other institutions to make recommendations for the future direction of each department and program. The outside authority for Survey XIX, Statistics and Statistical Services, was Tjalling C. Koopmans, the Yale econometrician and 1975 Nobel laureate in Economics. The committee described the existing offerings in statistics as "decentralized" by substantive disciplines, but with the greatest concentration in the Department of Economic and Social Statistics. In their report of June 30, 1958, they recommended that this organization be retained. At the same time they strongly recommended that the university seek out and recruit a leading scholar in mathematical statistics who would chair a separate department in that discipline within the Graduate School. The incumbent would be expected to hire two additional faculty in mathematical statistics as soon as possible. The new department would offer courses leading to masters and doctoral degrees in theoretical statistics. Its faculty would serve as consultants in theoretical statistics throughout Penn, and would interact with the Wharton department and any others at the university. The committee charged with forming the proposed Department of Mathematical Statistics interviewed a number of candidates, but no one accepted an offer.

Perhaps as a consequence of the Educational Survey, the Wharton undergraduate program was drastically revised in 1959 and 1960. A required year-long mathematics course was added, one that included calculus and linear algebra. Indeed, a new two-semester introductory statistics course was designed with that as a prerequisite. The use of integral calculus clearly set the course apart from traditional and mundane treatments of basic statistical methods. Ultimately, the MBA statistics course would also have a calculus prerequisite and a higher mathematical level.

Bursk's health had been declining, and he died suddenly in April 1963. Murray assumed the role of Acting Chairman. With only one other full-rank faculty member actually involved, the department was in a weak position, and perhaps faced absorption into another, larger, department. In 1964 the operations research group at Case Institute of Technology indicated its intention to leave, and negotiations began to combine that group with the department. The Case faculty and graduate students came on July 1, 1964. Shortly after his arrival, the new chairman, Russell L. Ackoff, asked certain of the department faculty to prepare a document describing a graduate program in theoretical statistics. He took that proposal to the Provost as evidence that the department would be moving in that direction.

In addition to serving as department chairman, Ackoff was the director of the Management Science Center of The Wharton School. Members of the statistics faculty were encouraged to participate in the consulting program of the Center as

buy-outs from their teaching loads. The center also provided support for graduate students in the Operations Research and Statistics Doctoral Programs.

The demands of a busy management consulting center and an academic department were heavy, the marriage of the statistics and operations research groups was stormy, and Ackoff turned the chair position over to Richard C. Clelland in January 1966. Clelland served as chair through June 1971, when he was appointed acting dean of The Wharton School for the coming academic year.

In a short time, Ackoff's interests shifted from operations research to the discipline he called social systems science. The original OR faculty had largely departed, and Ackoff assembled a small cadre of like-minded colleagues into the Social Systems Science Department within Wharton. Ultimately, the group left Penn for a new home in the University City Science Center, several blocks from the university. On Ackoff's passing in 2010 he was warmly remembered for his contributions as a pragmatic management guru.

In 1972 the new Wharton dean, Donald C. Carroll, arrived from the Sloan School at M. I. T. He came with a strong background in computing and the mathematical sciences. He immediately formed a committee to reconstitute the Graduate Group in Business and Applied Economics as the Wharton Doctoral Programs. Each program designed its new curriculum leading to the PhD, and the Wharton faculty unanimously approved the new doctoral group. The statistics program was not restricted to business, economics, or any other substantive discipline and for that reason the department name was changed to the Department of Statistics on July 1, 1975. The Provost declared the department to be the statistics department for the entire university. The stage was now set for it to become a full-fledged modern statistics department, a department that would further distinguish Wharton from all other business schools.

## The Later Development of the Department

The trend of the department toward mathematical statistics in both research and teaching was understandable, given the backgrounds of some of its members. Clelland came from graduate studies in pure mathematics. The theoretician Max Woodbury was briefly in the department during 1952–1954. John S. de Cani taught courses in nonlinear optimization and dealt with probabilistic and statistical models in a variety of applications. Much later the shift was evident in new faculty appointments. Jean Gibbons Fielden and Donald F. Morrison joined the department in the fall of 1963. Both had been dissertation students of Herbert A. David at Virginia Polytechnic Institute and State University.

David K. Hildebrand joined the department in 1965 after graduate study at Carnegie Institute of Technology, and a decade later began to produce introductory texts. Hildebrand cared deeply about improving the quality of business school statistical teaching, and was one of the founders of the annual conference Making Statistics More Effective in Schools of Business. James Pickands III came in 1969.

Having written his dissertation under Simeon Berman at Columbia, he was a highly regarded mathematical statistician who made seminal contributions in the area of extreme values, and as such, served as a mentor to junior faculty and PhD students with a more theoretical bent. In the 1970s and 1980s strong faculty hires included Monique Guignard–Spielberg (1972), a researcher in linear and nonlinear optimization; Abba M. Krieger (1974), with wide interests in both theory and applications; Paul Shaman (1977), a time series analyst; Robert A. Stine (1983), whose research covers credit scoring, model selection, classification and time series; and Paul R. Rosenbaum (1986), who works in the design and analysis of observational studies and experiments, and in health outcomes research.

In the late 1970s, an analysis center was established under the leadership of Lawrence S. Mayer, who came from Princeton. Well-funded, the center focused on statistical applications relating to energy, a response to the energy crises of the times. Noteworthy was the stream of high-level young researchers who spent time in the center. They included Yoav Benjamini, Richard D. DeVeaux, Stine, and Scott L. Zeger.

The department's faculty size was very small in the early years, but by the 1970s it had grown to fluctuate around 14. The size continued to increase slowly over the next 20 years, as the overall number of Wharton faculty grew substantially. The currently authorized size of the standing faculty is 21, with an additional 11 secondary appointments for faculty from other departments.

The years since 1990 have seen a dramatic transformation of the department's faculty (Fig. 3). Guignard–Spielberg transferred to the Department of Operations and Information Management in 1987, as the department turned its focus solely to statistics. The remaining departmental faculty who had started prior to 1970 retired and left throughout the 1990s, and Hildebrand died prematurely in 1999. In the first major move and turning point of the 1990s, the department hired J. Michael Steele in 1990. Steele's work in applications of probability and mathematical finance gave the department strong new directions that blended nicely with the interests of faculty and doctoral students at Wharton and across the university. With the arrival of Mark G. Low in 1991, the department began its acquisition of a very strong core of researchers in statistical inference, nonparametric function estimation, and decision theory. Dean P. Foster was hired in 1992, giving the department a strong presence in variable selection and in topics relating to economics, including inference for stochastic processes and game theory. The department's ascendancy in mathematical statistics was established when Lawrence D. Brown and Linda H. Zhao joined the department in 1994. Brown came with exceptional achievements in statistical theory, and with multiple honors, including membership in the National Academy of Sciences. Zhao brought further strength in Bayesian analysis and decision theory. In 1998 Abraham J. Wyner joined the department, providing expertise in probabilistic modeling, information theory, and data compression.

Moving to the 2000s, T. Tony Cai came to the department in 2000, further cementing the preeminence of mathematical statistics. Cai's wide-ranging interests in statistical inference included high-dimensional inference, functional data analysis,

**Fig. 3** Some department faculty in the 1990s. (Top row, left to right) David Hildebrand, Don Morrison, Mike Steele, Abba Krieger. (Bottom row, left to right) Bob Stine, Paul Rosenbaum, Dean Foster, Mark Low (holding Robyn Low)

large-scale multiple testing, nonparametric function estimation, and methodology and applications with wavelets. Next came Edward I. George in 2001, a senior hire who had already made significant contributions to Bayesian and frequentist decision theory, shrinkage estimation, tree modeling, and variable selection. He was quickly followed in 2002 by another senior hire, Andreas Buja, a preeminent researcher in modern multivariate analysis, statistical computing, and data visualization.

Six of the current faculty came as junior appointments in the next succession of hires: Dylan S. Small in 2002, with expertise in the analysis of observational studies, and in applications of statistics to questions arising in public health, medicine, and economics; Shane T. Jensen in 2004, with expertise in bioinformatics, hierarchical modeling, and MCMC methods; Alexander Rakhlin in 2008, with expertise in machine learning, sequential decision making, statistical learning theory, and applied probability; Sham Kakade in 2009, with expertise in machine learning, probabilistic artificial intelligence, algorithmic statistics, and game theory; Zongming Ma in 2010, with expertise in high dimensional statistical inference, nonparametric statistics, random matrix theory, and graphical modeling; and Emily B. Fox in 2011, with expertise in Bayesian and nonparametric Bayesian approaches to time series and longitudinal data analysis.

Three other recent appointments have served to add luster and breadth to the department. After a long and distinguished career at Bell Laboratories, spanning 34 years, followed by 13 years at Rutgers, Lawrence Shepp joined the department in 2010. A researcher with significant contributions in many areas of probability, statistics, and image reconstruction, he has received multiple honors, including membership in the National Academy of Sciences, the Institute of Medicine, and
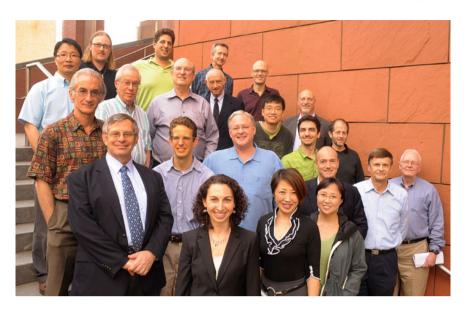
**Fig. 4** The faculty of the department for 2011-2012. From left to right: (1st row) Emily Fox, Linda Zhao, Nancy Zhang, Richard Waterman, Jean Lemaire, Mike Steele; (2nd row) Abba Krieger, Dylan Small, Ed George, Sasha Rakhlin, Paul Rosenbaum; (3rd row) Bob Stine, Paul Shaman, Larry Brown, Don Morrison, Dean Foster, Zongming Ma, Richard Berk; (4th row) Tony Cai, Shane Jensen, Adi Wyner, Andreas Buja. (Absent: Mark Low, Sham Kakade, Larry Shepp)

the American Academy of Arts and Sciences. Coming to the department from the faculty at Stanford, Nancy Zhang joined the department with tenure in 2011. Her research has focused on the development of new methodology for the statistical analysis of high-throughput biological experiments, adding substantial strength to the department's expertise in bioinformatics. Finally, Jean Lemaire, a distinguished professor of the Insurance and Risk Management Department and Director of the Actuarial Science Program at Wharton since 1987, migrated his primary appointment to the department in 2011. This appointment establishes a departmental research and teaching presence in the allied statistical areas of insurance and actuarial science. Figure 4 shows the current department.

## Teaching

Throughout its history, the department has always taught undergraduates, master's students, and doctoral students. Though the bulk of its teaching has taken place in Wharton, the department has also functioned as a teaching department for much of the entire university, a responsibility that has gradually increased over time.

The first 11 doctoral degrees awarded by the department were all completed under the direction of Simon Kuznets. The first three recipients, Bursk (1931),

Burdick (1935), and Murray (1944), and later Hamburg (1952), all became faculty members, as previously noted. Two more graduates of the department, Robert C. Jones and de Cani, were students of the Wharton financial economist Irwin Friend, and joined the faculty in 1958. They retired in 1994 and 1995, respectively. The pace of PhD production in the department picked up in the 1950s, with 17 awarded. All of the early dissertations dealt with the statistical analysis of economic data. For instance, Bursk's dissertation was entitled Seasonal Variations in Employment in Manufacturing Industries: A Statistical Study Based on Census Data, and the title of Hamburg's thesis was The Income Elasticity of Food Purchases, 1929–1948. It was not until 1968 that a departmental graduate wrote a dissertation focused on statistical methodology. This marked a turning point, as all departmental dissertations since the late 1970s have addressed statistical theory and/or methodology. In the first 30 years, the department graduated 22 PhDs with five becoming ASA fellows, including Hamburg, and de Cani. The following table shows the volume of PhD production by decade.

| Decade | Number of PhDs |
| --- | --- |
| 1930–1939 | 2 |
| 1940–1949 | 1 |
| 1950–1959 | 17 |
| 1960–1969 | 10 |
| 1970–1979 | 15 |
| 1980–1989 | 16 |
| 1990–1999 | 21 |
| 2000–2009 | 44 |

For a long time the department matriculated terminal master's students, as well as doctoral students. This practice stopped in the late 1980s when Wharton eliminated matriculation into terminal master's programs except for the MBA program. The department's doctoral program matriculation counts ranged from 2 to 6 per year in the 1980s and 1990s, becoming more stable after 2000, ranging from 4 to 6 per year. The percentage of matriculants completing the doctorate has also increased sharply, with essentially all now finishing.

Moves to change the department's curriculum began to emerge in the 1960s. Partly in response to the Educational Survey, five of the department faculty collaborated on a text for the two-semester statistics course required of all Wharton undergraduates (Clelland, et al., 1966, 1973).

During 1959–1960 Hamburg spent the academic year at the Harvard Business School in a Ford Foundation program introducing Bayesian statistical decision theory to business school faculty. On his return to Penn, Hamburg incorporated this material into the basic courses of the Wharton MBA Operations Research Option, and he directed several doctoral dissertations in decision theory. One of his outstanding students, Paul E. Green, became a mainstay and much-cited member of the Wharton Marketing Department.

In the graduate program Fielden introduced a course in nonparametric inference and began work on a text (Gibbons, 1970) for it. Morrison developed a two-semester course in multivariate statistical theory and methods, and produced a book for the methods component (Morrison, 1967). Concurrently, Hamburg prepared a text for the MBA statistics course with an extensive treatment of statistical decision theory and Bayesian inference (Hamburg, 1970). And Hildebrand developed a two-semester course in statistics for undergraduate psychology and biological basis of behavior majors that extended into complex experimental designs and the analysis of variance for cognitive investigations. Hildebrand went on to write a text for the course, and also texts for the introductory courses taught to Wharton undergraduate students and to MBA students. All of his texts reflected updated methods of teaching.

At the start of the 1990s, Wharton instituted a major overhaul of the MBA core curriculum. In response to this, Hildebrand produced notes that completely redesigned the required statistics course in the MBA core. The new treatment stressed interpretation and, with computer usage, avoided the details of statistical computation. Many real data sets were utilized to illustrate the use of methodology and provide interpretive examples. Later these notes were thoroughly revised and expanded by Foster, Stine, and Richard P. Waterman, a faculty member from 1993 to 1999. This led to publication of two casebooks (Foster, Stine and Waterman, 1998a, 1998b). Later, Foster and Stine authored an introductory statistics text for both the undergraduate and MBA students (Stine and Foster, 2011).

## Research

In various combinations with each other and with other researchers, Larry Brown, Tony Cai, Mark Low, and Linda Zhao have collaborated to investigate a variety of statistical issues with a special focus on nonparametric function inference. An important substream began with a paper by Brown and Low describing the asymptotic equivalence of two forms of nonparametric function estimation problems, nonparametric regression, and the white-noise signal estimation problem. Cai, with partial collaboration of Brown, has developed a long stream of innovations in the practice and theory of wavelet estimation. Cai and Low have devoted extensive attention to research into general adaptivity properties. Recently, Brown, Low, Zhao, and other coauthors have joined together these research streams, using wavelets, and ideas from the adaptivity investigations to propose improved nonparametric density function estimators.

A good deal of Michael Steele's research has focused on those parts of probability theory that share a connection with combinatorial optimization. The classic problems of this field are those associated with the traveling salesman problem, minimal spanning trees, and optimal matching. The central unifying object of this field is the subadditive Euclidean functional introduced by Steele in 1981. Steele has also studied discrete time processes, worked on interest rates, and written a text

on stochastic calculus with applications to finance (Steele, 2001). Another theme throughout his research work has been the development of inequalities, and he is the author of a monograph on this subject (Steele, 2004).

Abba Krieger's research has included the development of methodology for grouped data, categorical data, sample surveys, and observational studies. He also developed stochastic models for applications, and obtained worst-case bounds for operations research problems. In the 1980s with Paul Green, he engaged a wide variety of problems in marketing research, with a prominent focus on conjoint models. Krieger's recent applied work is in neuroscience, studying seizure propagation as a result of epilepsy and addressing various clinical questions such as whether seizures are predictive and whether they are localized.

Paul Rosenbaum's research has focused on design and analysis of observational studies and experiments, and on health outcomes research. With Donald B. Rubin, Rosenbaum developed the propensity score. He is the author of two books on observational studies (Rosenbaum, 2002, 2010). Dylan Small has studied causal inference, longitudinal data analysis, and applications of statistics to health studies. He has particularly contributed to methods for using instrumental variables, developing methods of sensitivity analysis, nonparametric estimation, building a stronger instrument and correction for measurement error, as well as applications of instrumental variables in neonatology comparative effectiveness studies. Rosenbaum, Small, Krieger, and Shane Jensen have collaborated in various combinations on research on observational studies.

In the early 1990s, Dean Foster and Ed George started a push for regression with large data sets by introducing the risk inflation criterion (RIC), which used an oracle argument to gauge variable selection uncertainty. Later in the decade, they developed empirical Bayes variable selection criteria with adaptive penalties. In the early 2000s, Foster and Robert Stine pushed large stepwise regressions to new limits, using a variety of techniques to improve the accuracy, and guarantee theoretical properties of such faster methods. Foster and Stine also reconsidered model selection from an information theory point of view, and developed new methods for testing multiple hypotheses. In another stream of work, Stine and Paul Shaman analyzed bias for several methods of autoregressive parameter and spectral estimation.

Beyond his work with Foster, George's research with other co-authors has included the methodological development of Bayesian variable selection, Bayesian CART, Bayesian treed modeling and Bayesian additive regression tree (BART) modeling, as well as the development of theoretical minimaxity and admissibility results for multivariate predictive density estimation.

A primary line of Andreas Buja's research is in data visualization, pushing the reach of what can be "seen" in high-dimensional data. He has also contributed to multidimensional scaling methodology, providing visualization of objects as varied as social networks, and manifolds in high-dimensional spaces. In recent years he has introduced statistical inference to data visualization, to help avoid reading "tea leaves," or random patterns in data. Buja's other lines of work include function

fitting, machine learning, and, most recently in collaboration with Richard Berk, Brown, George, Zhao and others, the problem of "post-selection inference."

Abraham Wyner has contributed research in a variety of areas, including information theory, machine learning, and climate science. His work has provided fundamental insight into the workings of the Lempel–Ziv data compression algorithm as well as into the limitations of boosting algorithms. He has recently focused on the statistical analysis of climate field reconstructions, demonstrating the large uncertainties underlying conventional wisdom about global warming.

Shane Jensen has worked extensively on statistical modeling in molecular biology and genetics. He has developed novel hierarchical models and semi-parametric approaches to address the rapid advances in DNA sequence analysis, regulatory network inference, gene expression analysis, and genome evolution. He has also collaborated with Wyner on the use of statistical models of player performance in major league baseball, with a focus on the quantitative analysis of fielding ability.

Alexander Rakhlin, working with co-authors, has formulated a minimax theory for sequential prediction problems. Analogs of many classical results from statistical learning theory can be proved in the setting of worst-case sequential prediction. A further generalization of these results gives a unified treatment to such problems as calibration of forecasters, Blackwell's approachability, regret minimization, and more.

Sham Kakade's research is in machine learning and artificial intelligence, with the objective of contributing to the statistical tools needed to make progress on core AI problems. The focus is on the core challenges facing machine learning: representational learning, large-scale learning and algorithmic statistics, and decision making in high-dimensional action spaces.

Zongming Ma's research focuses on high-dimensional statistical inference. Of particular interest are problems where only a small number of the unknown parameters under a suitable model are pertinent to statistical inference. Key questions include selection and estimation of the relevant parameters.

Emily Fox's research focuses on developing Bayesian and Bayesian nonparametric methodology for multivariate time series analysis. She has developed regime-switching and heteroscedastic models with application to a wide variety of domains including analysis of human motion, speech data, EEG, and stochastic volatility of stock indices.

Lawrence Shepp's research interests are diverse, including probabilistic, combinatorial, and statistical analysis models for problems arising in physics, engineering, and communications. They include computer tomography, automatic pattern recognition, probabilistic models for phase transitions, connectedness of random graphs, the mathematics of finance, and genetics.

Nancy Zhang's research interests lie at the intersection of statistics and biology. Her contributions involve innovative modeling methods for genomic profiling including new approaches for variable selection, data subsampling, false discovery rate control, and importance sampling.

A major contribution of Jean Lemaire's research has entailed the application of Markov chains to bonus-malus systems for automobile insurance (Lemaire 1995). He has also studied the adverse effects of prohibiting insurers from seeking genetic testing information, employed multiple decrement theory to estimate the life expectancy reduction from gunshot wounds, and used panel data techniques to improve prediction of insurance sales.

## Service

Departmental members have served as editors and officers for the professional societies, and in administrative positions at the University of Pennsylvania. Morris Hamburg was editor of The American Statistician from the April 1956 issue through that of February 1972. Under his stewardship the magazine matured from news and notices to one carrying more technical and scholarly articles. Donald F. Morrison assumed the editorship with the April 1972 issue, and continued that trend, with the encouragement of expository papers, until the end of his term in December 1975. Larry Brown and Tony Cai have both served as co-Editor of The Annals of Statistics, Brown during 1995–1997, and Cai during 2010–2012. Michael Steele was the first Editor of The Annals of Applied Probability, 1991–1993, Andreas Buja was Managing Editor of the Journal of Computational and Graphical Statistics, 1997–2000, and Ed George was Executive Editor of Statistical Science, 2005–2007. Further, both Brown and Steele have held the position of IMS President, Brown in 1992–1993, and Steele in 2009–2010. George was President of the International Society for Bayesian Analysis, 2003, and Nancy L. Geller, a departmental member during the 1970s, was the 2011 ASA President. Brown is Chair of the Committee on National Statistics for the term 2010–2013. Paul Shaman was IMS Managing Editor during 1986–1989, and IMS Managing Editor for Statistics, 2002–2007.

At the University of Pennsylvania, Richard Clelland was Acting Dean of The Wharton School during 1971–1972 and a Wharton Associate Dean from 1975 to 1981. He became the first Deputy Provost of the university when the position was created in 1982, and continued until his retirement in 1992.

## Honors and Awards

Simon Kuznets' Nobel Prize (1971), Larry Brown's membership in the National Academy of Sciences (1990), and Larry Shepp's membership in three academies, the National Academy of Sciences (1989), the Institute of Medicine (1992), and the American Academy of Arts and Sciences (1993), have already been mentioned. Both Brown and Shepp have been awarded honorary degrees, Brown from Purdue University (1993) and Shepp from New York Polytechnic University (2004).

**Fig. 5** Larry Brown celebrates his 70th birthday at a Wharton conference in his honor with Linda Zhao and three of his former PhD students, Jim Berger, Iain Johnstone and Tony Cai. From left to right: Zhao, Berger, Johnstone, Cai and Brown

Brown (Fig. 5) received the Wilks Award from ASA (2002) and the C. R. and B. Rao Prize (2007). Shepp received the Paul Lévy Prize (1966) and the IEEE Distinguished Scientist Award (1979). Jean Lemaire received the International INA-Lincei Prize from the Italian Academy of Sciences (1988). Mike Steele received the Frank Wilcoxon Prize from ASQC and ASA (1990). Paul Shaman was awarded the Harry C. Carver Medal by IMS (2004). Paul Rosenbaum was the recipient of the COPSS George W. Snedecor Award (2003), and Tony Cai the COPSS Presidents' Award (2008). Alexander Rakhlin was given an NSF CAREER Award for 2010–2012.

Brown delivered the IMS Wald Lectures in 1985 and an invited World Mathematics Conference Lecture in 2002. IMS Medallion Lectures have been given by Brown (2006), Andreas Buja (2002), Cai (2009), Ed George (2010), and Mark Low (2008).

Six faculty members, six secondary faculty members, one adjunct faculty member, and 12 former faculty members have been named ASA Fellows. As noted, five graduates of the doctoral program, two of whom were faculty members, are ASA Fellows. Nine faculty members, one secondary faculty member, and four former faculty members are IMS Fellows.

Eleven members of the department have been appointed to named chairs in The Wharton School. They are Steele (1991), Brown (1994), Krieger (1996), Rosenbaum (2001), George (2002), Buja (2003), Lemaire (2005), Cai (2007), Foster (2007), Low (2007), and Shepp (2010). The department has a long list of teaching awards. John de Cani (1964), Abba Krieger (1978), Robert Jones (1979), and Morris Hamburg received Lindback Awards for Distinguished Teaching. Krieger

(1977), Richard Waterman (1997) and Robert Stine (2011) were recipients of the Helen Kardon Moss Anvil Award, given once a year for excellent teaching to MBA students. The David W. Hauck Award for Excellence in Undergraduate Teaching, given twice a year, was awarded to Krieger (1996), Stine (2001), Lemaire (2008), and Jensen (2009). The Award for Excellence in Undergraduate teaching was given to Lemaire (2004, 2006, 2007, 2008, 2011), Steele (2010) and Low (2011), and the Provost's Award for Distinguished PhD Teaching and Mentoring was given to Brown (2011). In addition to these, George, Krieger, Stine, and Waterman (who has continued to teach MBA classes in an adjunct capacity) have been the recipients of multiple teaching awards.

## Appendix

| Department Names | |
| --- | --- |
| Department of Economic and Social Statistics | 1931–1964 |
| Department of Statistics and Operations Research | 1964–1975 |
| Department of Statistics | 1975– |

| Department Chairs | |
| --- | --- |
| J. Parker Bursk | 1932–April 1963 |
| Donald S. Murray (Acting Chair) | May 1963–June 1964 |
| Russell L. Ackoff | July1964–December 1965 |
| Richard C. Clelland | January 1966–June 1971 |
| John S. de Cani | July 1971–June 1976 |
| Donald F. Morrison (Acting Chair) | July 1976–December 1976 |
| John S. de Cani | January 1977–June 1978 |
| Donald F. Morrison | July 1978–June 1985 |
| David K. Hildebrand | July 1985–June 1990 |
| Paul Shaman | July 1990–June 2002 |
| Abba M. Krieger | July 2002–June 2008 |
| Edward I. George | July 2008– |

*Standing Faculty Roster in 2011–2012, with year of appointment*

Lawrence D. Brown, 1994; Andreas Buja, 2002; T. Tony Cai, 2000; Dean P. Foster, 1992; Emily B. Fox, 2010; Edward I. George, 2001; Shane T. Jensen, 2004; Sham M. Kakade, 2010; Abba M. Krieger, 1974; Jean Lemaire, 2011; Mark G. Low, 1991; Zongming Ma, 2010; Alexander Rakhlin, 2009; Paul R. Rosenbaum, 1986; Lawrence Shepp, 2010; Dylan S. Small, 2002; J. Michael Steele, 1990; Robert A. Stine, 1983; Abraham J. Wyner, 1998; Nancy Zhang, 2011; Linda H. Zhao, 1994.

*Secondary Appointments in Department of Statistics, Academic Year 2011–2012*

Richard A. Berk, Criminology; Robert F. Boruch, Graduate School of Education; Eric T. Bradlow, Marketing; Francis X. Diebold, Economics; Daniel F. Heitjan, Biostatistics and Epidemiology; Michael Kearns, Computer and Information Science; J. Richard Landis, Biostatistics and Epidemiology; Hongzhe Li, Biostatistics and Epidemiology; Max Mintz, Computer and Information Science; Robin Pemantle, Mathematics; Ben Taskar, Computer and Information Science.

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