

Department of Statistical Science Southern Methodist University

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July 14, 2011

Visionary Founding

Paul D. Minton graduated with Bachelor of Science and Master of Science degrees in mathematics from Southern Methodist University (SMU). Following the completion of his doctoral degree in statistics from the University of North Carolina (Chapel Hill) in 1951, he returned to SMU along with a vision of a unique statistics department within a university that had as its primary mission a broad-based liberal arts undergraduate education. Minton's vision focused on his belief that statisticians were collaborators and that there was no limit on opportunities for collaboration in statistics, regardless of the nature and mission of an academic institution. The key to achieving this vision was the collaborative merging of interests and opportunities within the university and throughout the local region.

Recognizing the growing importance of computing to the implementation of statistical theory and methods in industrial, agricultural, governmental, and social applications, Minton founded the university's Computing Laboratory in 1957 and remained its head until 1962. The Computing Laboratory maintained or provided remote access to commercial state-of-the-art mainframe computers and provided the earliest access for the university community to scientific computing and computing/statistical support. Simultaneously, he built university support for the creation of a free-standing department of experimental statistics. SMU approved the *Department of Mathematical and Experimental Statistics* and a master's degree program in statistics in 1961. The program grew out of courses and services in statistics offered by the Mathematics Department and by the Computing Laboratory. Minton chaired the new department which initially consisted of two faculty members, himself and Vanamamalai Seshadri, and fifteen graduate students. The first graduate of the Statistics Department was Vann B. Parr who was awarded a Master of Science degree in 1963.

Early Growth

From 1964-1966 the Department of Mathematical and Experimental Statistics began to establish its teaching and research credentials. Most of its faculty members were quarter-time research collaborators at the *Southwest Center for Advanced Studies* (the precursor of the *University of Texas at Dallas*) working in the Division of Mathematical and Stochastic Systems headed by Donald B. Owen. These joint appointments not only reinforced Minton's emphasis on developing a department with a strong emphasis on collaborative research, it also enabled the department to attract like-minded colleagues who would not otherwise have been attracted to the region.

In 1966 the newly renamed *Department of Statistics* became one of the first at SMU to offer a doctoral program. Major assistance in establishing the program came from a *National Institutes of Health* training grant in Biometry and was the culmination of early collaboration between the department and the *University of Texas Southwestern Medical School at Dallas*. Additional graduate student and research funding was secured by Professor John E. Walsh from the *Mobil Research and Development Corporation*. In addition to Minton (1961-1972) and Walsh (1967-1972), Professors Richard P. Bland (1963-1988), Chandrakant H. Kapadia (1963-2001), Anant Kshirsagar (1968-1971), Donald B. Owen (1966-1991), William T. Tucker (1966-1972), and John T. Webster (1962-1987) joined the faculty during this early period of growth. The first Ph.D. graduate of the department was Lowell Gregory in 1968.

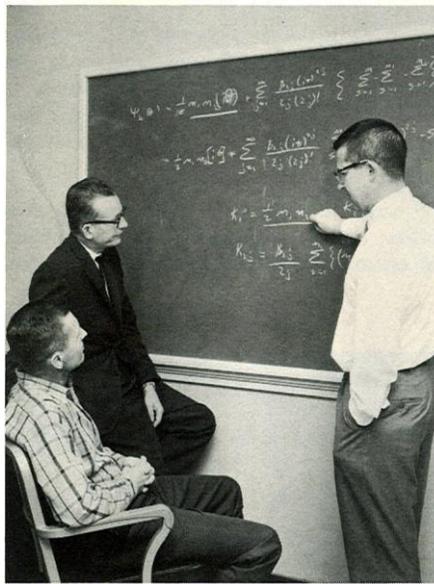


Figure 1.

[Early brochure picture left to right: Richard Bland, Paul Minton, and Jack Webster.]

In 1968 a THEMIS contract was obtained from the *Department of Defense*, and continued through the *Office of Naval Research* until 1975 with total funding of about \$1M. There was no cost sharing on this contract and over \$700,000 went into the development of the Statistics Department. The intent was to make SMU a center of excellence in the field of statistics. The THEMIS support by the Department of Defense implied a commitment on the part of SMU to provide continued support and development of the Statistics Department. The department typically graduated about five Ph.D.'s per year in the period from the late 1960's to the mid 1970's.

A major change in facilities accompanied this early period of departmental development. Minton's emphasis that statistics was a discipline important to a wide range of departments and programs on campus, especially research-oriented doctoral programs, enabled him to convince administrators that the Department of Statistics should be

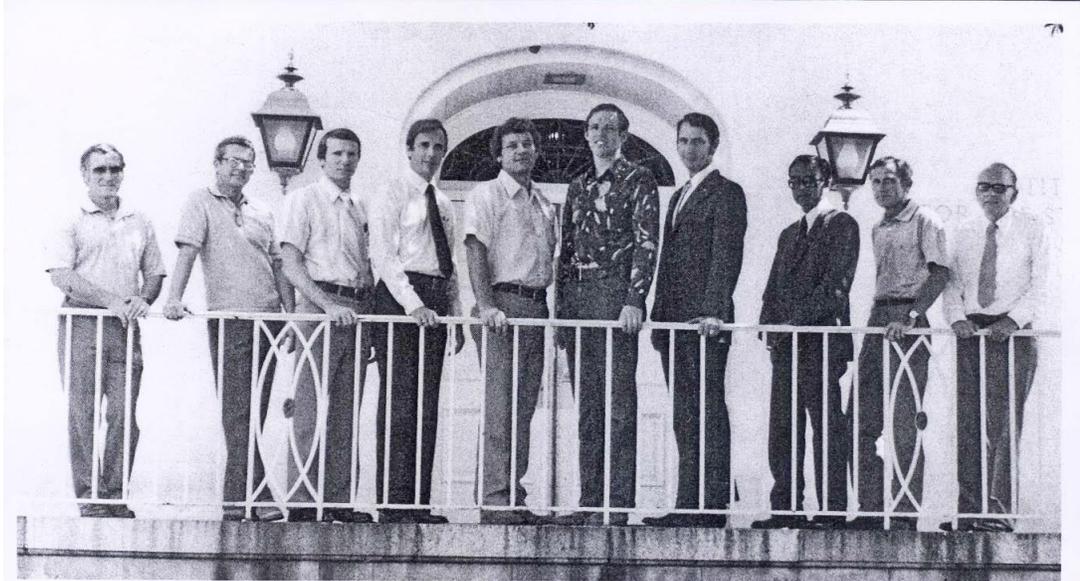
included in the planning for a new building. In 1969, the department joined two other Ph.D. programs, Anthropology and Geology, in moving to the new Heroy Science Hall. The design of the first floor of this building included classrooms, a departmental office, faculty offices along the outer wall and graduate student offices along the inner wall for the Department of Statistics. The placement of the faculty offices relative to the graduate student offices continues to serve its initial intended purpose, to facilitate routine and frequent interactions between faculty and graduate students.

The departmental faculty reached its peak size in the mid 1970's. In addition to Bland, Kapadia, Owen, and Webster, the faculty included J. Wanzer Drane (1968-1985) and Campbell B. Read (1969-1999) who had joint appointments with University of Texas Southwestern Medical Center at Dallas (UTSW) until 1976. Also added were, U. Narayan Bhat (1969-2004), joint with the *Operations Research Department*, William R. Schucany (1970-2011), Richard F. Gunst (1971-present), Jagdish Patel (1972-1975), Henry L. (Buddy) Gray (1973-2004, *C.F. Frensley Professor of Mathematical Sciences*), joint with the *Department of Mathematics*, Harold J. Hietala (1973-2002, joint with the *Department of Anthropology*), and Wayne A. Woodward (1974-present). These hires solidified the founding vision of collaborative activities across the university and region.

Evolution and Impact on the University

Owen succeeded Minton as Chair in 1972, and with a core group of research scholars in the department, he led the faculty to fulfill a new university mandate of increased scholarly productivity and visibility. The department's national visibility received a major boost when the department hosted the *1974 Symposium on the American Mathematical Heritage to Celebrate the Bicentennial of the United States of America*. This symposium brought distinguished architects of the foundations of statistical theory and methods in the United States to campus, including William G. Cochran, Herman Chernoff, H.O. Hartley, Oscar Kempthorne, Jersey Neyman, and Elizabeth L. Scott. This was a very prestigious symposium at the time and the presence of so many renowned scholars provided the relatively young faculty opportunities for personal interactions and exposure at a critical juncture in their development into recognized scholars within the field of statistics.

In 1979 a *Division of Mathematical Sciences* was created in order to streamline the administration of the mathematical sciences on campus and to foster a synergy between the Departments of Mathematics and Statistics in the School of Humanities and Sciences and the Department of Operations Research in the School of Engineering. U. Narayan Bhat was appointed to be the Director of the Division. It rapidly became clear that this organizational change was not serving its intended purposes. Simultaneously with Bhat being selected to be Vice Provost and Dean of Graduate studies in 1980, the Department of Operations Research administratively returned to the School of Engineering. Schucany was named Director of the reduced Division, and Gunst was named Chair of the Department of Statistics. This lasted one more year, at which time the two departments mutually agreed to return to the School of Humanities and Sciences as separate programs. Gunst remained Chair of the Department of Statistics.



Pictured: Henry Gray, John Webster, Richard Gunst, Wayne Woodward, William Schucany, John Boyer, Wanzer Drain, C. H. Kapadia, Richard Bland, Donald Owen.

Figure 2. Faculty Group in 1979 from left to right: Gray, Webster, Gunst, Woodward, Schucany, Boyer, Drane, Kapadia, Bland, and Owen

The department's faculty voted in 1986 to change the department's name to the *Department of Statistical Science* in order to emphasize the scientific nature of the discipline. Doing so focused the image of the department on its role in creating novel statistical theory and methods that are based firmly on scientific principles.



Figure 3. Faculty Group in 1984 from left to right: Bland, Mee, Gunst, Bhat, Eubank, Drane, Schucany, Read, Kapadia, and Owen

Administrative support for the university has long been an accepted responsibility of department faculty. In addition to Minton and Owen, department faculty who administratively led the program, each with more than one term as chair, are Bhat (1979-1980, 1987-1989), Gunst (1980-1984, 2000-2006), Schucany (1984-1987, 1989-1990, 1997-2000), and Woodward (1990-1997, 2006-2012). Gray, in addition to his responsibilities as the Frensey Chair holder, served in several administrative positions in Dedman College, the renamed School of Humanities and Sciences: Associate Dean (1980-1988), Dean ad-interim (1988-1989) and Dean and Vice Provost (1989-1991). While serving in these positions he was instrumental in promoting scholarly research and strong graduate programs.

Faculty members not mentioned previously who spent several years as faculty colleagues include John Boyer, Randall Eubank, Paul Whitney, Georgia Thompson, Robert Brunell, Rudy Guerra, Yuli Koshevnik, Sabyasashi Basu, Roberto Gutierrez, Steve Sain, William Christensen, and Raji Natarajan.



Figure 4.

[Faculty group in 2000 left to right: Read, Gray, Schucany, Kapadia, Woodward, Bhat, Natarajan, Gunst, Christensen, Guerra, and Sain]

Research and Graduate Program

The *Statistical Research Laboratory* (Stat Lab) was founded in 1968 to provide expert statistical consulting services to the academic and business communities while at the same time providing consulting experiences for the department's graduate students. Schucany served as the first manager of the Stat Lab while he completed his doctoral research. The structure of the Stat Lab has gone through a number of changes over the succeeding decades. From 1970-1979 the manager of the Stat Lab was a permanent full-time faculty member who taught a statistical consulting course and infrequently taught other courses within the curriculum. In addition to Schucany, Stat Lab managers during this time were William H. Frawley, Gunst, and Woodward.

In 1980 the Stat Lab manager became a salaried staff position. The manager was expected to bring in sufficient income from clients, short courses, grants, and contracts to meet the budgeted salary. Because of fluctuations in income generation, a third style of organization was implemented in which the Stat Lab manager received little if any salary from the university. The department provided an office and computing support and allowed the manager to conduct business as a statistical consultant. In return the manager taught a graduate-level statistical consulting course and facilitated actual consulting experiences for the students. Currently there is no functioning Stat Lab with a manager.

Graduate students continue to receive consulting training and experiences through the statistical consulting course, participation with faculty who are all heavily involved in collaborative research projects on and off campus, and a wide array of summer internships.

Owen's experiences at Sandia National Laboratories instilled in him a keen interest in numerical tables of probability distributions. In addition, military requirements of World War II and the Cold War led to continual funding opportunities for his work. His 1962 *Handbook of Statistical Tables* was used throughout the nation as the source of high quality tables of distributions and other quantities needed in contemporary statistical applications. One reason for the popularity of the tables was his insistence that he would not publish tables unless he had at least two very different algorithms for the calculations, a self-imposed check to ensure accuracy. This was a difficult and laborious task both in finding dual algorithms and in performing the computations themselves in the period just before widespread use of computers. Even when mainframe computers became available he would insist on two or more different computing algorithms, not simply coding the same algorithm two or more different ways. Much of Owen's later work concentrated on computational algorithms for the developing field of what was then termed *quality control*. This was a natural transition to industrial product and process improvement that had its early emphasis in wartime military needs.

Perhaps one of Owen's greatest contributions to research came from his desire to alleviate the inordinately long time delay from the completion of statistical research efforts to ultimate publication, a problem that persists today. His frustration with this lengthy process led to the creation of a new, corporately financed journal which he titled *Communications in Statistics*. The novel feature of this journal was the transfer of responsibility and authority for acceptance of submitted articles to a carefully selected group of reviewers, the journal's International Editorial Board. Board members could accept an article either after personally reviewing it or after having it reviewed by a referee more familiar with the topic of the article. The obvious concern about the quality of the refereeing process was mitigated by publishing the names of reviewers along with the article itself. This novel approach to scientific publication achieved its goal of rapid publication in the field of statistics.

Walsh's international stature was solidified by the publication of the three volumes of his *Handbook of Nonparametric Statistics* in 1962, 1965, and 1968, which was the state of the art reference for nonparametric statistics at the time. The success of both Walsh and Owen in their research programs attracted large numbers of graduate students to the department.

Linear model theory and applications (including regression) and multivariate analysis were also strengths of the department at this time. Webster and Kapadia, from their roots at North Carolina State and Oklahoma State, respectively, formulated core courses in linear models and experimental design. Kshirsagar also contributed to the linear models research and teaching but is mostly associated with his work in multivariate analysis and discriminant analysis, topics that led to his 1972 *Multivariate Analysis* text.

This text was the second in the new Marcel Dekker series of statistics publications, a series edited by Owen. The “renegade” in the department at his time was Bland, who taught and promoted the widely shunned topic of Bayesian methods. All of these research areas led to the creation of courses and to doctoral dissertations.

When Bhat joined the Department of Statistics full-time in 1979, he brought a well-developed research program in stochastic processes and queuing theory. His 1971 *Elements of Applied Stochastic Processes* formed the basis for graduate-level courses in his fields of expertise, courses which served graduate students in the department and in the Engineering School. His research program, combined with those of Gray and Woodward, formed a strong emphasis on theoretical and applied research in stochastic processes and time series.

Gray was conducting basic research in improved convergence of numerical sequences when he first joined the department in 1973. Owen encouraged Gray and Schucany to adapt this work to the bias reduction feature of the jackknife, enabling them to generalize this distribution-free approach to bias reduction. While Schucany continued work in bias reduction, Gray, soon joined by Woodward in a long and highly productive collaboration, redirected his efforts to research in time series modeling and analysis. They created a research team involving graduate students over the ensuing three decades in the areas of spectral estimation, ARMA model identification, long-memory time series, and the analysis of time series with time-varying frequencies.

Over this same time span, Schucany continued work on bias reduction and other nonparametric research areas, including rank statistics, kernel smoothing, and resampling methodologies. His research program resulted in major publications on the jackknife, bootstrap intervals, concordance of rankings, goodness of fit, minimum-distance estimation, adaptive bandwidths for nonparametric regression, simulation methodology, permutation tests, and wavelet resampling.

Gunst, building on his early mentoring by Webster, diversified the department’s research programs in linear models and regression. Initial emphasis was on biased regression estimators, including ridge regression, principal components regression, and latent root regression. He and his students also contributed to the growing interest in influence diagnostics for regression models. Recognizing the tenuous nature of assuming nonstochastic covariates and independent errors in regression modeling, he pursued work in measurement error modeling and spatial modeling, respectively. All of these topics continue to be taught in advanced graduate courses in regression.

Read was an important contributor to the department’s research and graduate programs during this period, and he became first an Associate Editor and later a co-Editor with founders, Norman L. Johnson and Samuel Kotz of Wiley’s nine-volume *Encyclopedia of Statistical Sciences* in 1982. Read not only edited many of the articles contributed to the encyclopedia, now 16 volumes, but he also wrote a large number of them.

Evolving Research Programs

In addition to Gunst and Woodward, current full-time tenured or tenure-track faculty are Ronald W. Butler (2007), Jing Cao (2005), Ian R. Harris (2001), Monnie McGee (2002), Hon Keung (Tony) Ng (2002), S. Lynne Stokes (2001), and Xinlei (Sherry) Wang (2003). Butler became the *C.F. Frensley Professor of Mathematical Sciences* following Gray's retirement. He is internationally recognized for his ongoing research program on saddlepoint methods. Other areas of major activity are bootstrap methods, survival analysis, systems theory, and stochastic networks.

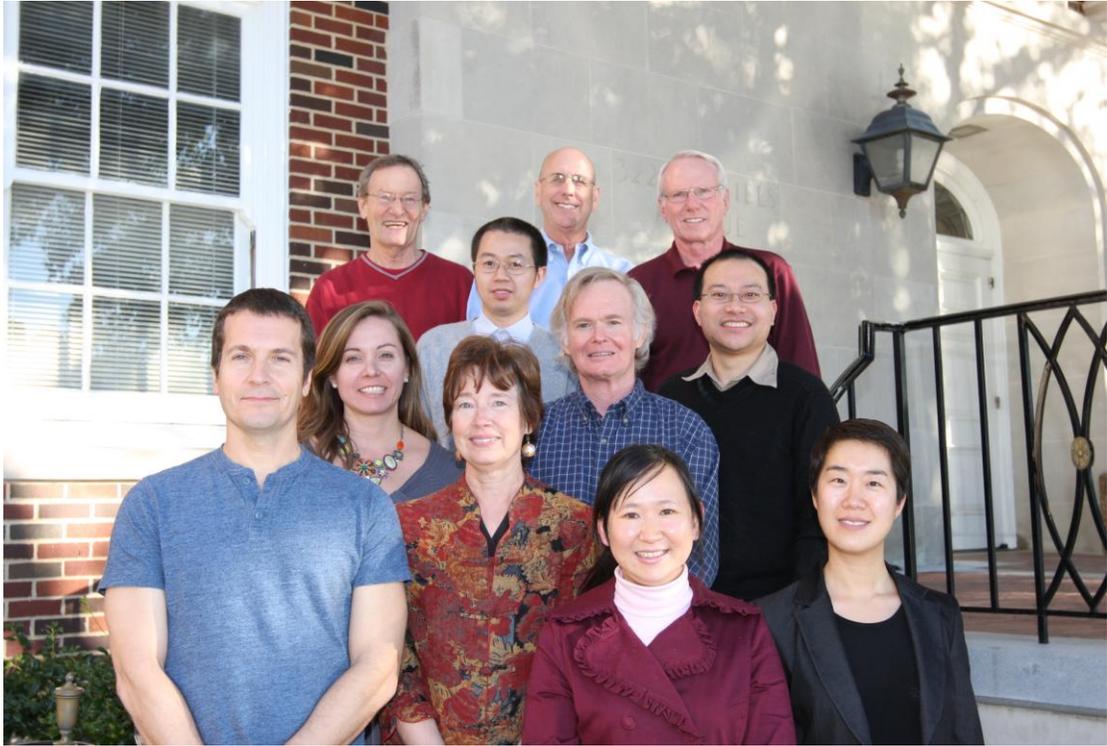


Figure 5. [Faculty in 2010/11: front row left to right Harris, Stokes, Wang, and Cao; middle left to right McGee, Gui(visiting), Butler, and Ng; top row left to right Schucany, Woodward, and Gunst].

A major research emphasis over the last decade by Stokes, Harris, and Cao has been collaboration with colleagues in the *Simmons School of Education and Human Development*. Areas of active research include studies of the relationship between low motivation and test-taking behavior, the predictive ability of teacher fidelity intervention measures on student performance, and statistical modeling and assessment of the outcomes of large-scale reading intervention programs. Over her career, Stokes has worked on problems of modeling and measuring non-sampling errors in surveys. Her early work focused on measurement of interviewer variance and effects of other interviewer errors, including undercount, in Census data. She also studies methods for improving data collection efficiency, for example by using ranked set sampling and other

methods making use of auxiliary information, and methods for ensuring privacy and confidentiality in data collection.

Ng is building a prolific research program that emphasizes censoring, precedence testing, and survival modeling and analysis. He is applying this work not only to industrial applications but also in epidemiology with colleagues at Baylor Medical Center at Dallas. Tony has assumed the role as our computing guru. In this position he teaches the graduate course on statistical computing to our first year graduate students and oversees departmental hardware and software.

Currently, the most extensive areas of collaborative research activities involve research groups of department faculty and graduate students with colleagues at UTSW. McGee collaborates with colleagues in the UTSW Department of Pathology on developing methods for determining whether genes are significantly overrepresented in biological pathways of interest. A goal of this activity is to discover new genes involved in important molecular processes and to categorize the functions of genes. She also has developed an active program to develop methods for preprocessing microarray data. Wang is collaborating with the Quantitative Biomedical Research Initiative Group in the UTSW Department of Clinical Sciences on developing Bayesian hierarchical spatial models, integrative Bayesian analysis for investigating molecular mechanisms of cocaine addiction, and the development of preprocessing methods for high-throughput data. Cao is interacting with colleagues in the UTSW Departments of Clinical Sciences and Cell Biology on simultaneous significance testing in high-throughput data analysis. She is also investigating gene set enrichment analysis and statistical issues relating to procedure volume and surgical outcomes investigations. Gunst, Schucany, and Woodward have worked for several years developing statistical methods for the analysis of brain imaging data. This work is being conducted with colleagues in the UTSW Departments of Internal Medicine and Clinical Sciences in support of a major study of Gulf War syndrome involving veterans from the 1991 Persian Gulf War.

A by-product of this extensive collaboration between SMU and UTSW is the creation of an internship program through UTSW's Department of Clinical Sciences. This program has provided funded support for Department of Statistical Science graduate students to provide statistical research support for UTSW scientists. These students have contributed to research projects in the Center for Human Genetics-McDermott Center for Human Growth and Development, Division of Translational Pathology, Simmons Cancer Center, Comprehensive Center for Molecular, Computational, and Systems Biology, Department of Clinical Sciences, and the Department of Internal Medicine.

Undergraduate Instruction

The contributions of the Department of Statistical Science to SMU's undergraduate teaching mission have primarily focused on introductory service courses for students in all of the undergraduate colleges of the university. This is consistent with Minton's vision for the department and with the interdisciplinary focus of the field of statistical science. The department provides courses for approximately 800

undergraduates per semester, most of whom are first- and second-year students. The department offers courses to a small number of majors and minors; however, the greatest enrollments are in our first-year *Introduction to Statistics* course and our second-year *Statistics for Modern Business Decisions* course. The first-year course is one of several options that satisfy the university's quantitative literacy requirement. The business statistics course is one of seven courses all pre-business students must take prior to becoming a major in the Cox School of Business.

In order to best take advantage of its small number of faculty, the teaching paradigm that the department has used throughout most of its history in undergraduate service courses has been to teach large lecture sections with full-time faculty twice weekly. The third weekly sessions are small laboratory or discussion/review sessions taught by graduate statistics students. The intent (which is consistent with SMU's philosophy) is to ensure that virtually all undergraduate students attending the department's statistics classes are taught by experienced tenure and tenure-track faculty. To accommodate both our graduate and undergraduate courses, a two-course per semester load for faculty members typically includes a course within our graduate curriculum and an undergraduate service course.

The department's dedication to providing outstanding undergraduate service teaching is attested to by two of its faculty members, Harris and Woodward, recently receiving the *Altshuler Distinguished Teaching Professor Award*. Only four university professors are selected each year.

Distinguished Graduates

Through calendar year 2010, 159 Master of Science and 157 Ph.D. degrees have been awarded to graduates of the Department of Statistical Science. Due to page limitations, only a very few of the department's distinguished graduates' careers can be highlighted here.

Stephen L. George (1969) began his career in biostatistics at MD Anderson Hospital and subsequently moved to St Jude's Children's Research Hospital and then to Duke University, where he is a Professor of Biostatistics and Bioinformatics. Don Wheeler (1970) owns a statistical consulting and publishing firm, SPC Inc., and has extensive experience assisting clients in statistical process control.

Two of the department's earliest doctoral students, Schucany (1970) and Gunst (1972), joined the SMU faculty immediately upon graduating and have had long and distinguished careers. Robert L. Mason (1971) holds the title of *Institute Analyst* at Southwest Research Institute and is nationally renowned for his decades-long activities in automotive research. He served as President of the American Statistical Association in 2003. Dwight B. Brock (1971) began his career with the Department of Health Statistics and rose to be the Head of Biometry in the National Center on Aging. He currently works for Westat, Inc.

After graduating with his doctorate, William L. Lester (1974) returned to his faculty position at Tuskegee Institute. He later rose to the position of Provost, a position he held for over 20 years. Joan Reisch (1974), Chief, Division of Biostatistics at UTSW heads a large contingent of biostatisticians several of whom are SMU alums. Edward Mansfield (1974) and Michael Conerly (1982) are long-time faculty members in and have each served as Head of the Department of Information Systems, Statistics, and Management at the University of Alabama.

James L. Hess (1977) has had a distinguished career with DuPont Chemical in Delaware and for the past 15 years with Leggett & Platt, where he is currently Vice President for Operations Services. William C. Parr (1978) entered academia in statistics at Texas A&M University (TAMU) upon graduating, then continued his career at the University of Florida, Harris Semiconductor, and the University of Tennessee. He is currently a Professor in the International School of Management in Shanghai, China.

Jeffrey D. Hart (1981), honored as Fellow of IMS and ASA is Professor of Statistics at TAMU. Mani Y. Lakshminarayanan (1984) has spent his entire career in the pharmaceutical industry, first at Hoechst-Roussel, then at Pfizer and Centocor, and is now with Merck & Co. Lori Thombs (1985) began her academic career at the University of South Carolina. She is now the Director of the Center for Social Statistics at University of Missouri, Columbia.

Pat Gerard (1993) has been on the faculty at Mississippi State and at Clemson, where he is Professor in the Applied Economics and Statistics Department. Alan Polansky (1995) is on the faculty at Northern Illinois University and is the author of the recent book *Observed Confidence Levels: Theory and Applications*. Krista Cohlmiia (2003) is professor and chair of the Department of Mathematics at Odessa College,

Continuing Vision

Minton's vision of a statistics department that would provide scholarly collaboration in teaching, research, and applications within SMU and throughout the surrounding region is being realized. The Department of Statistical Science is producing nationally recognized master's and doctoral graduates who are sought by academic, governmental, and industrial institutions, and is also providing statistical education for employees of regional industrial companies and medical research labs. The department continues to emphasize graduate and undergraduate courses that are available to diverse academic disciplines at SMU. Although he could not foresee the involvement of current faculty's research and methodological developments in fields as diverse as census confidentiality, brain imaging, nuclear test monitoring, genomics, accelerated life testing, and vehicle emissions modeling, his vision of the interaction of department faculty with scientists and engineers within the university, regionally, and nationally has been achieved. This history is dedicated to that vision, a vision that continues to evolve with emerging changes in our collaborative activities.

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