The Statistics Department Newsletter

DEPARTMENT OF STATISTICS
FOUNDED 1974
THE OHIO STATE UNIVERSITY

Editor: Angela Dean

Letter from the Chair,
by Tom Santner

The Department of Statistics experienced many changes in 1993. We hired two tenure track faculty, one visitor for a two year stay, and hosted several sabbatical visitors (see page 4). We will be hiring additional faculty for the 1994-1995 academic year. Our emphasis has been to hire faculty who are strong theoretically and who have an interest in interdisciplinary research.

Most of our faculty hiring has been possible because of the funds we have received to teach an elementary numeracy course that is part of the University's "General Education Curriculum" that has been implemented over the past few years. We are now in the final phase-in of the GEC courses and currently teach six 150-person lectures of such a course each quarter and three 50-person lectures. In addition to attending three hours of lectures, each student attends a lab twice a week to learn how to use computer software to analyze data. The experience that we have gained in this process has been translated into funding for a large technology-based learning NSF grant for which Bill Notz, Dennis Pearl and Elizabeth Stasny are co-principal investigators (page 8). Concerning graduate education, we are happy to announce that in 1993 we sent sixteen MAS students, eleven MS students and eight PhD students out into the world to make their mark (see page 15).

In the summer of 1993, our graduate student space increased dramatically when we were given five large graduate student office areas in the Neil and 17th Avenue building (directly across the road from Cockins Hall). This space is much more convenient than several previous graduate student office areas we have had (as those of you who experienced our quarters over

Bernie's Bagels on High Street will know!) This autumn we are in the midst of a second expansion; our Cockins Hall space will grow from about 7,000 square feet to 11,000 square feet. Ultimately, we will be able to house all students with TA or RA support in Cockins Hall, and other students will be assigned to the Neil and 17th Avenue building, as will our tutor room activities. It will now be much easier to accommodate visiting scholars and to assign graduate students who are in the thesis writing stages of their studies to quiet office space.

In July, our longtime administrative secretary, Mona Auck, left Ohio State for North Carolina after thirteen years at the University. We wish her well in her new life. We have hired a new administrative secretary, Marcie McGlaughlin, who has jumped into the departmental administration at this very hectic time of expanding course offerings and space changes. Among Marcie's duties has been the supervision of our expansion in Cockins Hall.

I would like to thank Ransom and Marian Whitney for their generous donation which will fund several new departmental awards in perpetuity (see page 10 for a description of these awards). I would also like to thank all of you who have made contributions to the department's development fund. Your gifts have been used, in part, to fund our seminars and recruiting efforts and they are greatly appreciated. If you are aware of summer internships for OSU students or job opportunities, please let us know. I would like to thank all those who contacted Angela, me or other faculty with suggestions after the publication of the first edition of the Department Newsletter. Lastly, be sure to stop by and visit the Department when you are next in Columbus.

WHAT IS HAPPENING IN RESEARCH

New Graphics Lab
by Mario Peruggia

An NSF-SCREMS grant of $65,000 was awarded last year to Mark Berliner, Jason Hsu, John Klein, Mario Peruggia and Thomas Santner for the acquisition of a high-resolution color workstation and imaging system to be dedicated to the support of ongoing and novel research projects within the department. The graphics system---one of the few in the entire world to be housed in a statistics department---includes a Silicon Graphics Iris workstation running powerful visualization software and an encoder supporting all major video formats. It has the ability to make, display and record animated sequences and still images. In particular it can provide frame accurate control over a write-once laser disk Sony recorder. The system also includes a high-quality video monitor, a Super-VHS recorder and a VHS recorder.

Visualization techniques are enjoying increasing popularity among statisticians, as they have been recognized to be valuable instruments for understanding high dimensional data. In several situations it is possible to develop interactive visualization tools in which individual frames are computed and displayed on the computer monitor in rapid succession to produce a smooth animation. There are, however, cases in which the computational burden required to produce a single frame of the animation is too great for this to be possible. In these cases the single frame editing capability of our system becomes crucial, for it allows one to record the various frames of the animation one at a time and play them back later at the required speed.

Some of the projects for which the equipment will be useful are as follows. Studying high dimensional stochastic dynamical systems, Mark Berliner will use the visualization system to portray realizations of the model, along with measures of credibility of predictions, by dynamical graphics techniques. Mario Peruggia and Thomas Santner plan to develop new methods for presenting the results from complex Bayesian analyses. They will emphasize the use of posterior and predictive distributions to describe the analyses of two data sets, one involving CAT scan images of bone sections and the other involving the catalog of Italian earthquakes from approximately 1100 AD. Jason Hsu will develop 3-D visualizations of confidence ellipsoids for the difference in Area Under the Curve, Maximum Concentration, and Time to Maximum Concentration between a test drug and a reference drug. This technique will enhance the FDA bioequivalence approval process.

Chaos
by Mark Berliner

The study of chaotic behavior has received substantial attention in many disciplines. Though often based on deterministic models, chaos is associated with complex, "random" behavior and forms of unpredictability. The key element of chaos producing models is that the functions involved are nonlinear. An essential feature of the behavior is that very similar inputs to these functions can lead to very different outputs, and this is the source of unpredictability. It is often surprising that even simple models can produce complex, chaotic behavior. Evidence is accumulating that many natural phenomena are "chaotic."

Chaotic behavior, because of the relationship to randomness, offers interesting challenges to statisticians. At a foundational level, chaos challenges our understanding of randomness and uncertainty. Fundamental work on the identification of and prediction for chaotic models, based on observational data, is ongoing at Ohio State. A number of statisticians in our department are also working on chaos as related to statistical approaches to nonlinear time series data in applied areas. These areas include climate modeling, engineering applications in materials science and fluid dynamics, and biological problems including blood flow and heart rate variability.

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Bayesian Modeling of Bone Strength
by Mario Peruggia

Understanding how different risk factors affect the strength and the mechanical properties of the human bone is an important concern for physicians and biomechanical engineers. In a study recently published in "Statistical Decision Theory and Related Topics V", Tom Santner, Yu-Yun Ho, Nancy McMillan and I have addressed this issue by analyzing data provided by Dr. Albert Burstein of the Hospital for Special Surgery in New York City. The observational data consist of a series of CAT scans of the hip area from each of a set of patients admitted to the hospital for evaluation and possible hip replacement.

From the set of available CAT scans a digitized cross-section of the femur close to the hip joint was selected for analysis for each subject. A typical section shows two clearly delineated regions. The inner area, called the trabecular bone, has a honeycomb-like structure and is surrounded by a denser outer area of cortical bone whose shape and structural characteristics determine the mechanical properties of the bone and in particular its strength. Since the ability of the bone to withstand stress is affected by the way in which its cortical mass is distributed, a useful statistical analysis cannot simply rely on global summary measures. For example, the ratio of the cortical area to the total area of the section has no structural meaning. Instead, one must account for the entire morphology of the bone and its mechanical properties under loading at different locations.

Motivated by the reasons above, we considered modeling two responses---the thickness of the cortical bone from a series of 72 equi-angular rays through the centroid of the section, and the components of the area moments of inertia about the major principal axis of the bone. While the former response describes the overall shape of the cortical annulus, the latter was suggested by strength of materials considerations and provides an indication of how the distribution of the cortical mass at different locations affects the bending strength of the bone.

The two salient characteristics of these data are their circular (wrap-around) nature and the fact that measurements at near locations are highly correlated. The analysis presented several thought provoking aspects that made our work fun and rewarding. In addressing the issue of the specification of the model, we experienced the necessity of relying both on classical and Bayesian statistical methods. In carrying out the actual Bayesian analysis, we had to resort to computationally intensive estimation techniques (Gibbs sampling) to circumvent the lack of closed form expressions for the posterior distributions of the model parameters. Because of the high dimensionality of the response and the complexity of the fitted model, the presentation of the results of the analysis also proved a challenging task. We relied heavily on graphical displays to understand several aspects of the model and the relationships between variables.

In particular, by constructing predictive confidence bands of the response curves for subject with given covariate values, we were able to describe the multivariate aspects of the data in a succinct way that can be easily understood by non-statisticians. This analysis showed how the reshaping and resizing of the bone (with consequent changes in its mechanical properties) differ by patient gender, disease mechanism and age.

Reliability Demonstration Tests for Series Systems
by Saul Blumenthal

Any system which has a breakdown recorded whenever one of its components fails is stochastically a series system. Series systems exhibit wear out if the components tend to wear out as they age. Acceptance sampling criteria are usually stated in terms of Mean Time Between Failures (MTBF) for an aged (or equilibrium) system. However, reliability demonstration, or acceptance, tests are often administered to relatively new systems. If the test does not take into account the fact that the young system has a much larger MTBF than it will have after

aging, too high a proportion of poor quality systems will be accepted. Tests have been developed which take this aging phenomenon into account. The above mentioned tests are based on the assumption that the component failure distribution is known except for the value of a scale parameter. We have also looked into the sensitivity of the operating characteristic curves of these procedures in the case where the failure distribution is a gamma or Weibull with unknown shape parameter. Further, a two stage testing procedure has been developed for gamma failure densities which calculates an estimate of the shape parameter based on the first stage data, and then uses that estimate to find an appropriate test time and acceptance criterion for the second stage.

If the system is newly produced, the differential in MTBF relative to an aged system is even more pronounced and a test that is appropriate for an old system is not stringent enough for a new one. Specialized tests for brand new systems have also been developed for the case where the component failure distribution has only one unknown parameter. Deriving tests that are exactly correct involves some complex combinatorial problems, and various approximations have been developed to make test derivation easier.

WHAT IS HAPPENING IN BIOSTATISTICS

Proposed Biostatistics Center
by Dennis Pearl

The proposal of the Departments of Statistics and Preventive Medicine to create a Biostatistics Center has attracted new support this past year. The restructuring proposals of the College of Mathematical and Physical Sciences and the College of Medicine along with support from the Associate Dean for Research and the faculty research committee of the College of Medicine have returned the proposal to the front burner. The goals of the proposed Biostatistics Center are:

• To provide a stimulating environment for methodological research in biostatistics and epidemiology;

• To provide a single readily identifiable source of experts with whom biomedical investigators can collaborate in the design, analysis, and management of clinical and laboratory research;

• To serve as a vehicle for attracting additional outside funding of biostatistical activities;

• To provide continuing training in biostatistics and epidemiology to biomedical researchers and practical experience to students in the graduate programs in Biostatistics, Preventive Medicine, and Statistics.

VISITORS AND SEMINARS

The Statistics Colloquium Series brings visitors to campus each quarter. In 1993, we were happy to have the opportunity to hear, among others, guest lectures by Barry Arnold of the University of California at Riverside, Susan Murphy of Penn State University, and Fred Lombard of Rand Afrikaans University. We also hosted a number of visitors from industry, (see page 6).

Other short-term visitors in 1993 included: David Goldsman of Georgia Tech who came to work on a book with Tom Santner; and Ken Russell of the University of Wollongong, and Dexter Wittinghill of Colby College, who came to spend part of their sabbatical leaves and to work with Angela Dean and Bill Notz in the design of experiments. An informal seminar on experimental design was run during the spring quarter with participation by several PhD students interested in the topic.

LINKS WITH INDUSTRY AND GOVERNMENT

Over the years, the Department has fostered links with industry and government through its research program, its seminar program and its Industrial Relations Board.

INDUSTRIAL RELATIONS BOARD

Members of the Statistics Department Industrial Relations Board interact with the faculty on research projects; they help obtain internships for students; they recommend topics to be included in the Applied Masters curriculum for students who intend to work in industry or government, and they facilitate the funding of fellowships for students. The Statistics Department is very happy to have the following people currently serving on its Industrial Relations Board.

Dr. Joseph J. Chmiel, Director of the Statistics & Data Management department of Abbott Labs.

Dr. Elizabeth Margosches, Section Chief of the Epidemiology and Quantitative Methods Health Effects Branch of the EPA.

Dr. Daniel Meyer of the Statistics Department at The Lubrizol Corporation.

Dr. Stephen J. Ruberg, Director of the Statistics Department of Marion Merrell Dow Pharmaceuticals.

Dr. Robert Tortora, Chief of the Statistical Research Division, U.S. Bureau of the Census.

USDA
by Elizabeth Stasny

One long-standing relationship with a government agency has been with the National Agricultural Statistics Service (NASS) of the USDA. Since 1989, Prem Goel and Elizabeth Stasny have had a cooperative agreement with NASS to work on methods for obtaining county-level estimates of crop production using data from national and state-wide farm surveys. Such estimates are used for local economic decision making, to set farm policy, and by companies selling fertilizers, pesticides, crop insurance, and farm equipment. Three former PhD students, Deb Rumsey, Lora Bohn, and Nancy McMillan, have been supported as research assistants on this project. Currently, PhD student Scott Linder is the graduate research assistant for the project.

The contact with NASS/USDA has also led to summer internships for a number of students (former MAS student Jay Harrison and current PhD student Chris Bush) and jobs for former students Darla Kusnia, Denise McCormick, and Wendy Messler.

INTERNSHIPS

In summer of 1993, **Keith Schleicher**, who is pursuing the M.S. degree, worked with Dr. Elizabeth Margosches at the **EPA** in Washington, DC. Keith worked on a number of projects including a review of a departmental toxicity study involving a chemical used in the dry cleaning industry, and risk calculations for human exposure to various kinds of chlorinated paraffins which are used primarily in metal cutting.

PhD student, **Nicole DePriest**, worked at **Lubrizol** during summer 1993. She was responsible for evaluating two computer packages that involve searching for optimal designs. The first was a SAS procedure called OPTEX and the second was a more extensive, C-based, software package called Gossett, designed by researchers at Bell Labs. In each case, Nicole wrote handbooks that summarized the basic code and contained many examples. She gave presentations to her co-workers after each handbook was completed.

INDUSTRIAL SEMINARS

Various visitors from industry and government presented talks to the department in 1993. Stephen Ruberg (Marion Merrell Dow Pharmaceuticals) spoke about statistical principles applied to drug development. Elizabeth Margosches (EPA), reviewed risk assessment of toxicological studies. Gerald Myers (Los Alamos Laboratories) discussed DNA and AIDS issues. Russell Wolfinger (SAS Corporation) described features of the new SAS procedure PROC MIXED. Dr Wolfinger's talk was co-sponsored by the Columbus Chapter of the American Statistical Association.

QUALITY CONFERENCE
by Prem Goel

In May 1993, a conference entitled *Statistical Innovations for Quality Improvement in Manufacturing* was held at the Greater Columbus Convention Center, under the auspices of The Chote Lal and Mora Devi Rustagi Memorial Fund that was established by Professor Jagdish S. Rustagi in the memory of his parents. This two day conference was organized by Prem Goel and Saul Blumenthal. It was sponsored by ADSTAR, An IBM Company, San Jose, CA, the OSU Department of Statistics, and OSU Department of Industrial and Systems Engineering at OSU. The main purposes of the conference were (i) to facilitate an exchange of ideas between the manufacturing industries and targeted academic disciplines on urgent QI problems, (ii) to provide a forum for various industries to disseminate their research and newly developed techniques for QI, and (iii) to make the industrial community in the Central Ohio area more aware of quality improvement related problems and their solutions through statistical approaches. Approximately 80 participants from the US and abroad attended.

Nine invited speakers comprising engineers and statisticians involved with directing the QI effort in manufacturing in major US corporations and two invited speakers from academia presented interesting and innovative QI methodologies as well as some success stories of QI in manufacturing.

The industrial speakers were

ADSTAR, An IBM Company, San Jose, CA: Dr. V. P. Singh, Dr. Kwan Wong, and Dr. J. S. Rustagi; ADOE: An Automated Design of Experiment Software

Alcoa Research Labs, Alcoa Center, PA: Ms. Linda W. Blazek; Statistical Process Control for Hierarchical Processes

AT&T Microelectronics, Allentown, PA: Dr. Randall Potter; Statistical Strategy for Process Equipment Qualification

Boise Cascade Corporation, Southern Operations, DeRidder, LA: Mr. Chris H. Nelsen; Groundwood Optimization Task Force on Newsprint Quality Improvement

E.I. du Pont de Nemours & Co., Newark, DE: Dr. Timothy Read; Process Qualification: A Global Strategy for Manufacturing Start-Up

Eli Lilly & Co., Indianapolis, IN: Dr. Robert Obenchain; Quality Trend Monitoring: Detecting At-Most-One-Change Within a Moving Window

General Electric Co., Schenectady, NY: Dr. William Tucker; Recent Applications of Algorithmic Statistical Process Control (ASPC): An Advanced SPC Method

General Motors Research & Development Center, Warren, MI: Dr. Thomas J. Lorenzen; Setting Realistic Specification Limits Using Classification Trees

The Lubrizol Corporation, Wickliffe, OH: Ms. Kathleen D. Blalock; Troubleshooting During Scale-Up to Manufacturing with Factorial Designs.

The keynote address entitled *Manufacturing Research at IBM* was given by Dr. Chae An, from the IBM Thomas J. Watson Research Center, Yorktown Heights, NY. We thank Dr. Kwan Wong, from ADSTAR, An IBM Company, and Prof. J.S. Rustagi for their sponsorship thereby making it possible for us to organize a highly useful conference on the issue of quality, a matter of national importance.

THANK YOU!

We wish to say a special thank you to all of you who help support our department activities through your donations to the University. You are helping to make lives richer for the students who are following in your footsteps. We encourage you to specify your university donations to be applied to one of the following Statistics Department funds:

525898 Powers Award (teaching awards for graduate students and faculty)
536826 Whitney Scholarship. (awards for consulting and research for graduate students)
526245 Rustagi Memorial Lecture
537669 Statistics Support Fund (support for visiting colloquium speakers and conference travel awards for graduate students)

INDUSTRIAL SUPPORT
by Doug Wolfe

Each year the Department of Statistics is able to offer special recruitment Fellowships to some of the very best new applicants to our graduate programs. These Fellowships are funded through the generous support of sponsoring industrial organizations, for which the Department is always grateful. The sponsoring organizations, their Fellowship stipend amounts and the current 1993-94 student recipients are as follows:

Lubrizol Foundation Fellowships--two awards in the amount of $1,500 each are provided; the 1993-94 recipients are **Jeffrey P. Hammel** from Rochester Institute of Technology and **Ramzi W. Nahhas** from The Ohio State University.

Dow Chemical Company Foundation Fellowship--one award in the amount of $1,500 is provided; the 1993-94 recipient is **Kristine Kuzora** from Rutgers University.

DePuy Fellowship--one award in the amount of $1,000 is provided; the 1993-94 recipient is **Brian A. Millen** from the University of Georgia.

We are also pleased to announce that beginning with the 1994-95 recruitment effort, the Department has been able to select an additional recipient for a new Marion Merrell Dow Graduate Fellowship in the amount of $1,500.

We appreciate all of the past support from the Lubrizol Foundation, the Dow Chemical Company Foundation, and DePuy, and hope that we are able to continue this excellent relationship in support of recruitment of outstanding American graduate students. In addition, we welcome Marion Merrell Dow to our Fellowship fold and look forward to many years of support from them as well.

ALUMNI, PLEASE HELP:

*** Please keep us up to date on your address and place of employment. We would like to know where all our graduates are and how they are doing. If you know an alumnus who has not received a copy of this newsletter, please ask them to drop us a line. You can also e-mail Bill Notz (next year's newsletter editor) at win@osustat.mps.ohio-state.edu ***

WHAT IS HAPPENING IN TEACHING

**Technology based learning:
Exploring statistical concepts and learning**
by Bill Notz

Bill Notz, Dennis Pearl, and Elizabeth Stasny are currently working on materials to enhance elementary statistics courses, especially those that make heavy use of technology such as our own GEC statistics courses. This project, supported by the National Science Foundation, is joint with Professor Paul Velleman at Cornell University (the 'creator' of Data Desk). Also involved have been several of our graduate students; Michael Bowcut, Rebecca Busam, Jim Clark, Nicole DePriest, Eric Eastmo, Greg Elfring, Kathy Steiner-Fritsch, and H.-C. Tsai. These students have done an outstanding job.

Our primary focus has been on developing an Electronic Encyclopedia of Exercises and Examples (EEEE) and a relational data archive containing a large collection of data sets. Ohio State has been involved in developing the EEEE and Cornell the data archive. The EEEE is aimed at classroom/student use and includes data, descriptions of experiments, graphics (including video "bites"), and computer-based retrieval keyed to specific statistical concepts and tied to statistical software. The data archive is intended for instructors and authors and is a computer archive of data sets also allowing computer-based retrieval keyed to specific statistical concepts. Although these are being developed separately, the development has been loosely coordinated. Ultimately the EEEE and the data archive will be combined in a single CD with electronic links between them.

Instructors in the department's GEC courses are welcome to use the EEEE in their lectures. A copy of the latest version of the EEEE is available to any instructor in these courses who is interested. In late summer 1994, we also plan to distribute copies to a number of beta test sites around the country.

In June 1994, an advisory panel consisting of Jane Fraser (from ISE here at Ohio State), Mike Meyer (Carnegie Mellon), David Moore (author of well-known textbooks in elementary statistics), and Jeff Witmer (Oberlin College) will be on campus to help us evaluate the project.

Survey Sampling Course
by Elizabeth Stasny

In Fall 1993, the Survey Sampling course used computers for the first time. The course made use of the simulation program SURVEY developed by Sharon Lohr, Ted Chang, and C. G. McLaren. SURVEY simulates a fictitious county in the midwest. The county includes two main cities, three smaller metropolitan areas, and surrounding rural area. The problem is to determine how much residents of the county are willing to pay for cable TV. Students use the SURVEY program to take simple random, stratified, and cluster samples of addresses from the county. The assessed value of homes in the county may be used to form strata or as an auxiliary variable for regression or ratio estimation. The program also computes the cost of each sample and can generate nonresponse within the sampled addresses. By forming their own strata, trying various estimators, and exploring different methods of adjusting for nonresponse, the students gain experience designing realistic surveys and analyzing data from such surveys.

1993 TOPICS COURSE
Designing Experiments for Selection, Screening
by Tom Santner

This course was the trial-by-fire of a draft of a text by Bechhofer, Santner and Goldsman that describes alternatives to standard hypothesis testing methodology for designing and analyzing experiments. Three goals were emphasized: (1) selection of the best treatment or treatment combination, (2) selection of a subset of treatments containing the best treatment (screening), and (3) simultaneous confidence intervals for selected differences of treatment means. Related formulations and problems such as the selection of a subset of all treatments whose means are at least as large as the mean of a standard or control treatment were also covered.

The primary emphasis was on the proper design of the experiment to achieve the given goal with a specified probability (an analogue of a power requirement in a testing setting). Procedures were explained for three underlying probability models: normal response experiments, Bernoulli response experiments, and univariate and bivariate (cross-classified) multinomial experiments. Various classical experimental designs, including completely randomized and different types of blocked designs, were considered within this framework.

1993 TOPICS COURSE
Generating Functions in Statistics
by Joe Verducci

According to Wilf, "A generating function is a clothesline on which we hang up a sequence of numbers for display." The method of generating functions gives a unified and elegant way of solving difference equations, finding recurrence relations, computing moments of random variables, obtaining asymptotic formulas, proving unimodality and convexity properties, establishing combinatorial identities, and learning about rates of convergence.

The course covered the basic theory as given in the very readable text by Wilf (now in a 2nd edition for 1994). The classical topics include Power Series, 'Exponential Family' Combinatorics, and Analytical Properties, which are all discussed at a friendly, elementary level. Applications to Statistical Genetics include tree-counting formulas for phylogenic trees and cycle structure of random permutations (relevant to models of allelic frequency distributions). Other statistical applications, such as relating the counting of restricted partitions to the power of goodness-of-fit tests, were also covered.

Statistical Computing
by Jason Hsu

A new 700-level statistical computing course was created this year. The primary objectives of the course are to teach the students programming, numerical, graphical and simulation techniques, and how these can be applied to solve statistical problems. The course covers random variate generation and variance reduction methods, numerical analysis techniques useful for statistical computing, software development in the UNIX environment using C, Fortran and S+, as well as data visualization using the Motif widget set and the X window system.

AWARDS

TRAVEL AWARDS

Geraldine Edralin Baggs was awarded a department travel award to present a paper at the joint IMS/Biometric Society Meetings in Cleveland in April 1994.

JOURNAL AWARDS
Awards (consisting of a subscription to a statistical journal) are given for academic achievement. In 1993, these awards were won by **Geraldine Edralin Baggs, Chris Bush, Jeff Draskoci-Johnson, David Donley** and **Chun-Lin Qian.**

MORE AWARDS

POWERS TEACHING AWARDS

The **Thomas and Jean Powers Teaching Awards** are presented each year to (i) an outstanding instructor from amongst the assistant and associate professors in the Department, (ii) an excellent graduate student lecturer (with sole responsibility for a class), and (iii) an excellent recitation instructor. These awards were instituted in 1986, via a generous donation to the Statistics Development Fund by Tom and Jean Powers.

In 1993, the *faculty award* was presented to **H.N. Nagaraja.** Past award winners have been Mark Berliner, Elizabeth Stasny, Steve MacEachern, Doug Critchlow, and Bill Notz.

The Department is lucky to have a large number of excellent Graduate Teaching Associates. The selection of "the" best instructor is never an easy task, and there are always a number of extremely good teachers who are runners-up for the award. In 1993, the award for *best lecturer* was presented to **R. Scott Linder**. The *best recitation instructor* awards were presented to **Rebecca Busam** and **Daniel Cotton**. Each of these TA's made an outstanding contribution to the teaching mission of the Department.

WHITNEY AWARDS

Last year, Professor Emeritus **Ransom Whitney** and his wife **Marian Whitney** made a generous donation to the Statistics Development Fund to institute three new awards for graduate students. Two awards were presented for the first time in 1993. The award for the *best consultant in the Statistical Consulting Service* was presented to **Geraldine Edralin Baggs** and the award for the *best consultant working as a research associate on a research grant* was presented to **Chun Lin Qian**. We congratulate these two people and thank them for their hard work.

In the autumn of 1994, a major award will be instituted for the *best research leading to the PhD*. The winner of this award will be asked to give a talk on his or her current research in the department colloquium series.

NEW GRANTS AWARDED TO FACULTY

Mark Berliner, Jason Hsu, John Klein, Mario Peruggia and **Thomas Santner** were awarded a SCREMS grant for "enhancing statistical analyses using dynamic graphics".

Prem Goel and **Elizabeth Stasny** have been awarded a grant by the USDA to continue their work on "small area estimation" for developing county yield estimates of various crops.

H. N. Nagaraja was awarded a two-year grant by the American Heart Association for working on "Markov chain model based analysis of heart period data from congestive heart failure patients".

Elizabeth Stasny has been awarded a grant by the National Institute of Justice to work on "adjusting the national crime victimization survey's estimates of rape and domestic violence for 'gag' factors". This is joint work with Ann Coker of the Universtiy of South Carolina.

Joseph Verducci, and Elizabeth Weller, Ronald Weller, and Mary Fristad all of the OSU Department of Psychiatry, have been awarded a 5-year grant by the National Institute of Mental Health to study grief and depression in children and adolescents.

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ABOUT THE FACULTY AND STAFF

New Faculty

The Department is building up its research interests in statistical computing and in biostatistics. We were lucky to be able to hire two new tenure-track assistant professors to help in these endeavors: **Nandini Raghavan** (PhD University of Illinois at Urbana-Champaign, 1993) and **Mark Irwin** (PhD University of Chicago, 1993).

Nandini was a visiting instructor in the department last year. Her research interests are in the areas of nonparametric regression including smoothing splines, generalized linear models and various aspects of statistical computing.

Mark's research interests include Monte Carlo methods in genetic linkage analysis and survival analysis. Recently, he has looked at mapping disease genes with many genetic markers using the method of sequential imputation (a new simulation approach allowing much larger problems to be handled).

The Department was also happy to be able to hire a visiting instructor in September 1993. **Smarajit Bose** will be with the department for two academic years. He graduated from Berkeley and has visited both IBM and University of Washington.

Books published 1993-1994

Probability Models and Statistical Analyses for Ranking Data, **Michael A. Fligner** and **Joseph S. Verducci** (Eds.), Springer-Verlag, 1993.

Discrete Iterated Function Systems, by **Mario Peruggia**, A. K. Peters, 1993.

Optimization Techniques in Statistics, by **Jagdish S. Rustagi**, Academic Press, 1994.

Designing Experiments for Selection, Screening and Multiple Comparisons by **Thomas J. Santner**, Robert Bechhofer and Dave Goldsman, due to be published in 1994.

Faculty Honors

Angela Dean and **H. N. Nagaraja** were both elected ordinary members of the International Statistical Institute.

Douglas Wolfe has been elected a Fellow of the Institute of Mathematical Statistics.

Departmental Research

In addition to the research supported by the new grants awarded to faculty mentioned on Page 10, there are many interesting research projects underway in the department. Some of these were highlighted as articles in last year's newsletter, and others in the current newsletter. A brief list of the main research interests of the faculty follows:

Smarajit Bose is working with Finbarr O'Sullivan of the University of Washington, on clustering algorithms for Image Segementation problems, and with Charles Kooperberg of the University of Washington, and Charles Stone of the University of California, Berkeley on classification problems. He is also collaborating in two projects on diagnosis of low back disorders with the Biodynamic Group (headed by Bill Marras) in the Industrial Engineering Department at OSU.

Michael Browne, who holds a joint appointment in the Departments of Psychology and Statistics, is working on models for learning data and rotation methods in factor analysis.

Robert Bartoszynski and **Dennis Pearl** are continuing their work on characterizations of equality of multi-dimensional distributions, and on related nonparametric goodness-of-fit tests for multivariate data.

Robert Bartoszynski is also working on the design of optimal tests of bioequivalence with Jean Powers (who took early retirement from OSU in 1992 and now works for Children's Hospital in Columbus).

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Doug Critchlow and Dennis Pearl are working on new techniques for using nucleotide sequence data to investigate the course of HIV infection with Paul Fuerst (Molecular Genetics), Michael Para (Internal Medicine), and Statistics PhD students Shuying Li and K. Nourijelyani.

Doug Critchlow and Joseph Verducci are interested in statistical analysis of hormonal stress patterns - a joint project with Myung-Hoe Huh (Korea University), and Ronald Glaser, Janice Kiecolt-Glaser and William Malarkey from the OSU Medical School.

Rob Leighty (Manager of the Statistical Consulting Service) is engaged in research on environmental statistics. Through the consulting service, he is developing software for the Ohio EPA to evaluate soil constituent concentrations using tests of known operating characteristics.

Doug Wolfe is working on various aspects of nonparametric tests. Current projects include tests for equality of two or more umbrellas (with PhD student Guohua Pan), tests for interaction (with Brad Hartlaub of Kenyon College and Angela Dean) and, on a different aspect of interaction tests with Paul Horn of the University of Cincinnati).

Angela Dean is also interested in construction of nested change-over designs (a joint project with Susan Lewis of the University of Southampton, England, and Jane Chang, Idaho State University) and factorial designs efficient in the presence of carryover effects (with Ken Russell of University of Wollongong, Australia).

Angela Dean and Bill Notz are working on construction of designs for multiple response drug comparison trials (with PhD students Lie-Jane Kao and H.-C. Tsai).

Bill Notz, Dennis Pearl and Elizabeth Stasny are continuing work on the NSF funded project on computer technology in teaching (with Paul Velleman of Cornell University).

Elizabeth Stasny is working on the modelling of missing data, especially survey data in relation to juries in death penalty cases (with Jay Kadane of Carnegie Mellon University) and pensions (with Pat Reagan of the OSU Department of Economics).

Prem Goel is working on the USDA sponsored project on small area estimation problems in the context of county yield estimates (with Elizabeth Stasny), on the Howard Hughes Foundation sponsored project on dynamic graphics software for simulating stochastic models for biological phenomena (with Mario Peruggia and PhD student Baoshe An), and on Poisson approximations and limit theorems for dependent variables arising in the context of micro-data file merging and DNA finger-printing (with Baoshe An).

Jason Hsu is interested in graphical representation. He has recently completed a project with Mario Peruggia on representing Tukey's multiple comparison method, and is now working with Steven Ruberg of Marion Merrell Dow, on representing bioequivalence measures.

Mario Peruggia is also working on Bayesian diagnostics and model selection (with Tom Santner and PhD student Yu-Yun Ho).

Tom Santner is working on the design of computer experiments (with Bill Notz and PhD student David Donley) and on the development of Bayesian diagnostics.

Kimberly Kinateder works on the geometries of Brownian motion and is currently working on a project in this area with Pat McDonald of Denison University.

H. N. Nagaraja is continuing to work on the statistics of record values. He has also begun work in stochastic modelling of heart period data. He is currently working with Dr. Philip Binkley of the Division of Cardiology (and PhD student Srinath Sampath) at Ohio State University. Their work is supported by the American Heart Association.

Other faculty activities

Michael Browne is an Associate Editor for Psychometrika. He is also a consultant for SYSTAT Inc.

Angela Dean was an invited speaker at a conference on Optimal Design at Oberwolfach in Germany in May 1993. She was also invited to give talks at Penn State University and the University of Waterloo, Canada, in November 1993.

Mike Fligner is Director of the Statistical Consulting Service.

Prem Goel was one of the 18 invited speakers at the Symposium on Modern Interdisciplinary University Statistics Education, sponsored by the Committee on Applied and Theoretical Statistics, Board of Math. Sciences, National Research Council, Aug. 6-7, 1993 in San Francisco, California.

Prem is the 1993-94 Program Chair of the Section on Bayesian Statistical Sciences of the ASA and the Chair of the Management Committee of the Current Index to Statistics, a joint venture of the IMS and the ASA for a three year term.

Rob Leighty is Editor of The Statistical Consultant, a newsletter published by the ASA. He is also publications officer for the ASA section on Statistical Consulting.

Steve MacEachern took a leave of absence for the academic year 1993-1994. He is visiting the Decision Sciences Institute at Duke University in North Carolina.

Mario Peruggia presented a paper on some joint work with Tom Santner and Lucia Ladelli in August 1993 at the ISI conference in Florence, Italy.

Bill Notz is a member of the ASA/MAA Committee on Education.

Jagdish Rustagi (professor emeritus) is currently a consultant to the Storage Products Division of IBM in San Jose, California. He is on the Editorial Board of the journals Communications in Statistics and Journal of the Indian Society of Agricultural Statistics, and served as Chairman of the IMS committee to select officers for the years 1991-93.

Jagdish was an invited speaker at the Conference on Industrial Statistics and Quality Improvement, held at Oakland University, Rochester, MI, and was a co-organizer of the Conference on Statistical Innovations for Quality Improvement in Manufacturing in Columbus in May 1993.

Thomas Santner is currently Chair of the Department. He has been appointed Editor of the new ASA Contemporary Statistics book series. Tom also acts as consultant to the Hospital for Special Surgery in New York City.

Elizabeth Stasny is publications officer for the ASA section on Survey Research Methods. She is also Associate Editor for the Journal of Computational and Graphical Statistics.

Joseph Verducci is a member of the Review Board for the American Journal of Psychiatry. He was the keynote speaker at the Canberra Chapter Meeting of the Australian Statistical Society in February 1993.

Doug Wolfe is Associate Editor for the Journal of the American Statistical Association. He also acts as consultant to the law firm of Samuels and Northrop, Columbus, Ohio.

ABOUT THE GRADUATE STUDENTS

Life in the Statsitics Department is not 100% work. Some of the students do find time to show their skills in various sports. The Department was proud to have two winning teams in 1993:

Intermurals
by Brian Wynne

The Statistics Departments corec volleyball team, Fantastic, won the Class II championship in the fall of 1993. Made up of first and second year grad students playing together for the first time, they began the regular season with a loss, but then they proceeded to win their next six matches and the title.

Seated: Brian Wynne, Nicole DePriest. Standing: Jeff Hammel, Michele Wishard, Kathy Fritsch, Deb Huland, John Lawrence.

Fantastic's road to the final included an emotional first tournament match in which they lost the first game of the set, then regrouped to win the last two games by scores of 15-12 and 15-10 to move on in the tournament. This victory made up for the disappointing three game loss in the previous winter's final game and provided them well deserved championship T-shirts.
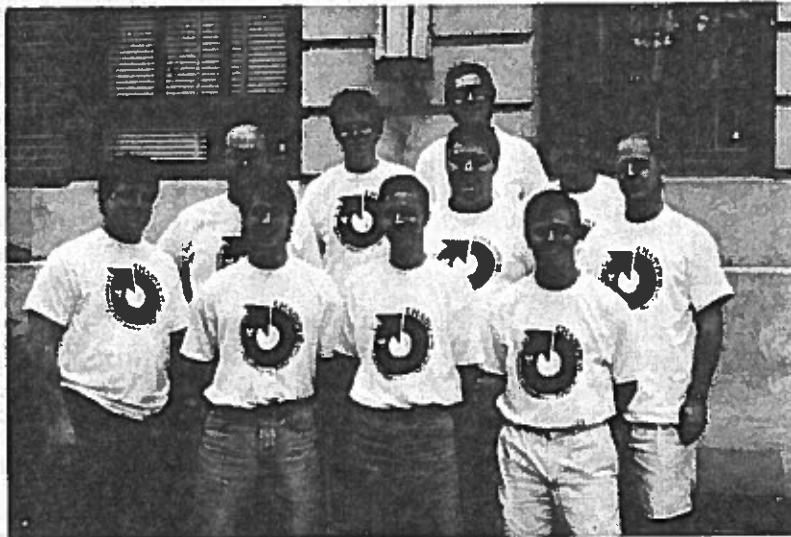
Front row: Dave Donley, Brian Wynne, Rob Vierkant, Dan Cotton. Second row: Jim Clark, Scott Linder, Keith Schleicher, Joe Pultz, Greg Elfring. Back row: Steve MacEachern.

The Statistics Department's Softball team, the B.L.U.E. Sox, also won a championship in 1993. The team consisted of first year through fifth year students, plus one faculty member, and was captained by former Division I college baseball player Dan Cotton. After losing a few games in the regular season, the Sox finally began to play well together as the season ended, and no team came within five runs of the Sox in the tournament. Much of the credit for victory goes to the "Posse", a dedicated fan following consisting of ten to fifteen students and spouses that cheered the team on throughout the season.

**The following students graduated in 1993.
CONGRATULATIONS to all of you!**

1993 MAS Graduates

Kelly Archer
Misty Ayers-Cumbow, A.C. Neilsen
Michael Bowcut, Peer Review Systems
Eric Eastmo, Information Resources Inc.
Paula Jackson
Scott Keshanek
Dong-Eun Lee
Shuying Li, continuing for PhD
Margaret Liang, Central Benefits
Tricia Myers, CBC Companies
Daniel Niemiec
Gunvant Patel
Robert Rashid, OSU College of Dentistry
Bharath Sankaranarayan
Robert Vierkant, The Marshfield Clinic, WI
Min Hui Wang, continuing for PhD

1993 MS Graduates

Craig Cooley, continuing for PhD
Daniel Cotton, Boehringer Ingelheim Pharm.

Anthony Hamlett
Peggy Hwang, continuing for PhD
Joseph Kosler, continuing for PhD
Cathie Hannon Leister, Wyeth-Ayerst Res.
Nancy Niemuth, Battelle Memorial Institute
Theresa Papa, continuing for PhD
Hsing-Chuan Tsai, continuing for PhD
Joann Wright
Yuying Zhang, continuing for PhD

1993 PhD Graduates

Robert George, instructor, OSU
Jen-Fue Maa, Proctor and Gamble
Nancy McMillan, postdoc, (NISS), NC
Steven Naber, Battelle Memorial Institute
Deborah Rumsey, assistant prof., Kansas
State Universtiy
Minggao Shi, postdoc, U.C.L.A.
Darryl Yamashita, statistician, California
State Government
Yuangen Zhu, consultant, Jefferson Medical
College, Philadelphia, PA

ALUMNI NEWS

Jane Chang (PhD 1989) is now an Assistant Professor at Idaho State University. She is the proud mother of Joyce August Chao who was born on October 10th 1993, right after a very exciting football game!

Chand (Usman) Chauhan (PhD 1983) is an Associate Professor at the University of Illinois-Purdue University in FortWayne, Indiana. Chand has two daughters, Neha and Risheka. Her husband Asheet, is a Microbiologist at Defiance Hospital.

David Cameron (MAS 1987) is working in sample design and subsequent universe estimation for retail and economic data for A.C. Nielsen Co. in Northbrook, Illinois. He also teaches a night course at a local community college.

Seonwoo Kim (PhD Biostat 1991) is a Senior Researcher at the Korea Institute for Health and Social Affairs.

Yasuhiro Omori (visitor 1992-93) is now at Chiba University in Japan.

Catherine Scipione (PhD 1992) has a postdoc/research fellowship position in the Economics Department of Monash University in Australia.

Jong Suk Um (PhD 1991) is working at Hanseng University in Korea.

Dong Kwon Park (PhD 1989) is Assistant Professor and Chair of the Mathematics Department, Yonsei University, Wonju, Korea. In 1993, he received the award of "New Fellow in Statistics" from the Korean Statistical Association.

Sunchil Yeo (PhD 1987) is working at KunKuk University in Seoul, Korea.