GRADUATE PROGRAMS IN BIOSTATISTICS

Division of Biostatistics
Medical College of Wisconsin
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INTRODUCTION

This handbook is intended for students entering the graduate programs in the Division of Biostatistics in the Department of Population Health at the Medical College of Wisconsin. It describes the programs, including detailed course requirements and related academic processes throughout the student's pursuit of a graduate degree in the Division.

The College

The Medical College of Wisconsin is a private educational institution that offers MD, Ph.D., MS, MA and MPH degrees. The College traces its beginning to two medical schools founded in Milwaukee in the 1890's. In 1913, these schools merged to become the Marquette University School of Medicine. In 1967, the medical school separated from Marquette University to become a free-standing institution, subsequently named the Medical College of Wisconsin. In 1978, the College moved to its present location in suburban Milwaukee, on the 240 acre campus of the Milwaukee Regional Medical Center. Other institutions on the campus include Froedtert Memorial Lutheran Hospital, Children's Hospital of Wisconsin, Milwaukee County Mental Health Complex, Curative Rehabilitation Center and the Blood Research Center of Wisconsin. The College benefits from a close working relationship with these institutions, as well as other Milwaukee institutions including the Zablocki Veterans Affairs Medical Center, Marquette University, the University of Wisconsin at Milwaukee, and the Milwaukee School of Engineering.

The Medical College of Wisconsin is internationally known for its research programs. These programs offer opportunities for students to study with funded investigators at the cutting edge of biomedical research. In addition to the traditional biomedical departments, several interdisciplinary research opportunities are available in areas such as cancer biology, functional imaging, molecular biology and genetics, neuroscience and cardiovascular physiology. Special research centers and facilities at the College include the Human and Molecular Genetics Center, Nuclear Magnetic Resonance Laboratories, Electron Microscope Laboratory, NIEHS Aquatic Biomedical Research Center, Protein and Nucleic Acid Laboratory, Center for International Blood and Marrow Transplant Research, Center for AIDS Intervention Research, Cardiovascular Research Center, Clinical Research Center, Injury Research Center, Cancer Center and Center for Patient Care and Outcomes Research. The research effort at the Medical College has grown remarkably over the past 15 years. Today, the college is among the upper half of academic medical institutions in terms of research support from the National Institutes of Health, and in the upper third of all medical institutions nationally in overall research and training support.

Currently, the College has about 170 PhD students, and more than 135 MS and MA students pursuing graduate studies in the Graduate School of Biomedical Sciences and

about 800 medical students. The college is accredited by the North Central Association of Colleges and Schools Commission on Institutions of Higher Education.

The Graduate School of Biomedical Sciences

Programs of graduate study in biomedical sciences have been an integral part of the Medical College since early in the past century. The Graduate School of Biomedical Sciences at the Medical College of Wisconsin has as its primary mission the provision of graduate study and research training opportunities for degree-seeking students who wish to study in an interdisciplinary environment and desiring to achieve intellectually stimulating careers as productive biomedical scientists. The Graduate School has programs leading to Ph.D. degrees in Biochemistry, Biophysics, Biostatistics, Cell and Developmental Biology, Functional Imaging, Microbiology and Molecular Genetics, Neuroscience, Pathology, Pharmacology and Toxicology, and Physiology, and Masters degrees in Bioethics, Biomedical Informatics, Epidemiology, Healthcare Technologies Management, Public Health and Medical Informatics. All programs emphasize biomedical research, and students are expected to make original contributions to knowledge in their chosen field.

About 160 of approximately 800 faculty at the College participate actively in the education and research training of graduate students. Class sizes are small and the overall student-to-faculty ratio is better than 1:1. A low student-to-faculty ratio fosters individual attention and a close working relationship between student and faculty mentor.

The Division of Biostatistics

The Division of Biostatistics is a part of the Department of Population Health at the Medical College of Wisconsin. Other divisions in the Department include Bioethics, Epidemiology and Preventive Health. The Biostatistics Division has eight full time faculty members, three faculty members with joint appointment with Biostatistics Division, and several adjunct faculty members whose primary appointments are in the Mathematical Sciences Department at the University of Wisconsin-Milwaukee.

The Biostatistics faculty are engaged in a number of collaborative research projects at the Center for International Blood and Marrow Transplant Research, General Clinical Research Center, Center for Patient Care and Outcomes Research, Cancer Center, Functional Imaging Research Center, Center for Human and Molecular Genetics, as well as specific projects in genetics, medical imaging, clinical trials, and pharmacologic modeling. Students participate in these projects under faculty supervision. Dissertation research topics in statistical methodology often evolve from such participation, and students usually become co-authors on papers arising from these projects. Faculty is also engaged in research aimed at development of new statistical methodologies, evaluating recently developed methods and investigating their theoretical properties. The research areas of the faculty include survival analysis, random effect models, statistical genetics, model selection, Bayesian statistics, time series analysis, missing data problems, longitudinal data analysis, nonparametric statistics, decision theory, functional magnetic

resonance imaging, epidemiology, design of clinical trials, and multiple comparison.

The Division of Biostatistics maintains a computing system composed of SUN Unix client-server environment with networked workstations and PC′s. All biostatistics graduate students are provided SUN workstations. Available software includes C, FORTRAN, SPLUS, R, SAS, GLIM, IMSL, MINITAB, BUGS, MATHEMATICA, MAPLE and SAGE. The system has the capacity of processing large data sets.

For up-to-date information on the Biostatistics Division see the page http://www.biostat.mcw.edu or contact:

The Division of Biostatistics
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Ph.D. PROGRAM IN BIOSTATISTICS

The program leading to Ph.D. degree in Biostatistics is offered through the Graduate School of Biomedical Sciences at the Medical College of Wisconsin. It is designed for students with strong undergraduate preparation in Mathematics. The curriculum includes a sound foundation in statistical theory and applications, and training in statistical consulting. In addition, students gain substantial training and experience in statistical computing and software packages. The degree requirements, including dissertation research, are typically completed in at most five years for a well-prepared student entering the program with a B.S. degree. The program is in collaboration with the faculty of the Department of Mathematics at the University of Wisconsin-Milwaukee.

Admission Requirements

The minimum admission requirements are: (i) an undergraduate degree in mathematics or closely related fields from an accredited college or university, (ii) an overall grade point average of B or better, (iii) a B average or better in mathematics and science, and (iv) an average of 60th percentile score on the quantitative and verbal sections of the GRE. International students whose first language is not English are required to have a minimum TOEFL score of 580.

Applicants are also expected to have completed courses in advanced calculus, linear/matrix algebra and scientific programming with minimum grade of B in each of these courses. Those who have not done so may be considered for admission to the program upon approval of the biostatistics admission committee, and if admitted, these requirements must be completed during the first year of study. In addition to the above requirements, the applicant must have strong interest in pursuing research in biomedical sciences.

Financial Support

Every entering full time student is supported year round by a Fellowship for the first 18 months, followed by a Research Assistantship for the remaining part of the program, for a maximum of 5 total years of support. The research assistantships provide students with the opportunity to gain experience in statistical consulting and collaborative research. Both types of support include the cost of tuition and fees, a stipend to cover living expenses, and an allowance toward health insurance. The stipend for the academic year 2006-2007 is $24,000. The college provides the health insurance to all stipend students, with additional benefits for dental and vision coverage requiring a nominal cost for dental and vision coverage.

During the fellowship period the student is expected to give full time effort to graduate studies, taking minimum 12 credit hours of coursework per semester in the Fall and Spring, and 9 credit hours in the Summer.

As a Research Assistant, the student works 20 hours per week on research projects under faculty supervision. The course load during this period is 9 credit hours per semester, six in the summer.

In addition to coursework and research, throughout the student's graduate program, participation in the Division's seminar series – the weekly lunch seminar and the biweekly Special Talks – is expected. General participation in the activities of the Division and the Graduate Student Association via committee memberships and volunteering is greatly encouraged.

Student Advising

Upon entering the program the Director of Graduate Studies serves as the student's academic advisor until the student identifies a dissertation advisor with mutual agreement – usually at the beginning of the third academic year. The student's choice of dissertation advisor must be approved by the Director of Graduate Studies and the Division Director. Dissertation advisors are typically chosen from the senior faculty. A junior faculty member who has not previously served as dissertation advisor may do so, provided a more experienced faculty member is chosen as co-advisor. Students are required to spend time reading with two faculty members prior to selecting a dissertation advisor.

Prior to selecting the dissertation advisor, students will work with the Director of Graduate Studies to complete a "Plan of Study" form. This form includes selection of appropriate elective courses, covers plans to make up deficiencies in admission requirements as soon as possible, and describes the planned course schedule to complete the required course work. This plan is to be completed prior to signing up for courses in each semester. Once a dissertation advisor is selected, the student works with this advisor to update the "Plan of study form", and then submits it to the Director of

Graduate Studies for approval. From this point forward, the dissertation advisor monitors the student's program and progress.

Course Curriculum

A. Required Courses:

BIOETH	10222a	Ethics and Integrity in Science	1 credit hour
BIOST	214	Design and Analysis of Clinical Trials	3 credit hours
BIOST	220	Research Seminar	1 credit hour*
BIOST	221	Theory of Consulting	2 credit hours
BIOST	222	Statistical Consulting	3 credit hours
BIOST	224	Biostatistical Computing	3 credit hours
BIOST	231	Statistical Models and Methods I	3 credit hours
BIOST	232	Statistical Models and Methods II	3 credit hours
BIOST	233	Statistical Models and Methods III	3 credit hours
BIOST	261	Statistical Inference I	3 credit hours
BIOST	262	Statistical Inference II	3 credit hours
BIOST	264	Time Series Analysis	3 credit hours
BIOST	275	Applied Survival Analysis	3 credit hours
BIOST	280	Applied Probability	3 credit hours
BIOST	285	Introduction to Bayesian Analysis	3 credit hours
BIOST	313	Advanced Statistical Computing	3 credit hours
BIOST	363	Advanced Statistics I	3 credit hours
BIOST	365	Linear Models I	3 credit hours
BIOST	384	Statistical Genetics	3 credit hours
BIOST	385	Advanced Bayesian Analysis	3 credit hours
BIOST	386	Theory of Survival Analysis	3 credit hours

* each semester

B. Readings & Research: Beginning with the summer after the first academic year students take Readings & Research (BIOST 295) hours with various faculty members. The purpose of this is to become familiar with faculty interests and engage in independent preparatory work in possible areas of dissertation research to begin later in the program. Over the first two years students are required to read with at least two different faculty members before making a choice of dissertation topic and advisor. During the third academic year students continue to take Readings & Research hours, now with one faculty member, concentrating in an area of research that will lead to a dissertation proposal. After passing the Qualifying Examination and presenting a dissertation proposal, research is carried out under Readings & Research hours until the final semester in which the student defends the dissertation and graduates.

C. Writing Requirement

Students are required to prepare written reports on two consulting/collaborative research projects during the first two years of study. These reports should include a description of the biological problem, a discussion of the statistical methods used in the analysis and a presentation of results. The reports must be written for presentation to the clinical investigator and not be focused solely on statistical techniques. A guide to writing consulting reports can be found in *The Statistical Consultant in Action* by DJ Hand & BS Everitt, Cambridge University Press, 1987.

Reports can be based either on projects from the student's consulting classes or from the student's work assignment. The papers should be 5-10 pages in length as a guide. The documents must be approved by a faculty member (typically the instructor of the consulting class or the supervising faculty member for a collaborative project).

D. **Elective Courses:** A minimum of 6 credit hours of biological/medical science electives are required. Students may take appropriate courses from MCW, UWM or Marquette to satisfy the elective requirements. Electives must be approved by the student's advisor and the Graduate Committee of the Division. Examples of courses meeting this requirement are:

BIOETH	201	Medical Ethics	2 credit hours
BIOETH	222	Ethics and Integrity in Science	2 credit hours
BIOETH	232	Ethics, Policy and Genetic Technology	2 credit hours
BIOPHYSICS	215	Medical Physics	1 credit hour
CELLBIO	150	Introductory Cell Biology	1 credit hour
CELLBIO	152	Human Development	1 credit hour
CELLBIO	207	Introduction to Neuroscience	2 credit hours
EPI	201	Clinical Epidemiology	3 credit hours
EPI	256	Research Methods in Epidemiology	3 credit hours
EPI	272	Epidemiology of Cardiovascular Disease	1 credit hour
EPI	274	Cancer Epidemiology	1 credit hour
PHARM	202	Survey of Pharmacology	3 credit hours
PHY	285	Mathematical Biology	3 credit hours

E. **Research Seminar:** Each semester, students are required to participate in the Division's two seminar series – the weekly seminar at lunch and the biweekly series of Special Talks. Credit for this activity is obtained by registering for 1 hour of BIOST 220 Research Seminar.

Examination Process

A. Preliminary Examinations

Upon completion of the necessary courses, the student is given two written preliminary examinations. One addresses Theory of Statistics, covering the subject matter from Statistical Inference I & II. The other, on Applied Statistics, covers

Statistical Models and Methods I, II and III, Design and Analysis of Clinical Trials and Biostatistical Consulting. Both examinations are organized and administered by the Division's Graduate Studies Committee. Evaluation is done by the entire faculty. The criteria for evaluation are the student's understanding and competency in basic principles and foundations of biostatistics, and his/her potential for conducting independent research in statistical methods and applications. To continue in the Ph.D. program, both examinations must be successfully completed by the end of August in the student's second year. The examinations are offered every January. If a student does not pass an exam, he/she is given a second opportunity to take it in July.

B. Choosing an Advisor and forming a Dissertation Committee

By the beginning of the Fall semester in the student's third year in the program, the student chooses a member of the Division's faculty as his/her advisor with mutual agreement. It is expected that this choice will grow out of the student's coursework, two research and readings courses, seminar participation and general immersion in the Division's academic activities. The two readings courses are taken in the first summer and the second spring or summer semesters. The student's choice of advisor must be approved by the Director of Graduate Studies and the Division Director. Advisors are typically chosen from the senior faculty. A junior faculty member who has not previously served as dissertation advisor may do so provided a more experienced faculty member is chosen as co-advisor.

In close consultation with the advisor, the student forms the Dissertation Committee in full accordance with the requirements of the Graduate School. The committee consists of five graduate faculty members including the advisor. Four of the five must be from the Division of Biostatistics (including Joint and Adjunct faculty) and one must be from outside the Division of Biostatistics. The committee must be approved by the Director of Graduate Studies and the Division Director. The process of committee formation, including submission of the appropriate form to the Graduate School, must be completed by the end of September in the student's third year. From this date forward the student's progress is monitored by the advisor and the Dissertation Committee.

C. Qualifying Examination

Upon successful completion of the preliminary exam and at a time determined by the Dissertation Committee, the student is given a qualifying examination. This examination is individualized for each student, and it is organized, administered and evaluated by his/her Dissertation Committee. The evaluations are based on student's in-depth understanding and competency in advanced topics in biostatistics, and his/her ability and maturity to apply the knowledge earned from the course-work in conducting meaningful research. The exam consists of two parts. One part is an oral examination testing the student's general statistical knowledge at the advanced level. The other part consists of writing a dissertation proposal and presenting it to the Division. This proposal must be approved by his/her Dissertation Committee. A student not passing either part of the exam may be given another chance to retake that part within three months of the first attempt. Students passing this exam will be

admitted to Ph.D. candidacy.

D. Final Examination

The Ph.D. candidate must submit a dissertation representing an original research contribution. It must show high attainment and clear ability to carry out independent biostatistics research of publishable quality. The final oral examination, including a public defense of the dissertation, is administered by his/her Dissertation Committee after the student has completed all other formal requirements for the Ph.D. degree. The student is expected to demonstrate a good understanding of the general field in which the dissertation is written. The student's Dissertation Committee will evaluate the performance of the student in the dissertation defense.

Sample Program Plans **

Typical Sequence for the Completion of Required Courses (starting in even year)

Fall 1: Clinical Trials (B214) Models & Methods I (B231) *Statistical Inference I (B261)* Elective/Math/Programming	**Spring 1:** Models & Methods II (B232) *Statistical Inference II (B262)* Applied Survival (B275) Theory of Consulting (B221)	**Summer 1:** Consulting (B 222) Readings & Research Elective/Prob/Programming
Fall 2: Biostat Computing (B224) Models & Methods III (B233) *Time Series Analysis (B264)* Adv. Statistics I (B363)	**Spring 2:** Intro. Bayesian (B285) Linear Model I (B365) Survival Analysis (B386) Eth.&Int. in Sc.(BEth10222a)	**Summer 2+:** Readings & Research Consulting/Elective
Fall 3: Advanced Computing (B313) Statistical Genetics (B384) Elective	**Spring 3:** ***Applied Probability (B280)*** Advanced Bayesian (B385) Elective	

Typical Sequence for the Completion of Required Courses (starting in odd year)

Fall 1: Biostat Computing (B224) Models & Methods I (B231) *Statistical Inference I (B261)* Elective/Math/Programming	**Spring 1:** Models & Methods II (B232) *Statistical Inference II (B262)* Intro. Bayesian (B285) Theory of Consulting (B221)	**Summer 1:** Consulting (B 222) Readings & Research Elective/Prob/Programming
Fall 2: Clinical Trials (B214) Models & Methods III (B233) Advanced Computing (B313) Statistical Genetics (B384)	**Spring 2:** Applied Survival (B275) Applied Probability (B280) Advanced Bayesian (B385) Eth.&Int. in Sc.(BEth10222a)	**Summer 2+:** Readings & Research Consulting/Elective
Fall 3: *Time Series Analysis* (B264) Adv. Statistics I (B363) Elective	**Spring 3:** Linear Model I (B365) Survival Analysis (B386) Elective	

** Italicized courses are taught at the UWM Mathematics Department.

Dissertation Research Requirements

The student begins his/her dissertation research during the third year. The initial step consists of identifying a topic that is of mutual interest to the student and a member of the faculty who serves as the dissertation advisor. Courses, talks and presentations by the faculty assist the student in this process. After a literature survey and a clearer definition of the scope of the research under the direction of the advisor, the student submits a written proposal and presents it orally to the advisory committee. During the conduct of dissertation research the advisory committee meets periodically to monitor the student's progress. Upon completion of the proposed research the student submits the dissertation and defends it in a public presentation.

The dissertation must be an original contribution to scientific knowledge. It can involve development of new statistical methodologies, evaluation of existing methodologies and study of their properties, innovative application of existing methodologies, or any combination of the above. The dissertation should be of publishable quality in peer reviewed journals in biostatistics or statistics.

Academic Life/Activities

The Division's academic activities include regular Biostatistics Seminar Series and consulting meetings. Students are expected to participate actively in both. The faculty, staff and students in the Division work together in an informal environment. There are regular social gatherings to facilitate and enhance interaction among the faculty, staff and students. In addition, students are urged to participate in the activities of the Graduate Student Association, including its fund raising efforts.

MS Program in Biostatistics

The Division of Biostatistics offers a Master's degree in Biostatistics. Currently no students are admitted to this degree program, reserving all admissions to those intending to complete the Ph.D. program. The M.S. degree is thus only occasionally awarded to those who must discontinue the Ph.D. program but have met the M.S. requirements.

A. Required Courses

All of the Following Courses

BIOST	214	Design and Analysis of Clinical Trials	3 credit hours
BIOST	224	Biostatistical Computing	3 credit hours
BIOST	231	Statistical Models and Methods I	3 credit hours
BIOST	232	Statistical Models and Methods II	3 credit hours
BIOST	233	Statistical Models and Methods III	3 credit hours
BIOST	261	Statistical Inference I	3 credit hours
BIOST	262	Statistical Inference II	3 credit hours
BIOST	275	Applied Survival Analysis	3 credit hours
BIOST	285	Introduction to Bayesian Analysis	3 credit hours
BIOST	221	Theory of Consulting	2 Credit Hours
BIOST	222	Statistical Consulting	3 credit hours
BIOETH	1022a	Ethics and Integrity in Science	1 credit hour

Any Two of the following Courses

BIOST	264	Time Series Analysis	3 credit hours
BIOST	280	Applied Probability	3 credit hours
BIOST	313	Advanced Statistical Computing	3 credit hours
BIOST	363	Advanced Statistics I	3 credit hours
BIOST	365	Linear Models I	3 credit hours
BIOST	384	Statistical Genetics	3 credit hours
BIOST	385	Advanced Bayesian Analysis	3 credit hours
BIOST	386	Theory of Survival Analysis	3 credit hours

B. Oral Examination

Students will select an examination committee consisting of an advisor and two additional graduate faculty members. The composition of the committee must be approved by the Director of Graduate Studies and the Division Director. This committee will administer an oral examination over the material covered by the student in his/her course of study. The length and content of the exam will be determined by the committee. At the end of the examination the committee will vote on the student's performance on the examination. A majority vote is needed for passing. Students who

fail this oral exam can take it a second time.

C. Writing Requirement

Students are required to prepare written reports on two consulting/collaborative research projects. These reports should include a description of the biological problem, a discussion of the statistical methods used in the analysis and a presentation of results. The reports must be written for presentation to the clinical investigator and not be focused solely on statistical techniques. A guide to writing consulting reports can be found in *The Statistical Consultant in Action* by DJ Hand & BS Everitt, Cambridge University Press, 1987.

Reports can be based either on projects from the student's consulting classes or from the student's work assignment. The papers should be 5-10 pages in length as a guide. The documents must be approved by a faculty member (typically the instructor of the consulting class or a member of the student's examination committee).

DESCRIPTION OF COURSES

BIOST 214 **Design and Analysis of Clinical Trials** (3 cr, MCW)
Prerequisites: Statistical Models and Methods I or concurrent registration
Description: The clinical trial protocol, sources of bias in clinical trials, blinding, randomization, sample size calculation; phase I, phase II, phase III and hybrid trials; interim analysis, stochastic curtailment, Bayes designs, and administrative issues in study design.

BIOST 220 **Research Seminar** (1 cr, MCW)
Prerequisites: Enrollment in Division of Biostatistics graduate program
Description: Students present plans for and analysis of research projects and research data. Projects and examples from classical and current literature are discussed by students and faculty.

BIOST 221 **Theory of Statistical Consulting** (2 cr, MCW)
Prerequisites: Statistical Models and Methods I or concurrent registration
Description: Theory of consulting, statistical techniques most often used in consulting, practical experience in the real consulting setting and writing statistical reports.

BIOST 222 **Statistical Consulting** (3 cr, MCW)
Prerequisite: Statistical Models and Methods II
Description: This course is designed for students to gain experience in statistical consulting by working with the biostatistics faculty members on various consulting projects.

BIOST 224 **Biostatistical Computing** (3 cr, MCW)
Prerequisites: Statistical Models and Methods I or concurrent registration
Description: This course will cover the details of manipulating and transforming data required for statistical analysis, such as reshaping the data from a per case to a per event within a case and vice-versa. It will also cover the techniques necessary to write functions and macros in both SAS and S-Plus for developing new/modified data analysis methods. Students are expected to be facile in the use of computers before they take this course.

BIOST 231 **Statistical Models and Methods I** (3 cr, MCW)
Prerequisite: Three semesters of calculus and one semester of linear algebra
Description: Models and analyses for count data and contingency tables, basic nonparametric methods including sign, rank-sum and signed-ranks tests, simple linear regression model and inference, checking model assumptions, correlation analysis, one-way and two-way analysis of variance. Emphasis is on models, their application to data and interpretation.

BIOST 232 **Statistical Models and Methods II** (3 cr, MCW)
Prerequisite: Statistical Models and Methods I
Description: Factorial, nested, split-plot and repeated-measures designs, multiple regression and variable selection, multiple comparisons, logistic regression, discriminate analysis, principal components and factor analysis, rates and proportions, introduction to survival analysis.

BIOST 233 **Statistical Models and Methods III** (3 cr, MCW)
Prerequisite: Statistical Models and Methods II
Description: Model diagnostics in regression analysis, influence and leverage, outliers, collinearity, remedies including transformations and ridge regression; Models for discrete data, two-way and multi-way tables, loglinear models, analysis of loglinear models, Mantel-Haenszel test, models for ordinal variables, multinominal response and matched pairs, analysis of repeated response data.

BIOST 261 **Statistical Inference I** (3 cr, UWM)
Prerequisite: Advanced Calculus
Description: Fundamentals of probability, independence, distribution and density functions, random variables, moments and moment generating functions, discrete and continuous distributions, exponential families, location and scale families, marginal and conditional distributions, transformation and change of variables,

multivariate distributions, random samples, convergence concepts, sampling from normal distributions, order statistics.

BIOST 262 **Statistical Inference II** (3 cr, spring, UWM)
Prerequisite: Statistical Inference I
Description: Point estimation, interval estimation, hypothesis testing, minimal sufficiency and completeness, ancillary statistics, likelihood and invariance principle, asymptotic properties of estimators and likelihood ratio tests, LMP tests, union-intersection tests, pivotal quantities, coverage probability, large sample estimation and testing.

BIOST 264 **Time Series Analysis** (3 cr, UWM)
Prerequisites: Statistical Models and Methods II, Statistical Inference II
Description: An introduction to univariate and bivariate time series with emphasis on stationary ARIMA processes, Box-Jenkins model building and forecasting, spectral representation of stationary time series, model testing and diagnostic evaluation, piecewise non-linear models, and bivariate ARMA processes.

BIOST 275 **Applied Survival Analysis** (3 cr, MCW)
Prerequisites: Statistical Models and Methods I
Description: Basic parameters in survival studies; Censoring and truncation, Competing risks; Univariate estimation including the Kaplan-Meier and Nelson-Aalen estimator; tests comparing two or more populations, the log rank test; Semi-parametric regression, the Cox model; Aalen's additive hazards regression model; regression diagnostics.

BIOST 280 **Applied Probability** (3 cr, UWM)
Prerequisite: Statistical Inference I
Description: Markov chains in discrete and continuous time, Poisson processes, random walks, branching processes, birth and death processes, queuing systems, applications to survival and other biomedical models.

BIOST 285 **Introduction to Bayesian Analysis** (3 cr, MCW)
Prerequisites: Statistical Models and Methods I
Description: This course introduces basic concepts and computational tools for Bayesian statistical methods. Topics covered include one and two sample inference, regression models and comparison of several populations with normal, dichotomous and count data.

BIOST 295 **Readings and Research** (1-9 cr)
Prerequisite: Permission
Description: Readings in recent literature and supervised research project.

BIOST 313 **Advanced Statistical Computing** (3 cr, MCW)
Prerequisites: Statistical Models and Methods II, Statistical Inference II, Biostatical Computing
Description: Numerical algorithms useful in biostatistics including likelihood maximization, numerical integration using quadrature and Monte Carlo methods, interpolation using splines, random variate generation methods, data augmentation algorithms, Markov chain Monte Carlo and the Metropolis-Hastings algorithm.

BIOST 363 **Advanced Statistics I** (3 cr, MCW)
Prerequisite: Statistical Inference II.
Description: Exponential family of distributions; Likelihood, score, information, MLE; Asymptotics related to likelihood, Wald, Score, and Likelihood Ratio statistics, delta method; Types of likelihoods, e.g. marginal, conditional, and profile likelihood; Generalized Estimating Equations and quasi-likelihood; Multiple Comparisons

BIOST 365 **Linear Models I** (3 cr, MCW)
Prerequisites: Statistical Models and Methods II, Statistical Inference II
Description: Review of matrix algebra and vector spaces; multivariate normal distribution and quadratic forms, least squares estimation, testing nested models, weighted least squares, one-way ANOVA, testing contrasts, multiple comparison, partial and multiple correlation coefficients, polynomial regression, lack-of-fit test. Analysis of experimental design models including randomized complete block, latin square and factorial designs, analysis of covariance, random effects and estimation of variance components, mixed models, models for spatial data, krieging, maximum likelihood theory for loglinear models, likelihood, prior, and posterior distributions for linear models, hierarchical models and introduction to their Bayesian analysis.

BIOST 384 **Statistical Genetics** (3 cr, MCW)
Prerequisites: Linear Models I, Statistical Inference II
Description: Fundamental elements of mathematical and population genetics, and statistical theory of the methods of human genetic analysis. Topics include Hardy-Weinberg equilibrium, inbreeding, selection, mutation, models for polygenic and multifactorial inheritance, variance components estimation for the genetic analysis of familial aggregation, linkage and segregation analysis, and ascertainment problems.

BIOST 385 **Advanced Bayesian Analysis** (3 cr, MCW)
Prerequisite: Introduction to Bayesian Analysis, Advanced Statistics I and Statistical Models and Methods III
Description: A combination of Bayesian principles and advanced methods; conjugate, conditional conjugate and noninformative priors in the exponential family; Markov chain Monte Carlo methods for generalized linear mixed models, hierarchical models; restricted parameter spaces and censored data; longitudinal and spatio-temporal models; nonlinear models, population pharmacokinetics; examples of Bayesian analysis of complex biomedical models.

BIOST 386 **Theory of Survival Analysis** (3 cr, MCW)
Prerequisite: Statistical Inference II
Description: Analysis of survival data using counting process techniques. Topics include the mathematical theory of counting process, censoring and truncation, estimation of the survival and cumulative hazard functions, extensions of k-sample nonparametric tests to censored and truncated data, proportional hazards and additive hazards regression models.

BIOST 391 **Special Topics in Biostatistics** (1-3 cr)
Description: This course is designed to cover special topics in Biostatistics that are not covered in regular courses. The topics will depend on the research interests of the instructor and the students.

BIOST 399 **Doctoral Dissertation** (1-9 cr)
Prerequisite: Permission
Description: Dissertation research and publication of research as necessary for completion of the doctoral dissertation.

FACULTY AND THEIR RESEARCH INTERESTS

John P. Klein, Professor and Division Director
Ph.D. University of Missouri-Columbia (Statistics) 1980

Professor Klein joined the Division of Biostatistics in the summer of 1993 coming from the Ohio State University where he was Professor of Statistics and Preventive Medicine. He was formerly the Statistical Director of the Ohio State University Comprehensive Cancer Center. He is an elected member of the International Statistical Institute, and a fellow of the American Statistical Association.

Professor Klein has authored over 130 papers on statistical methodology. His primary research interest is in the area of survival analysis, dependent competing risks theory and methods for dynamic interpretation of time dependent covariates. Dr. Klein is an expert in statistical methods for longitudinal data. He has published extensively on statistical methods for survival data and on the use of these techniques in analyzing complex illness-death models. His areas of research include the use of stochastic modeling of disease processes.

Other research interest include probabilistic models for cancer and the metastatic process, graphical association models for longitudinal data and techniques for the design and analysis of clinical trials. These techniques have been applied, for example, to transplant data, to data from the Framingham Heart Study and to data from the Danish Breast Cancer Cooperative Group. His research is funded by a grant from the National Cancer Institute. Professor Klein serves as the Statistical Director of the Center for International Blood and Marrow Transplant Research and as a collaborator on a number of NIH funded projects with investigators at the Medical College of Wisconsin. He serves on the editorial board of *Lifetime Data Analysis, Metron, Iranian Journal of Statistics* and *Biometrics*.

Some Recent Publications

Shu Y., and **Klein JP**. Additive Hazards Markov Regression Models Illustrated with Bone Marrow Transplant Data. *Biometrika,* 92, 283-301, 2005.

Bhattacharyya M., and **Klein JP**. Testing in Aalen's Additive Hazards Regression Model. *Statistics in Medicine,* 24, 2005

Bhattacharyya M., and **Klein JP**. A Random Effect Model for Multistate Survival Analysis with Application to Bone Marrow Transplantation. *Mathematical Biosciences,* 194, 37-48.

Klein JP, and Moeschberger ML. *Survival Analaysis: Techniques for Censored and Truncated Data 2nd Edition,* Springer Verlag., New York, 2003.

Raymond G. Hoffmann, Professor
Ph.D. Johns Hopkins University (Biostatistics) 1979

Dr. Hoffmann has coauthored or authored over 200 papers applying statistical methods to biomedical problems. He is an expert in statistical methods for neuroimaging, connectionist neural networks for modeling addiction, statistical methods for epidemiology, time series analysis and analysis of variance involving repeated measures. He has investigated binary time series, graphical methods for identifying nonlinear binary time series, categorical nonlinear time series and models for the pulsatile secretion of insulin. He has extensive experience with the design and planning of community studies. He also is interested in cardiovascular epidemiology and has investigated the effects of mediating factors such as alcohol, body fat distribution and hormone profile on the development of occlusive heart disease.

Dr. Hoffmann serves as the Biostatistician for the Medical College of Wisconsin General Clinical Research Center and is a collaborator on a number of NIH funded projects with investigators at the Medical College of Wisconsin. He is Chair of the Statistics in Epidemiology Section of the American Statistical Association, and Chapter Representative of the Milwaukee Chapter of the American Statistical Association. Dr. Hoffmann is certified in Epidemiology by the American College of Epidemiology.

Some Recent Publications

Rowe D., and **Hoffmann RG**. Multivariate Statistical Analysis in fMRI. *IEEE Eng Med Biol Mag*. 25(2):60-4, 2006

Brousseau D., **Hoffmann RG,** Yauck J., Nattinger A., and Flores G. Disparities for latino children in the timely receipt of medical care. *Ambulatory Pediatrics* 5(6):319-25, 2005.

Jadcherla S., Duong HQ, Hofmann C., **Hoffmann RG** and Shaker R. Characteristics of upper esophageal sphincter and esophageal body during maturation in healthy human neonates compared with adults. *Neurogastroenterol Motil* 17, 663–670, 2005.

Halum S., Patel N., Simpson CB, **Hoffmann RG,** Marotti AL. Medialization Thyroplasty Window Creation using an Ultrasonic Surgical Aspirator. *Laryngoscope* 115(1):155-8, 2005.

Sikkema K., Anderson ES, Kelly JA, Winett RA, Gore-Felton C., Roffman RA, Heckman TG, Graves K., **Hoffmann RG** and Brondino MJ. Outcomes of a randomized, controlled community level HIV prevention intervention for adolescents in low-income housing developments. *AIDS* 19:1509-16, 2005.

Purushottam W. (Prakash) Laud, Professor
Ph.D. University of Missouri-Columbia (Statistics) 1977

Professor Laud joined the Division of Biostatistics in the spring of 1994. He was previously Associate Professor of Mathematics in the Division of Statistics at Northern Illinois University.

Professor Laud has published over twenty papers in the statistical literature. His areas of specialization are Bayesian statistics, linear and generalized linear models, nonparametric inference and Monte Carlo methods. He currently serves on the editorial board of the *Journal of Nonparametric Statistics.*

In medical research, Dr. Laud is involved in cost-effectiveness analysis, patient safety investigations, workforce prediction and surveillance of cancer treatment using large administrative databases. He is Director of the Statistics Core of the Injury Research Center and a member of the Center for Patient Care and Outcomes Research.

Some Recent Publications

Laud, P.W., Damien, P., Walker, S.G. Computations via Auxiliary Random Functions for Survival Models. *Scandinavian Journal of Statistics* 2006; 33(2):219-226.

Hanson, T.E, Johnson, W.O., **Laud, P.W.** A Semiparametric Accelerated Failure Time Model for Survival Data with Time Dependent Covariates. In *Bayesian Statistics and its Applications*. S.K. Upadhyay, U. Singh and Dipak K. Dey, editors. Anamaya Publications, New Delhi, 2006; (In press).

Smith, T.L., Mendolia-Loffredo, S., Loehrl, T.A., **Laud, P.W.**, Sparapani R., Nattinger, A.B. Predictive Factors and Outcomes in Endoscopic Sinus Surgery for Chronic Rhinosinusitis. *Laryngoscope* 2005; 115(12):2199-2205.

Nattinger, A.B., **Laud, P.W.**, Bajorunaite, R., Sparapani, R.A., Freeman, J.L. An Algorithm for the Use of Medicare Claims Data to Identify Women with Incident Breast Cancer. *Health Services Research*; 39:1733-1749, 2004.

Johnson-Masotti, A., **Laud, P.W.**, Hoffmann, R.G., Hayat, M.J., Pinkerton, S.G. A Bayesian Approach to Net Health Benefits : An Illustration and Application to Modeling HIV Prevention**.** *Medical Decision Making,* 24:634-653, 2004.

Meyer MC and **Laud PW.** Predictive Variable Selection in Generalized Linear Models. *Journal of the American Statistical Association,* 97:859-871, 2002.

Mei-Jie Zhang, Professor
Ph.D. Florida State University (Statistics) 1991

Professor Zhang came to the Medical College of Wisconsin to serve as an assistant professor and a biostatistician for the International Blood and Marrow Transplant Registry (IBMTR) and the Autologous Bone Marrow Transplant Registry (ABMTR) in 1992. Professor Zhang joined the Division of Biostatistics in 1994.

Professor Zhang's major research areas are survival analysis, inference from stochastic processes, non-linear models and diagnostic testing. As a biostatistician for the IBMTR and ABMTR he is interested in developing statistical model and methodology for analyzing complex transplant data. His research is funded by the National Institute of Health and the National Cancer Institute. Professor Zhang has over 50 statistical and applied publications from his own and collaborative research.

Some Recent Publications

Logan BR, **Zhang MJ** and Klein JP. Regression Models for Hazard Rates versus Cumulative Incidence Probabilities in Bone Marrow Transplant Data. *Biol. of Blood and Marrow Transplantation*, 12:107-112, 2006.

Sun LQ, Liu JX, Sun JG, and **Zhang MJ**. Modelling the Subdistribution of a Competing Risk. *Statistica Sinica*, 16(4):, 2006.

Andersen PK, Ekstrom CT, Klein JP, Shu Y., and **Zhang MJ**. Testing the Goodness of Fit of a Coupla Based on Bivariate Right Censored Data, *Biometrical Journal*, 47:815-824, 2005.

Logan BR, Wang H., and **Zhang MJ**. Pairwise Multiple Comparison Adjustment in Survival Analysis. *Statistics in Medicine*, 24, 2509-2523, 2005.

Laughlin MJ, Eapen M, Rubinstein P, Wagner JE, **Zhang MJ**, Champlin RE, Stevens C, Barker JN, Gale RP, Lazarus HM, Marks DI, van Rood JJ, A Scaradavou, Horowitz MM. Outcomes after transplantation of cord blood or bone marrow from unrelated donors in adults with leukemia. *New England Journal of Medicine*, 351:2265-2275, 2004.

Brent R. Logan, Associate Professor
Ph.D. Northwestern University (Statistics) 2001

Professor Logan joined the Division of Biostatistics in the summer of 2001. Prior to joining MCW he worked at the Institute for Health Services Research and Policy Studies at Northwestern University, where he worked on software issues related to the design and interim analyses of a sequential clinical trial.

Dr. Logan is a biostatistician for the clinical trials network of the Center for International Bone Marrow Research. He has research interests in multiple comparison procedures, methods for analyzing multiple endpoints in clinical trials, and inference in dose-response studies.

Some Recent Publications

Logan BR, Zhang MJ, and Klein JP. Regression models for hazard rates versus cumulative incidence probabilities in bone marrow transplant data. *Biology of Blood and Marrow Transplantation*, 12:107-112, 2006.

Gendelman M., Halligan N., Komorowski R., **Logan B.**, Murphy WJ, Blazar BR, Pritchard Jr, KA, and Drobyski WR. Phenyl N-Tert-Butylnitrone (PBN) protects syngeneic marrow transplant recipients from the lethal cytokine syndrome occurring after agonistic CD40 antibody administration. *Blood*, 105: 428-431, 2005.

Rowe DB, and **Logan BR.** Complex fMRI analysis with unrestricted phase is equivalent to a magnitude-only model. *Neuroimage*, 24: 603-606, 2005.

Logan BR, Wang H., and Zhang MJ. Pairwise multiple comparison adjustment in survival analysis. *Statistics in Medicine*, 24: 2509-2523, 2005.

Logan BR. Optimal two-stage randomized phase II clinical trials. *Clinical Trials*, 2: 5-12, 2005.

McGregor DK, Keever-Taylor CA, Schur B., Vesole DH, Bredeson C., **Logan B.**, Farkas DH, and Chang CC. The implication of follicular lymphoma patients receiving allogeneic stem cell transplantation from donors carrying t(14;18) positive cells. *BMT*, 35: 1049-1054, 2005.

Starsky AJ, Sangani SG, McGuire JR, **Logan B.**, and Schmit BD. Reliability of biomechanical spasticity measurements at the elbow of people post stroke. *Archives of Physical Medicine and Rehabilitation*, 86: 1648-1654, 2005.

Sergey Tarima, Assistant Professor
Ph.D. University of Kentucky (Statistics) 2005

Professor Tarima joined the Division of Biostatistics in the fall of 2005 after completing the doctorate degree in statistics. In a pre-doctoral position he worked on missing data problems in the Injury Research Center at the University of Kentucky. Professor Tarima's current research interests include methods for using additional information in statistical estimation, estimation with missing, censored and partially grouped data, and survey data analysis.

Some Recent Publications

Tarima S., and Pavlov D. Using Auxiliary Information in Statistical Function Estimation ESAIM. *Probability and Statistics,* Vol. 10, 11-23, 2006.

Liu H., **Tarima S.,** Borders A., Getchell T., Getchell M., and Stromberg A. Quadratic Regression Analysis for Gene Discovery and Pattern Recognition for Microarray Time-course Experiments. *BMC Bioinformatics* 6:106 2005.

Fritsch TA, **Tarima SS**, Caldwell GG, Beaven S. Intimate partner violence against Kentucky women: prevalence and health consequences. J Ky Med Assoc. 2005 Sep;103(9):456-60. PMID: 16190002

Fritsch TA, **Tarima SS**, Caldwell GG, Beaven S. Intimate partner violence against older women in Kentucky. J Ky Med Assoc. 2005 Sep;103(9):461-3. PMID: 16190003

Tao Wang, Assistant Professor
Ph.D. North Carolina State University (Statistics) 2001

Professor Wang joined the Division of Biostatistics in January 2002, coming from North Carolina State University where he was a PhD student in the Bioinformatics Research Center. He also holds a joint appointment at the Human Molecular Genetic Center (HMGC) here at MCW.

Dr. Wang's research interests are in statistical genetics and dynamical systems modeling. His current research includes theoretical models and statistical methods for quantitative trait loci (QTL) analysis using polymorphic genetic markers, and statistical methods for haplotype analysis of single nucleotide polymorphisms (SNPs).

Some Recent Publications

Wang T, Weir BS and Zeng ZB (2006) A population-based latent variable approach for association mapping of quantitative trait loci. Annals of Human Genetics 70(4): 506-523.

Wang T and Zeng ZB (2006) Models and partition of variance for quantitative trait loci with epistasis and linkage disequilibrium. BMC Genetics 7: Article 9

Babusukumar U, **Wang T**, McGuire E, Miranda A, Broeckel U and Kugathasan S (2006) Contribution of OCTN variants within the IBD5 locus in pediatric onset Crohn's disease. Am J Gastroenterol 101(6): 1354-1361.

Kugathasan S., Loizides A., Babusukumar U., McGuire E., **Wang T.**, Hooper P., Nebel J., Kofman G., Noel R., Broeckel U., and Tolia V. Comparative phenotypic and CARD15 mutational analysis among African American, Hispanic, and White children with Crohn's disease. *Inflamm Bowel Dis*, 11 (7):631-638, 2005.

Zeng Z B, **Wang T.**, and Zou, W. Modeling quantitative trait loci and interpretation of models. *Genetics* 169: 1711-1725, 2005.

Bilusic M., Bataillard A., Tschannen M., Gao L., Barreto N., Vincent M., **Wang T.,** Jacob HJ, Sassard J., and Kwitek AE. Hypertension and related phenotypes cluster on chromosome 2, 13 and 17 in the Lyon Hypertensive (LH) rat. *Hypertension* 44:695-701, 2004.

Joint Faculty Members

Sun-Wei Guo, Professor, Department of Pediatrics
Ph.D. University of Washington University, 1991
Research Interests: Human Genetics
Genetic Epidemiology
Molecular Genetics

Timothy McAuliffe, Professor, Department of Psychiatry
Ph.D. University of California – Los Angeles,, 1981
Research Interests: Design and Analysis of Field Trials
Reliability and Validity
AIDS Prevention

Daniel Rowe, Assistant Professor, Department of Biophysics
Ph.D. University of California - Riverside, 1998
Research Interests: Statistical Methods in fMRI
Matrixvariate Bayesian Analysis
Time Course Modeling

Adjunct Faculty Members

From Department of Mathematical Sciences, University of Wisconsin - Milwaukee

Jay Beder, Professor
Ph.D. George Washington University, 1981
Research Interests: Gaussian Processes
Design

Jugal Ghorai, Professor
Ph.D. Purdue University, 1977
Research Interests: Nonparametric estimation
Survival Analysis

Eric Key, Professor
Ph.D. Cornell University, 1983
Research Interests: Probability theory
Stochastic processes

Gilbert Walter, Professor Emeritus
Ph.D. University of Wisconsin, 1962
Research Interests: Mathematical Analysis
Sampling Theorems

Vytaras Brazauskas, Associate Professor
Ph.D. University of Texas - Dallas, 1999
Research Interests: Robust & Nonparametric Methods
Actuarial Science

Daniel Gervini, Assistant Professor
Ph.D. University of Buenos Aires, 1999
Research Interests: Robust & Nonparametric Methods
Dimension Reduction

From Department of Mathematics Statistics and Computer Science, Marquette University

Ruta Bajorunaite, Assistant Professor
Ph.D. Medical College of Wisconsin, 2003
Research Interests: Survival Analysis
Competing Risks

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COLLABORATIVE RESEARCH OPPORTUNITIES

Faculty and students in the Division of Biostatistics play important roles in a number of centers and program projects at the Medical College of Wisconsin. The types of problems encountered in these projects often motivate dissertation topics for students.

Biostatistics Consulting Service

The consulting service in the Division of Biostatistics at the Medical College of Wisconsin offers comprehensive statistical consulting, computing and data entry services for clients within and outside the Medical College. A full time statistician serves as the manager of the statistical consulting services, and a Biostatistics faculty member is in charge of overseeing the operation. Each consulting project is supervised by a faculty member, and the consulting is provided by the faculty member and/or the manager of the services. Biostatistics graduate students also become involved in consulting under the supervision of the faculty.

Specific services offered include assistance in grant proposal preparation, design of clinical trials, experimental design, survey design, determination of sample size requirements, randomization, data management, modeling, data analysis and interpretation. The Biostatistics Division has state of the art statistical software packages and computing facilities.

Cancer Center at MCW

The Cancer Center at the Medical College of Wisconsin is actively involved in clinical and basic science research in the areas of bone marrow transplantation, biological response modifiers, gene regulation experimental radiotherapy, cell biology and experimental therapeutics. MCW participates in multi-institutional cooperative group studies as well as serves as coordinating center for some clinical trials. Today, the statistician is recognized as an integral partner in the design of cancer clinical trials from concept to execution. Survival outcomes are frequently the principal measurement of effect of therapy in clinical trials. Statistical research in the area of survival (time of event) analysis has become a major area of research in biostatistics. Cancer research at the Medical College of Wisconsin offers biostatistics students the opportunity to gain familiarity and experience in the design and conduct of clinical trials.

Center for AIDS Intervention Research

The Center for AIDS Intervention Research represents an interdisciplinary research team collaborating with a primary thematic focus of developing, studying and evaluating behavior change interventions to prevent the spread of HIV infection. The Center includes four basic science and clinical cores: Intervention Model Development, Assessment Methodologies, Quantitative Models Analysis and Epidemiology, and Cost-Benefit Analysis. These cores interact synergistically with one another and with individual projects of the Center's investigators to facilitate the conduct of established studies, new investigator research, and pilot and developmental studies. The overall intent of the Center is to advance both conceptual and applied scientific knowledge concerning effective HIV prevention intervention strategies and mental health services research related to HIV.

Center for Patient Care and Outcomes Research

The Center for Patient Care and Outcomes Research has the mission of conducting state-of-the-art research of effective/efficient patient care services and related health outcomes. The purposes of the Center are to conduct research on patient care services and related health outcomes, to facilitate a supportive environment for MCW investigators new to this area, to determine the need for and recruit new faculty in targeted methodological areas, and to provide a seminar series to enhance collaboration. A strong emphasis of the Center is cancer prevention and control. Women's health is another area of content emphasis.

General Clinical Research Center

The General Clinical Research Center at the Medical College of Wisconsin is designed to be a central focus for clinical research projects funded by the National Institute of Health, as well as other foundations supporting clinical research. Some highlights of the current CRC are the Endocrine Section where studies in the etiology of obesity and diabetes are conducted; Renal Section where studies of causes and prevention of kidney stones are conducted; Gastroenterology Section where studies of swallowing disorders are conducted. The endocrine studies involve the use of statistical methods to identify and characterized the frequency and spectrum of pulses of insulin secretion and develop mathematical models that reflect the deep psychologic data obtained from these studies. Opportunities abound for students to gain experience with multi-factorial designs and repeated measures designs to maximize the information gained from a clinical study. There are also opportunities to gain experience with genetic studies of factors for obesity and diabetes and with statistical methods for genetic studies, such as segregation and linkage analyses.

Epidemiology Data Service

The Epidemiology Data Service Center (EDSC) was created in January of 1995 to meet the needs of researchers in the areas of Epidemiology and Health Services Research. Since then, the staff has been trying to meet those needs by collecting and cataloging local and national datasets for use by the Medical College of Wisconsin Community.

Currently there are 40 titles in the EDSC Data Resource Catalog, with over one half of these titles coming from departments other than the EDSC. These include two datasets created by MCW faculty. Other titles in the catalog were purchased by the EDSC, received through the National Center for Health Statistics Public Use Data Tape Program, or downloaded from the Internet.

The EDSC has a homepage on the World Wide Web which allows users to read our newsletter and browse our catalog. The homepage has attracted the attention of researchers from across the country which we hope will allow us to expand our services and resources in the future.

Statistical Center of the Center for International Blood and Marrow Transplant Research (CIBMTR)

The CIBMTR is an international study group engaged in ongoing investigation of allogeneic and syngeneic bone marrow transplantation for more than 25 years. The CIBMTR database contains more than 80,000 patients with detailed information on a subset of more than 38,000 patients transplanted for more than 80 diseases at 390 centers worldwide (68% of all teams in the world performing allogeneic bone marrow transplants participate in this registry). More than 61,000 patients transplanted since 1989 are registered. The Statistical Center is the core component of the registries and is located at the Medical College of Wisconsin in Milwaukee. The Statistical Center provides the biostatistical expertise for designs, conduct, analysis and interpretation of scientific studies. Professor Klein serves as the Statistical Center Director and Professors Logan, Zhang, Tarima and Wang serve as the biostatistician of the Statistical Center which brings the close relationship between the Division of Biostatistics and the Center, and provides the biostatistical students with a broader range of opportunity to analyzing complex transplant data.

Human and Molecular Genetics Center

The HMGC at the Medical College of Wisconsin provides academic support for researchers at MCW who use the genomic sequence to understand disease and translate this information from the laboratory to the patient. Most of the research projects in the Center are funded by government agencies such as the National Institutes of Health. The research areas include various directions in genomics, high throughput sequencing and

the development and use of single nucleotide polymorphisms (SNP's), microarray analysis and bioinformatics. Prof. Tao Wang is the main biostatistics faculty member associated with this Center.

Injury Research Center

The IRC at the Medical College conducts research in wide ranging aspects of injury and its treatment. Ongoing projects include quality of life after trauma, biomechanics of penetrating brain injury, violence related fatalities and injuries, and psychological factors in adjustment after traumatic injury. Professors Laud and Tarima from the Biostatistics Division collaborate with various researchers in the Center.

LIFE IN MILWAUKEE

Christened **"**Millioki" or gathering place by the waters by the Algonquin Indians, Milwaukee is a city with an interesting variety of cultural, recreational and educational opportunities. Newcomers discover that it holds plenty of big and small surprises for all who gather here. Located on the southwest scenic shores of Lake Michigan, Milwaukee is the largest city in Wisconsin and the 18th largest city in then nation. The metropolitan area numbers more than 1.4 million in population.

The showcase for Milwaukee's cultural activities is the Performing Arts Center (PAC), a uniquely designed facility that draws performing groups from around the world and features the Milwaukee Symphony Orchestra, considered one of the major symphonies in the country. The Milwaukee Ballet Company and the Milwaukee Repertory Theater are among other cultural attractions in the theater district in downtown Milwaukee.

Near the PAC is the Pabst Theater, a Milwaukee showplace since 1895, which also has a regular schedule of plays and concerts. The Milwaukee Public Museum, the 5th largest natural history museum in the country, is a major attraction of the city.

The Milwaukee Art Museum on the lakefront exhibits over 10,000 works of art, sculpture, decorative art, photography, and paintings. It contains originals by a diversity of artists Rodin, Rembrandt and Andy Warhol, and is noted for its collection of Haitian art, Mettlach steins, and works from Frank Lloyd Wright's Prairie School of Architecture. The Zoo and the Natural History Museum are perennial centers of activity and rank among America's top five respectively.

A surprise found throughout the area is the Milwaukee County Park System. Its well-kept 14,000 acres are a model for cities across the nation. For Milwaukeeans, they provide convenient opportunities to enjoy Wisconsin's seasons. In summer it's golf, tennis, softball, basketball, biking, volleyball, hiking and swimming. Winter brings out the cross-country skiing, ice skating, ice sculpture contests and toboggans.

Lake Michigan is a favorite boating, swimming, sailing, skiing and fishing spot for many Milwaukeeans. Or, if smaller lakes are preferred, the city is within an hour's driving time of 160 inland lakes.

Downtown is where major sports teams play at the Bradley Center, home of NBA basketball (Bucks), IHL hockey (Admirals), NSPL soccer (WAVE) and the Marquette University basketball team (Warriors). At MECCA (Milwaukee Exposition and Convention Center and Arena) are more varied sports events such as national tennis matches and skating events.

Ten minutes away is Milwaukee's Miller Park, home of National League baseball (Brewers). In addition, the PGA makes a tour stop annually in Milwaukee for the Greater Milwaukee Open, and Stock and Indy cars pull up for several USAC and NASCAR-

sanctioned racing events, such as the Miller 200.

The Pettit National Ice Center is the only facility of its kind in the U.S. and one of only three in the world to feature an enclosed ice training and competition center for speed skating, hockey and figure skating.

Milwaukee hosts many annual events such as the Wisconsin State Fair (one of the nation's best) Summerfest, Lakefront Festival of Arts, Holiday Folk Fair and Historic Third Ward Block Party.

Milwaukee is home to over 70 nationalities, and annual ethnic festivals reflect this cultural background. These celebrations include Fiesta Italiana, Fiesta Mexicana, African World Festival, Irish Fest, German Fest, Polish Fest, Greek Festivals, Jewish Jubilee, Bastille Days, Juneteenth Day, and Oktoberfest.

The result of this cultural blending is a city where everyone feels welcome and at home. The best description of this feeling is the German phrase-Gemutlichkeit. Gemutlichkeit is the reason people find Milwaukee a big city with a small town atmosphere.

Milwaukee's ethnic flavor can also be enjoyed year-round in the city's many fine restaurants with their wide variety of food and entertainment. Many restaurants are run by third generation family members carrying on their cultural traditions and commitment to quality dining.

Milwaukee has the nightlife to suit any taste, from cozy relaxation to chic sophistication. The city's live entertainment includes the finest in folk, country, rock, jazz, and big band sounds. This variety is matched by the range of nightspots to enjoy - from small lounges to large nightclubs.

In addition to the Medical College of Wisconsin, the Milwaukee area has ten other colleges and universities. The two largest are Marquette University and the University of Wisconsin-Milwaukee.

The Milwaukee area features many surprises - shopping in an old world market place, touring a brewery, or picnicking in the park. But remember, whatever you do and wherever you go, Milwaukee's Gemutlichkeit will be there to greet you.

In a recent national survey, the state of Wisconsin ranked near the top in terms of quality of life. There is an extensive network of state parks and national forests which includes, among others, the Apostle Islands National Lakeshore, the Brule River State Forest, Chequamegon National Forest, Devil's Lake State Park, Kettle Moraine State Forest, Nicolet National Forest, and Point Beach State Forest. These areas provide extensive opportunities for camping, boating, hiking, and skiing. Other points of interest include the Experimental Aircraft Association Museum, National Railroad Museum, Circus World Museum, Johnson Golden Rondelle Theater and historical sites such as Villa Louis.