DEPARTMENT OF BIOSTATISTICS

UNDERGRADUATE STUDENT HANDBOOK MINOR IN STATISTICS

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Table of Contents

About the Department ........................................................................................................................................3
Biostatistics at the University at Buffalo .........................................................................................................3
Mission of the Department ..............................................................................................................................3
Teaching Philosophy .......................................................................................................................................3
Research Activities ..........................................................................................................................................4
Contact Information .......................................................................................................................................4
Personnel: Faculty ...........................................................................................................................................5
Personnel: Staff ..............................................................................................................................................9
Advisement and Supervision ...........................................................................................................................10
Undergraduate Program – Minor in Statistics ..................................................................................................10
Required Statistics Courses ............................................................................................................................11
Course Descriptions .....................................................................................................................................11
About the Department

Biostatistics at the University at Buffalo
The Department of Biostatistics of the State University of New York at Buffalo was formed within the School of Public Health and Health Professions (SPHHP) in June 2003. The formation of the Department followed the opening of the SPHHP in January 2003. This new organization allowed for the development of graduate programs in biostatistics and for a more centralized coordination research activities of applied and theoretical instruction. The Department includes biostatisticians at the Roswell Park Cancer Institute, the Research Institute on Addictions, and the Women and Children’s Health Research Foundation. These affiliations, in addition to collaborations with researchers in the Center of Excellence in Bioinformatics, the College of Dentistry, the College of Medicine and Biomedical Sciences, and the School of Public Health and Health Professions, provide a rich environment for the education and training of statisticians and biostatisticians. In addition to their classroom studies, the Department’s students have opportunities to gain practical training through mentored, hands-on data analyses in the context of important biological and health science research projects. It is a thriving environment and an exciting time for biostatistics at the University at Buffalo.

Mission of the Department
The mission of the Department of Biostatistics is to educate and train biostatistical scientists; to collaborate with researchers in the clinical and public health sciences; to conduct methodological research; to collaborate with local, state, or national health institutions; and to serve our University and the statistics and public health professions.

Teaching Philosophy
Our philosophy of education is that students learn what they apply. The Department seeks to provide opportunities for students to communicate their knowledge to others through classroom presentations and student seminars.

Faculty bring a philosophy to the classroom and to their mentoring that is consistent with the Department’s goals to promote and extend the proper use of statistics in the health sciences, to contribute substantively and methodologically to the advancement of knowledge in health related disciplines, and to aid the advance of evidenced-based medicine, healthcare, public health practice and policy making. This emphasis brings a high degree of relevance to the classroom and enhances students’ opportunities to work as apprentices with faculty. Faculty and students together work with collaborators in the School of Public Health and Health Professions, the School of Medicine and Biomedical Sciences, and at the Roswell Park Cancer Institute.

We believe in a holistic approach to education. The Department is dedicated to providing a wide variety of educational, research, and collaborative opportunities to students in a friendly, respectful, nurturing, and stimulating environment that promotes intellectual and professional development.
Research Activities
The Departmental faculty engages in theoretical, methodological, and applied statistical research. This work is often motivated by their collaborations with health science researchers. There is ongoing involvement in medical informatics and bioinformatics, cancer research, maternal and child health, research on addictions, and epidemiology. Projects span a wide range of topics such as biosurveillance, metabonomics, microarray data analysis, pattern recognition and classification, proteomics, statistical genetics, clinical trials to assess the efficacy of cancer treatments, epidemiologic studies of environmental risk factors, and outcomes research.

Contact Information
Department Phone Number:

716) 829-3690

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(716) 829-2200

Email address:

sphhp-biostat@buffalo.edu

Personnel: Faculty

Chair and Professor
Alan D. Hutson, PhD University of Rochester
Biostatistics, clinical trials design, epidemiological modeling, Bioinformatics, computational methods and order statistics

Associate Chair and Professor
Randolph L. Carter, PhD Iowa State University
Longitudinal data methods, measurement errors models, risk assessment, biostatistics, epidemiological modeling, maternal and child health epidemiology, radiation effects

Graduate Director and Professor
Lili Tian, PhD University of Rochester
Design of Clinical Trials, Survival Analysis, statistical genetics, skewed data analysis, analysis of medical expenditure data, cancer research, behavioral studies, health policy issues

Professor
Marianthi Markatou, PhD Pennsylvania State University
Statistical Sciences (Statistics and Biostatistics): Problems in model assessment and selection, robustness, mixture models, statistical distances, biomarker development and ROC analysis, high dimensional data analysis, large databases data analysis, surveillance in large databases, methods for the analysis of observational data. Interdisciplinary: Machine
learning and data mining, text data mining, biomedical informatics, emerging safety sciences relevant to health, study of dependence in microarrays and proteomics data, comparative safety and comparative effectiveness research.

**Research Professor**

John Blessing, PhD  
University at Buffalo  
Clinical trials, Biostatistics Data Center Administration

Mark Brady, PhD  
University at Buffalo  
Clinical Trials, drug development, time to failure analyses, screening trials

**Undergraduate Director and Research Professor**

Dietrich Kuhlmann, PhD  
University of Missouri

Calyampudi Radhakrishna Rao, PhD  
Purdue University  
National Medical of Science Winner  
PhD received at ScD at Cambridge University  
Recipient of 27 honorary doctoral degrees in 16 countries

David Tritchler, PhD  
University of Toronto  
Statistical Analysis of DNA microarrays, statistical genomics, design & analysis of genetic studies, graphical models, casual inference, Bayesian networks, meta-analysis, statistical computation.

**Research Associate Professors**

Kathleen Darcy, PhD  
Translational research science - Gynecologic Oncology Group, Roswell Park Cancer Institute

Song Liu, PhD  
University at Buffalo  
Vice-Chair of Roswell Park Cancer Institute Dept. of Bioinformatics  
Research interests: developing computational and statistical methods to discover genetic risk factors and biomarkers for predicting some human diseases such as cancer using integrative analysis of multi-dimensional data from biomedical science such as microarray, high throughput sequencing, etc.

Michael Sill, PhD  
University of Pittsburgh  
Adaptive designs and inference, Phase I and II clinical trial development, exact methods for small sample sizes, translational research, differences between Bayesian & frequentist methods
Associate Professors

Changxing Ma, PhD
Nankai University
MPH Concentration Co-Director
Statistical genetics and experimental design

Jeffrey Miecznikowski, PhD
Carnegie Mellon University
Research interests: bio-technical image analysis, array comparative genomic hybridization (aCGH) analysis, microarray analysis, nonparametric statistics, bootstrap methods, and software development

Albert Vexler, PhD
Hebrew University of Jerusalem, Israel
Research interests: receiver operating characteristic curves analysis; measurement error; optimal designs; regression models; censored data; change point problems; sequential analysis; statistical epidemiology; biostatistics; applications of Bayesian approaches to tests; asymptomatic methods of statistics; forecasting; sampling; optimal testing; nonparametric tests; empirical likelihoods; renewal theory; tauberian theorems; time series; categorical analysis; multivariate analysis; multivariate testing of complex hypotheses; factor and principal component analysis

Gregory E. Wilding, PhD
University of Rochester
Vice-Chair of Biostatistics at Roswell Park Cancer Institute and Co-Director of the Biostatistics Shared Resource. Research interests: clinical trial design, permutation tests, resampling techniques, goodness-of-fit tests, distributional characterizations, copulas, tests of independence, biostatistics.

Jihnhee Yu, PhD
Texas A & M University
Research interests: stochastic processes and small clinical trials

Assistant Professors

Daniel P. Gaile, PhD
Texas A&M University
Research interests: Biomarker identification, array comparative genomic hybridization (aCGH) analysis, expression analysis via array, NGS and bead-based technologies, proteomics, normalization methods for data generated by high throughput biotechnologies, non-parametric statistics, bootstrap methods, exact methods, linear combinations of order statistics, sparse matrix approaches, finite mixture models, statistical computing, software development.
Rachael Hageman Blair, PhD  
Case Western University  
Research interests: mathematical biology, optimization, numerical analysis, inverse problems, statistics and scientific computing, methodology development for mathematical modeling and simulation of metabolic and genetic networks, data analysis including microarray and quantitative trait loci.

Jiwei Zhao, PhD

Research Assistant Professors

Kristopher Attwood, PhD  
University at Buffalo  
Research interests: Clinical, observational and diagnostic studies, decision theory, research operations, and statistics education.

William Brady, PhD  
University at Buffalo  
Research interests: statistical methods research focuses primarily on phase I and II clinical trial design and the application of exact methods to binary data.

Wei Deng, PhD  
Gynecologic Oncology Group  
University at Buffalo

Rositsa B. Dimova, PhD  
Columbia University

Kevin Hasegawa Eng, PhD  
University of Wisconsin-Madison  
Research interests: Translational genomics in ovarian cancer; Biomarker development and validation; and statistical genomics algorithms for personalized medicine

Virginia Filiaci, PhD  
Gynecological Oncology Group, Roswell Park Cancer Institute  
University at Buffalo

Terry Mashtare, Jr., PhD  
University at Buffalo

Yoram Shotland, PhD  
Hebrew University of Jerusalem, Israel

Jianmin Wang, PhD  
Roswell Park Cancer Institute  
Iowa State University

Austin Miller, PhD  
University at Buffalo  
Research interests: The design and analysis of experimental, clinical and observational studies, measurement error models and structural equations modeling

Lei Wei, PhD  
University at Buffalo
Roswell Park Cancer Institute
Qianqian Zhu, PhD
Roswell Park Cancer Institute

Professors Emeriti
M.M. Desu, PhD
Nonparametric statistical methods and sample size methodology
University of Minnesota

Richard N. Schmidt, PhD
Statistical Computing
University of Michigan

Adjunct Professor
Leonid Khinkas, PhD
Voronezh State Univ., Voronezh, USSR

Peter Rogerson, PhD
Spatial Statistics and GIS Analysis
University at Buffalo

Enrique E. Schisterman, PhD
Senior Investigator at NICHD, Washington, DC
University at Buffalo

Sargur N Srihari, PhD
Ohio State University

Adjunct Associate Professor
Joseph Lucke, PhD
Research Institute on Additions, Buffalo, NY
University of Kansas

Adjunct Assistant Professor
Zihua Hu, PhD
Center for Computational, Buffalo, New York
University of Iowa

Tao Liu, PhD
Institute of Bioinformatics, Chinese Academy of Sciences

Lara Sucheston, PhD
Case Western University
Research interests: molecular and genetic causes for complex diseases and the methodology used to find these mechanisms.

Yijun Sun, PhD
University of Florida

Li Yan, PhD
University of Rochester PhD in Physics and University at Buffalo PhD Biostatistics

**Personnel: Staff**

Amy Barczykowski
Data Coordinator, Population Health Observatory

Nancy M. Barczykowski
Assistant to the Chair

Jon Dare
Data Manager/Statistician

Noreen D. McGuire
Graduate Program Coordinator

Teresa Sikorski
Department Secretary
**Advisement and Supervision**

All students are assigned a faculty advisor to assist in planning a program to meet their educational goals and to answer questions relating to university requirements. Students are expected to consult with their advisor prior to registration each semester. Failure to do so could result in a student’s program not meeting the requirements necessary for graduation, which may delay or prevent degree conferral. If a student wishes to change advisors, he/she should submit a request in writing to the Director. Changes will be made with the approval of the new advisor. Administrative questions should be directed to the Department’s Director of Undergraduate Studies.

**Undergraduate Program in Statistics**

Statistics is the science of making decisions in the face of uncertainty. The study of statistics provides a background for understanding numerical data and the process of making inferences from such data. Statistics is an invaluable tool for all scientific disciplines as well as being a significant independent mathematical discipline in its own right. The Department of Biostatistics provides students with a calculus-based foundation in probability and statistics before branching into numerous areas of application. This foundation prepares students for career opportunities in government (e.g., Center for Disease Control, Food and Drug Administration, Census, Bureau of Labor Statistics) or business and industry (e.g., Data Analyst, Data Manager, Actuary) or for graduate study in statistics or any quantitative discipline. Statistics is an excellent co-discipline with computer science, mathematics, management, and many of the social sciences such as economics, geography, and psychology. Students may apply at any time after they have taken MTH 142. Students should visit the Undergraduate Director in the Department of Biostatistics to discuss the program.

**Minor in Statistics**

Coursework leading to a Minor in Statistics includes three introductory courses and four advanced statistics courses. All University graduation requirements must be met as well.

**Required Courses**

Seven courses are required (26 credits) with a minimum GPA of 2.5 in the first three pre-requisite or lower-division courses.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>MTH 141</td>
<td>College Calculus 1 (4)</td>
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<tr>
<td>MTH 142</td>
<td>College Calculus 2 (4)</td>
</tr>
<tr>
<td>STA 119</td>
<td>Statistical Methods (4)</td>
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<tr>
<td>STA 301</td>
<td>Introduction to Probability (4)</td>
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<tr>
<td>STA 302</td>
<td>Introduction to Statistical Inference (4)</td>
</tr>
<tr>
<td>STA 403</td>
<td>Regression Analysis (3)</td>
</tr>
<tr>
<td>STA 404</td>
<td>Analysis of Variance (3)</td>
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Administrative Requirements
The Undergraduate Catalog (http://undergrad-catalog.buffalo.edu/) contains official information regarding university policies. Please consult it for information regarding, for example, University graduation requirements, course grade policies, academic dishonesty policy, registration, student records, Application for Degree Form.

Course Descriptions
Unless otherwise specified, courses are 3 credit courses.

STA 111 Quantitative Reasoning (4)
Designed especially for students in the humanities or the social sciences. Focuses primarily on the fundamental ideas of probability and introduces statistics.
Credits: 3 / 1
Semester(s): F
Prerequisites:
None  Type:
LEC/REC

STA 119 Statistical Methods (4)
Covers topics in descriptive statistics, probability, inference, and experimental design, all of which are put together to draw conclusions from uncertainty through analysis of experimental data. Although a general statistical methods course, the material (through examples) is geared towards sciences majors, especially those in the health sciences. The underlying reasoning behind the techniques will be explored.
Credits: 3 / 1
Semester(s): F
Sp
Prerequisites:
None  Type:
LEC/REC

STA 301 Introduction to Probability (4)
Provides students with probability and distribution theory necessary for the study of statistics. Topics include axioms of probability theory, independence, conditional probability, random
variables, discrete and continuous probability distributions, functions of random variables, moment generating functions, the Law of Large Numbers, and the Central Limit Theorem.

**Credits:** 3 / 1  
**Semester(s):** F  
**Prerequisites:** MTH 142 (Calculus II) or permission of instructor  
**Type:** LEC/REC

**STA 302 Introduction to Statistical Inference (4)**  
Introduces principles of statistical inference. Introduces and develops classical methods of estimation, tests of significance, the Neyman-Pearson Theory of testing hypotheses, maximum likelihood methods, and Bayesian statistics.

**3 Credits:** 3 / 1  
**Semester(s):** Sp  
**Prerequisites:** STA 301  
**Corequisites:**  
None  
**Type:**  
LEC/REC

**STA 403 Regression and Design of Experiments I (3)**  
Regression analysis and introduction to linear models. Topics: Multiple regression, analysis of covariance, least square means, logistic regression, and non-linear regression. This course includes a one hour computer lab and emphasizes hands-on applications to datasets from the health sciences.

**Credits:** 3 / 1  
**Semester(s):** F  
**Prerequisites:** MTH 142 (Calculus II) or permission of instructor  
**Type:** LEC/LAB

**STA 404 Regression and Design of Experiments II (4)**  
Presentation of statistical methods for comparing populations and estimating and testing associations between variables. Topics: Point estimation, confidence intervals, hypothesis testing, ANOVA models for 1, 2, and k way classifications, multiple comparisons, chi-square test of homogeneity, Fisher’s exact test, McNemar’s test, measures of association, including odds ratio, relative risks, Mantel-Haenszel tests of association, and standardized rates, repeated measures
ANOVA, simple regression and correlation. This course includes a one hour computing lab and emphasizes hands-on applications to datasets from the health related sciences.

**Credits:** 3 / 1  
**Semester(s):** F  
**Prerequisites:** STA 403  
**Corequisites:** None  
**Type:** LEC/LAB