

# BIostatISTICS AND MEDICAL INFORMATICS (B M I)

## **B M I/POP HLTH 451 – INTRODUCTION TO SAS PROGRAMMING FOR POPULATION HEALTH** 2 credits.

Use of the SAS programming language for the management and analysis of biomedical data. Enroll Info: Pop Hlth grad student or consent of instructor

**Requisites:** None

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2018

## **B M I/STAT 511 – INTRODUCTION TO BIOSTATISTICAL METHODS FOR PUBLIC HEALTH** 3 credits.

Provides breadth in biostatistical methods for public health practitioners. Topics will include research design, data collection methods and database management, statistical computing and programming, descriptive statistics in tables and graphics, introductory statistical methods, and survey sampling. Enroll Info: None

**Requisites:** Declared in the Master of Public Health (MPH) program. Not open to students who have taken STAT/B M I 541 or POP HLTH/ B M I 551

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2018

## **B M I/STAT 541 – INTRODUCTION TO BIOSTATISTICS** 3 credits.

Course designed for the biomedical researcher. Topics include: descriptive statistics, hypothesis testing, estimation, confidence intervals, t-tests, chi-squared tests, analysis of variance, linear regression, correlation, nonparametric tests, survival analysis and odds ratio. Biomedical applications used for each topic. Enroll Info: Graduate standing. Students may not enroll if they have completed BMI 511 or BMI 551.

**Requisites:** None

**Course Designation:** Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2018

## **B M I/STAT 542 – INTRODUCTION TO CLINICAL TRIALS I** 3 credits.

Intended for biomedical researchers interested in the design and analysis of clinical trials. Topics include definition of hypotheses, measures of effectiveness, sample size, randomization, data collection and monitoring, and issues in statistical analysis. Statistics graduate students should take STAT/B M I 641. Enroll Info: STAT/B M I 541 or equiv or cons inst

**Requisites:** None

**Course Designation:** Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2019

## **B M I 544 – INTRODUCTION TO CLINICAL TRIALS II** 3 credits.

Intended for biomedical researchers, focuses on design, implementation, and conduct of clinical trials. Topics include: regulatory requirements; data collection; data quality and management; budgets; federal, institutional, and sponsor-defined requirements; establishment of research infrastructures; preparation of investigator-INDs; investigator responsibilities. Enroll Info: BMI 541 or equiv BMI 542 cons inst

**Requisites:** None

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2018

## **B M I/STAT 546 – PRACTICUM IN CLINICAL TRIAL DATA ANALYSIS AND INTERPRETATION** 3 credits.

Provides practice in analysis and interpretation of existing datasets from national and international clinical trials in a variety of diseases. Students will develop a research question, review clinical protocols, and analyze available data to prepare a report. Enroll Info: STAT/B M I 541 or 572 STAT/B M I 542 or 641

**Requisites:** None

**Course Designation:** Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Summer 2015

**B M I/POP HLTH 551 – INTRODUCTION TO BIOSTATISTICS FOR POPULATION HEALTH**

3 credits.

Course designed for population health researcher. Topics include descriptive statistics, elementary probability, probability distributions, one- and two-sample normal inference (point estimation, hypothesis testing, confidence intervals), power and sample size calculations, one- and two-sample binomial inference, underlying assumptions and diagnostic work. Enroll Info: None

**Requisites:** Declared in the Population Health or Epidemiology graduate program; not open to students who have taken STAT/B M I 511 or STAT/B M I 541

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2018

**B M I/POP HLTH 552 – REGRESSION METHODS FOR POPULATION HEALTH**

3 credits.

Introduction to the primary statistical tools used in epidemiology and health services research; multiple linear regression, logistic regression and survival analysis. Enroll Info: Pop Hlth/BMI 451 and Pop Hlth/BMI 551 ; or cons inst

**Requisites:** None

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2019

**B M I/COMP SCI 567 – MEDICAL IMAGE ANALYSIS**

3 credits.

Present introductory medical image processing and analysis techniques.

Topics include medical imaging formats, segmentation, registration, image quantification, classification. Strongly encourage Matlab experience, such as COMP SCI 310 or 368-Matlab. Enroll Info: None

**Requisites:** (MATH 320 or 340) and (STAT/B M I 511, 541, POP HLTH/B M I 551, STAT 324, 371, or STAT/F&W ECOL/HORT 571) or graduate/professional standing

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Spring 2019

**B M I/COMP SCI 576 – INTRODUCTION TO BIOINFORMATICS**

3 credits.

Algorithms for computational problems in molecular biology. The course will study algorithms for problems such as: genome sequencing and mapping, pairwise and multiple sequence alignment, modeling sequence classes and features, phylogenetic tree construction, and gene-expression data analysis. Enroll Info: None

**Requisites:** (COMP SCI 300 or 367) and MATH 222 or graduate/professional standing or declared in the Capstone Certificate in Computer Sciences for Professionals

**Course Designation:** Breadth - Biological Sci. Counts toward the Natural Sci req

Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

**Repeatable for Credit:** No

**Last Taught:** Fall 2018

**B M I/BIOCHEM/BMOLCHEM/MATH 606 – MATHEMATICAL METHODS FOR STRUCTURAL BIOLOGY**

3 credits.

A rigorous foundation for mathematical modeling of biological structures. Mathematical techniques include ordinary and partial differential equations, 3D Fourier analysis and optimization. Biological applications include protein folding, molecular dynamics, implicit solvent electrostatics, and molecular interactions. Enroll Info: None

**Requisites:** (MATH 234, 320, 340, or 375) and (COMP SCI 200, 300, 301, 302, or 310) or graduate/professional standing or member of the Pre-Masters Mathematics (Visiting International) Program

**Course Designation:** Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2016

**B M I/BIOCHEM/BMOLCHEM/MATH 609 – MATHEMATICAL METHODS FOR SYSTEMS BIOLOGY**

3 credits.

Provides a rigorous foundation for mathematical modeling of biological systems. Mathematical techniques include dynamical systems and differential equations. Applications to biological pathways, including understanding of bistability within chemical reaction systems, are emphasized. Enroll Info: None

**Requisites:** MATH 415 and (MATH 320, 340, 341, or 375) or graduate/professional standing or member of the Pre-Masters Mathematics (Visiting International) Program

**Course Designation:** Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2018

**B M I/ SY E 617 – HEALTH INFORMATION SYSTEMS**

3 credits.

Provides grounding in core concepts of health information systems. Major applications include clinical information systems, language and standards, decision support, image technology and digital libraries. Evaluation of IE tools and perspectives designed to improve the quality, efficiency and effectiveness of health information. Enroll Info: None

**Requisites:** I SY E 417**Course Designation:** Level - Advanced

L&amp;S Credit - Counts as Liberal Arts and Science credit in L&amp;S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No**Last Taught:** Spring 2016**B M I/STAT 641 – STATISTICAL METHODS FOR CLINICAL TRIALS**

3 credits.

Statistical issues in the design of clinical trials, basic survival analysis, data collection and sequential monitoring. Intended for statistics graduate students; those with medical backgrounds should take STAT/ B M I 542. Enroll Info: Math/STAT/MATH 310 or equiv or cons inst

**Requisites:** None**Course Designation:** Breadth - Natural Science

Level - Advanced

L&amp;S Credit - Counts as Liberal Arts and Science credit in L&amp;S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No**Last Taught:** Spring 2019**B M I/STAT 642 – STATISTICAL METHODS FOR EPIDEMIOLOGY**

3 credits.

Methods for analysis of case-control, cross sectional, and cohort studies. Covers epidemiologic study design, measures of association, rates, classical contingency table methods, and logistic and Poisson regression. Enroll Info: Statistics 310 or equivalent or consent of instructor

**Requisites:** None**Course Designation:** Level - Advanced

L&amp;S Credit - Counts as Liberal Arts and Science credit in L&amp;S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No**Last Taught:** Fall 2018**B M I/POP HLTH 651 – ADVANCED REGRESSION METHODS FOR POPULATION HEALTH**

3 credits.

Extension of regression analysis to observational data with unequal variance, unequal sampling and propensity weights, clusters and longitudinal measurements, using different variance structures, mixed linear models, generalized linear models and GEE. Matrix notation will be introduced and underlying mathematical and statistical principles will be explained. Examples use data sets from ongoing population health research. Enroll Info: POP HLTH 798 and POP HLTH/B M I 552; or cons inst

**Requisites:** None**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Spring 2019**B M I/POP HLTH 652 – TOPICS IN BIOSTATISTICS FOR EPIDEMIOLOGY**

1-3 credits.

Each module will adopt an in-depth focus on a biostatistical method of particular relevance to epidemiology such as measurement error, missing data, intermediate variables, complex study designs, meta-analysis, splines, propensity scores, causal inference, spatial statistics and resampling. One or more modules will be offered every spring semester.

Enroll Info: None

**Requisites:** POP HLTH/B M I 551, POP HLTH/B M I 552, and (STAT 850 or POP HLTH/B M I 651)**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Spring 2015**B M I 699 – INDEPENDENT STUDY**

1-3 credits.

Directed study to pursue knowledge beyond curriculum. Enroll Info: Jr st or cons inst

**Requisites:** Consent of instructor**Course Designation:** Level - Advanced

L&amp;S Credit - Counts as Liberal Arts and Science credit in L&amp;S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Spring 2019**B M I/STAT 741 – SURVIVAL ANALYSIS THEORY AND METHODS**

3 credits.

Theory and practice of analytic methods for censored survival data, including nonparametric and parametric methods, the proportional hazards regression model, and a review of current topics in survival analysis. Enroll Info: STAT 610 or 710 or equivalent or consent of instructor

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Fall 2018**B M I 750 – CUMULATIVE CAPSTONE IN CLINICAL AND HEALTH INFORMATICS**

3 credits.

Application of core coursework to a real world project where students assess all 10 American Medical Association informatics (AMIA) competencies for healthcare informatics. These competencies are integrated into a large cumulative project to ascertain the knowledge, skills and attributes to successfully work in an informatics field. Enroll Info: None

**Requisites:** Declared in Clinical and Health Informatics MS program**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No

**B M I/COMP SCI 767 – COMPUTATIONAL METHODS FOR MEDICAL IMAGE ANALYSIS**

3 credits.

Study of computational techniques that facilitate automated analysis, manipulation, denoising, and improvement of large-scale and high resolution medical images. Design and implementation of methods from computer Vision and Machine Learning to efficiently process such image data to answer biologically and clinically meaningful scientific questions. Students are strongly encouraged to have programming skills and basic proficiency in calculus and linear algebra, such as MATH 340. Enroll Info: None

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Fall 2016**B M I/STAT 768 – STATISTICAL METHODS FOR MEDICAL IMAGE ANALYSIS**

3 credits.

Introduce key statistical methods and concepts for analyzing various medical images. Analyze publicly available and student/instructor supplied imaging data using the most up-to-date methods and tools. Aimed at graduate student and researchers with strong quantitative background. Enroll Info: Two semesters of statistics courses (STAT/MATH 309-310), or the consent of instructor. The course is self-contained. The knowledge of calculus and linear algebra is needed

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Spring 2019**B M I 773 – CLINICAL RESEARCH INFORMATICS**

3 credits.

Course will familiarize students with basic informatics principles and techniques to support clinical research. Content includes information systems for protocol design; regulatory compliance; approaches for patient recruitment; efficient protocol management; data collection and acquisition; data security, storage, transfer, processing and analysis. Enroll Info: None

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Spring 2018**B M I/COMP SCI 776 – ADVANCED BIOINFORMATICS**

3 credits.

Advanced course covering computational problems in molecular biology. The course will study algorithms for problems such as: modeling sequence classes and features, phylogenetic tree construction, gene-expression data analysis, protein and RNA structure prediction, and whole-genome analysis and comparisons. Enroll Info: None

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Spring 2019**B M I 826 – SPECIAL TOPICS IN BIOSTATISTICS AND BIOMEDICAL INFORMATICS**

1-3 credits.

Covers advanced topics in the areas of biostatistics and biomedical informatics. Includes reading and discussion of original literature and individual student projects. Enroll Info: None

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** Yes, unlimited number of completions**Last Taught:** Summer 2019**B M I/COMP SCI/PSYCH 841 – COMPUTATIONAL COGNITIVE SCIENCE**

3 credits.

Studies the biological and computational basis of intelligence, by combining methods from cognitive science, artificial intelligence, machine learning, computational biology, and cognitive neuroscience. Requires ability to program. Enroll Info: None

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Fall 2018**B M I/STAT 877 – STATISTICAL METHODS FOR MOLECULAR BIOLOGY**

3 credits.

Develop statistical problems in gene mapping, high throughputomic data analysis, phylogenetics and sequence analysis. Introduce ideas of key methods using published data. Statisticians learn statistical basis for research methodology. Collaboration among students and with biologists is encouraged through projects. Enroll Info: STAT/MATH 309-310 or 609-610 or 709-710 or equiv, or cons inst. GENETICS 466 or equiv strongly recommended

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No**Last Taught:** Spring 2019**B M I 881 – BIOMEDICAL DATA SCIENCE SCHOLARLY LITERATURE 1**

2 credits.

Critical evaluation of the scholarly literature is a crucial skill for researchers. Through this course, students will develop this valuable skill by focused reading and discussion of a variety of journal articles of present or historical importance from the biomedical sciences literature, including biostatistics, biomedical informatics, and relevant topics in statistics and computer science. Enroll Info: None

**Requisites:** Graduate/professional standing**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement**Repeatable for Credit:** No

**B M I 882 – BIOMEDICAL DATA SCIENCE SCHOLARLY LITERATURE 2**  
2 credits.

Critical evaluation of the scholarly literature is a crucial skill for researchers. Through this course, students will develop this valuable skill by focused reading and discussion of a variety of journal articles of present or historical importance from the biomedical sciences literature, including biostatistics, biomedical informatics, and relevant topics in statistics and computer science. Enroll Info: None

**Requisites:** B M I 881

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**B M I 883 – BIOMEDICAL DATA SCIENCE PROFESSIONAL SKILLS 1**  
1 credit.

A variety of skills that are important for a successful research career are often left to students to develop on their own. This course attempts to fill many of those gaps, including writing and reviewing papers, securing research funding, giving talks, presenting posters, making a personal website, job opportunities in universities and industry, and teaching. Enroll Info: None

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**B M I 884 – BIOMEDICAL DATA SCIENCE PROFESSIONAL SKILLS 2**  
1 credit.

A variety of skills that are important for a successful research career are often left to students to develop on their own. This course attempts to fill many of those gaps, including writing and reviewing papers, securing research funding, giving talks, presenting posters, making a personal website, job opportunities in universities and industry, and teaching. Enroll Info: None

**Requisites:** B M I 883

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**B M I 899 – PRE-DISSERTATOR RESEARCH**  
1-12 credits.

Pre-dissertator Research. Enroll Info: Course is open to pre-dissertator students only.

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Summer 2019

**B M I 901 – FUNDAMENTALS OF INFORMATICS IN CLINICAL RESEARCH**  
2 credits.

Become familiar with basic informatics principles and techniques to support clinical research. Content includes information systems for protocol design; regulatory compliance; approaches for patient recruitment; efficient protocol management; data collection and acquisition; data security, storage, transfer, processing and analysis. Enroll Info: None

**Requisites:** MED SC-M 810, 811, 812, and 813

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2019

**B M I/B M E/BIOCHEM/CBE/COMP SCI/GENETICS 915 – COMPUTATION AND INFORMATICS IN BIOLOGY AND MEDICINE**  
1 credit.

Participants and outside speakers will discuss current research in computation and informatics in biology and medicine. This seminar is required of all CIBM program trainees. Enroll Info: None

**Requisites:** Consent of instructor

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2019

**B M I/MEDICINE 918 – HEALTH INFORMATICS FOR MEDICAL STUDENTS**  
2 credits.

Explore medical informatics as a new way to practice medicine with applications to patient care, electronic medical records, and patient safety. Enroll Info: Basic computer literacy 4th yr Med st or cons inst

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2019

**B M I 990 – DISSERTATOR RESEARCH**  
1-3 credits.

Dissertator Research. Course is open to dissertators only. Enroll Info: None

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Summer 2019