MEDICAL BIOINFORMATICS (MEDB)

Courses

MEDB 5501 Applied Biostatistics I Credits: 3
This course is the first course in the Biostatistics sequence and is intended for students, physicians, and researchers. It introduces statistical concepts, analysis methods, and research designs for data commonly encountered in biological, clinical, and medical research. Topics include an introduction to SPSS, types of data, descriptive statistics, illustrative statistics, sampling, hypothesis testing, parametric and nonparametric analysis, correlation, linear regression, and graphic representation of data. Familiarity with basic statistics is not required. Statistical analyses involved in this course can be performed in SPSS or SAS. Students using SAS must have a working knowledge of SAS.
Prerequisites: graduate or professional students and an advanced math course (i.e. Calculus, statistics).

MEDB 5502 Applied Biostatistics II Credits: 3
The second in the Applied Biostatistics sequence and is intended for graduate, doctoral, and professional students in the biological, clinical and medical fields, and medical education. Statistical concepts, analysis methods, and research designs commonly used in these fields are included: diagnostic testing, hypothesis testing, power analysis, analysis of variance, analysis of covariance, multivariate analysis of variance, propensity scoring, simple and multiple regression, logistic regression, and survival analysis. Familiarity with basic statistics and the statistical techniques presented in Applied Biostatistics I is required. Statistical analyses involved in this course will be performed primarily using the SPSS statistical analysis package. The course will also cover the interpretation, presentation and the write up of analytical results and graphs.
Prerequisites: MEDB 5501.

MEDB 5503 Biostatistics III-Mixed-Effects Models Credits: 3
This course is the third in the Biostatistics sequence and is intended for students, physicians and researchers in the clinical, biological, and medical fields. The course builds on foundations of linear regression model and logistic regression model. It will cover hierarchical linear mixed model for normally distributed outcomes, and generalized linear mixed models for binary outcome, count data or liker scale outcome. The course offers step by step understanding of how to construct a model with random effect. Specifically, we cover model techniques to address data resulting from cluster randomized study, repeated measures and longitudinal study. Students will learn about these different mixed models and use SAS and R to perform the analyses. The course will also cover the presentation of analytical results and graphic representation of data.
Prerequisites: MEDB 5507, MEDB 5501, MEDB 5502.

MEDB 5505 Introduction to R Credit: 1
Provides a working familiarity with R. No advanced programming or statistical analytic skills, other than the ability to create and modify text files are needed. Basic methods for data import, data management, simple graphics, and basic statistical analysis are introduced. Provides student with a firm foundation to address these areas in advanced statistics classes or in the student's research efforts, including thesis/dissertation research. A basic understanding of statistical terminology and a working familiarity with computer-based data files (e.g., Excel) is necessary. A basic understanding of the concepts of computer coding is recommended.

MEDB 5506 Introduction to SPSS Credit: 1
Session provides a working familiarity with SPSS. Students are not expected to have advanced programming or statistical analysis skills, other than the ability to create and modify text files. Basic methods for data import, data management, simple graphics, and basic statistical analysis are introduced. This class will not cover advanced statistical methods, but will provide the student with a firm foundation to address these areas in advanced statistics classes or in the student's research efforts, including thesis/dissertation research. A basic understanding of statistical terminology and a working familiarity with computer-based data files (e.g., Excel) is necessary.

MEDB 5507 Introduction to SAS Credit: 1
Course provides a working familiarity with SAS. Students are not expected to have advanced programming or statistical analysis skills, other than the ability to create and modify text files. Basic methods for data import, data management, simple graphics, and basic statistical analysis are introduced. This class will not cover advanced statistical methods, but will provide the student with a firm foundation to address these areas in advanced statistics classes or in the student's research efforts, including thesis/dissertation research. A basic understanding of statistical terminology and a working familiarity with computer-based data files (e.g., Excel) is necessary.

MEDB 5508 Introduction to SQL Credits: 2
This course is an introduction to SQL programming. The course is designed to teach students basic skills that will prepare them to use SQL for data analysis.

MEDB 5509 Machine Learning and Python in Health Sciences Credits: 3
In the artificial intelligence (AI) era, health care systems and practices have made changes in the nature of their services. Students will learn the basic knowledge of machine learning (ML), the core AI approach, and how to implement ML projects using Python, the most powerful programing language for ML. This is an introductory course for beginners to obtain practical knowledge and skills in ML and Python programming. The scope of ML techniques is limited to the most widely used basic methods, especially those of supervised learning.
Prerequisites: Basic Statistics

MEDB 5510 Clinical Research Methodology Credits: 3
This course trains the student to contribute to research design, planning, and implementation, and to manage and interpret health-related data. This course will provide a broad overview of clinical research in terms of definition, methodology, conduct and applications. The course will explore basic elements of clinical research including the hierarchy of clinical research design and the conduct of clinical research. Course topics include: conceiving the research question; study designs; questionnaire construction; research methodology; research ethics; human subjects requirements; the role of statistical analysis in clinical research; research proposal preparation; and research based on analysis of secondary data.

MEDB 5511 Principles and Applications of Epidemiology Credits: 3
This course will provide an introductory overview of the principles of epidemiology and illustrate applications in specialized topic areas. Course lectures will introduce measures of effect used to study disease in human populations, epidemiological study designs, concepts of causal inference, and threats to study validity. Specialized lectures will demonstrate the application of these concepts in select health and disease conditions.

MEDB 5512 Clinical Trials Credits: 3
Clinical Trials explores the knowledge and skills required to conduct clinical trials, and implications of clinical trials on practice in medicine and allied health.

MEDB 5513 Overview of Health Services Research Credits: 3
Provides an overview of the U.S. health care and public health systems including issues about cost, access, and quality of health care. This course focuses on the role of research and information in the process of redesigning of health care delivery in the U.S. for the purpose of improving the value of health services.
Prerequisites: MEDB 5501, MEDB 5510 or MEDB 5511.

MEDB 5514 Human Genome Epidemiology Credits: 3
Designed for biological researchers and clinicians interested in studying common human diseases using state of the art genomics/genetics epidemiological approaches. Comprehensive introduction to concepts and methodologies of quantitative/statistical genetics, emerging technologies and analytical methods for genomic science, basic study design, utilization of software packages for analyses of genomic data, successful examples of using human genome epidemiology information to improve health, and ethical, legal and social issues in the design and conduct human genome epidemiology research.

MEDB 5520 Introduction to Medical Informatics Credits: 3
This course provides an overview of Biomedical and Health Informatics. It describes the use of data, information and knowledge in improving healthcare and biomedical research. This includes the use of technology and computers to store, retrieve, and process data. Topics include clinical decision making, standards and clinical terminology, natural language processing, imaging, electronic health records, patient monitoring, consumer health informatics, public health informatics, clinical decision support, bioinformatics, translational bioinformatics and clinical research informatics.

MEDB 5521 Clinical Bioinformatics Credits: 3
Clinical bioinformatics will provide the foundation required for effective communication between computational, biological and clinical experts. This class uses a series of exercises to enable participants to independently perform gene and protein-based bioinformatics queries and analyses. Throughout the course, core biological principles are explained, as are the foundational technology and computational topics. Students will become proficient with public bioinformatics resources. This course will prepare students to apply the techniques to their research or participation in interdisciplinary clinical terms.

MEDB 5525 Social Determinants of Health Credits: 3
This course will describe how social, economic and political factors affect health. It will examine strategies to address social determinants of health to reduce health inequities. Students will explore how specific social determinants like socioeconomic status, race ethnicity, and lifestyle influence health, use a "life course" approach to look at different stages of life and the effect of social determinants on specific populations.

MEDB 5530 Independent Study I Credits: 1-3
Focused readings and/or special research project in an area selected by the graduate student in consultation with the advisor.

MEDB 5531 Independent Study II Credits: 1-3
Focused readings and/or special research projects in an area selected by the graduate student in consultation with the advisor.

MEDB 5535 Quantitative Aspects of Epidemiologic Research Credits: 3
This course offers students advanced training in the analysis of epidemiological data. Topics include application of common measures of frequency and association, confounding, effect modification, bias, misclassification, and sensitivity analysis in epidemiologic and clinical data sources.
Prerequisites: MEDB 5501, MEDB 5502 and one of the following: MEDB 5510 or MEDB 5511

MEDB 5540 Multidisciplinary Graduate Seminar Credit: 1
This course is a weekly seminar presented by the Department of Biomedical and Health Informatics. Internal and external guest speakers will present current topics in biomedical and health informatics. Four Journal Clubs are also a component of this course where students and faculty read, assess, present, and discuss selected readings related to biomedical and health informatics and clinical research. The seminar is designed to update students of the department on current topics and to assist students in the development of critical skills for evaluating published research, designing research projects, and communicating research findings.

MEDB 5550 Health Outcomes Seminar Credit: 1
The course content is guided by a series of seminars presented by researchers who are actively engaged in health outcomes studies. It explores multiple topics that are unique relevant to clinical investigators. Faculty and peer discussion forums highlight key concepts and applications.

MEDB 5560 Medical Decision Making Credits: 3
This course will introduce the concept of medical decision making under uncertainty through an examination of disease probabilities and how they are altered by the characteristics of the diagnostic test being studies or used clinically. Decision trees will be introduced as a mechanism for communicating complex medical decisions and introductory level decision analysis will be presented. The measurement of patient values for alternative outcomes will be introduced as they pertain to direct payoff values as well as modifiers to cost payoffs.

MEDB 5561 Responsible Conduct of Research Credits: 3
An interdisciplinary course which covers principles and day-to-day practicalities of research ethics, information about regulatory requirements for conducting research including safety issues and the use of humans, animals and radioactive biohazardous materials; discuss current issues in the ethical aspects of research, such as scientists' obligations with respect to public policy and advocacy.

MEDB 5563 Implementation Science in Health Credits: 3
This course in Implementation and dissemination sciences addresses a multidisciplinary set of theories and methods to improve and expedite translating research evidence to everyday health-related practices and communities. These theories and methods are systematic approaches to understanding how healthcare interventions can be better integrated into diverse practice settings and emphasize direct engagement with institutions and communities where health interventions take place. To optimize public health goals, this course will present the best evidence-based interventions, how to create those interventions, and how to best ensure that these interventions are effectively delivered within clinical and community practice.

MEDB 5573 Biostatistical Consulting Practicum Credits: 2-4
This course is designed to provide students with an opportunity for statistical consulting training. Students will work on real consulting projects that were received through the Research and Statistical Consult Service. Projects may involve sample size calculation, study design, data analysis, generating statistical reports and manuscripts. Student will be able to apply their statistical knowledge and communication skills while learning how to work with other researchers.
Prerequisites: MEDB 5501, MEDB 5502, MEDB 5507 and MEDB 5503.

MEDB 5589 Special Topics Credits: 1-3
An opportunity to explore in depth topics not included in usual course offerings. One or more topics will be announced in advance of registration.

MEDB 5591 Internship I Credits: 1-3
Opportunity to apply knowledge and skills in clinical, computational, or genomics research and gain insight into potential career options. Students develop appreciation for teamwork and commitment in professional environments.
Prerequisites: MEDB 5501, MEDB 5502, MEDB 5510, MEDB 5513.

MEDB 5592 Internship II Credits: 1-3
Opportunity to apply knowledge and skills in clinical, computational, or genomics research and gain insight into potential career options. Students develop appreciation for teamwork and commitment in professional environments. Internship II is applicable to students who have previously completed 3 hours of internship.
Prerequisites: MEDB 5501, MEDB 5502, MEDB 5510, MEDB 5513, MEDB 5591.

MEDB 5595 Capstone Experience Credits: 3
This course is designed for the non-thesis student to demonstrate that they have mastered key learning objectives expected of the graduating master's student in the Clinical Research emphasis area. After completion of the core courses in the Masters of Bioinformatics curriculum, students will apply their learning to developing, implementing and presenting results from a project that demonstrates integration of the knowledge, abilities and values emphasized in the degree program.

MEDB 5599 Research and Thesis Credits: 1-6
Research for thesis.

MEDB 5696 Pre-Dissertation Research Credits: 1-6
This course is individually directed research leading to the preparation of a doctoral dissertation.
Prerequisites: Permission of the instructor.

Co-requisites: Completion of comprehensive exam.

MEDB 5699 Research and Dissertation Credits: 1-12
Research and dissertation preparation for IPhD degree students participating in Biomedical and Health Informatics primary and co-discipline.
Prerequisites: instructor approval

MEDB 5899 Required Graduate Enrollment Credit: 1