**BIOSTATISTICS (BIOS)**

**BIOS 806 BIOSTATISTICS 3 Credit Hours**
This course is designed to prepare the graduate student to understand and apply biostatistical methods needed in the design and analysis of biomedical and public health investigations. The major topics to be covered include types of data, descriptive statistics and plots, theoretical distributions, probability, estimation, hypothesis testing, and one-way analysis of variance. A brief introduction to correlation and univariate linear regression will also be given. The course is intended for graduate students and health professionals interested in the design and analysis of biomedical or public health studies; not intended for Ph.D. students enrolled in the Biostatistics Graduate Program.
Cross List: CPH 506.
Typically Offered: FALL

**BIOS 808 BIOSTATISTICS II 3 Credit Hours**
This course is designed to prepare the student to understand and apply advanced biostatistical methods needed in the design and analysis of biomedical and public health investigations. The major topics to be covered include multiple linear regression, analysis of covariance, logistic regression, survival analysis, and repeated measures analysis.
Prerequisite: BIOS 806 or an equivalent statistics course. The course is intended for graduate students and health professionals interested in the design and analysis of biomedical or public health studies; not intended for Ph.D. students enrolled in the Biostatistics Graduate Program.
Cross List: CPH 650.
Typically Offered: SPRING

**BIOS 810 INTRODUCTION TO SAS PROGRAMMING 3 Credit Hours**
An introduction to programming for statistical and epidemiologic analysis using the SAS Software System. Students will learn to access data from a variety of sources (e.g. the web, Excel, SPSS, data entry) and create SAS datasets. Data management and data processing skills, including concatenation, merging, and sub-setting data, as well as data restructuring and new variable construction using arrays and SAS functions will be taught. Descriptive analysis and graphical presentation will be covered. Concepts and programming skills needed for the analysis of case-control studies, cohort studies, surveys, and experimental trials will be stressed. Simple procedures for data verification, data encryption, and quality control of data will be discussed. Accessing data and summary statistics on the web will be explored. Through in-class exercises and homework assignments, students will apply basic informatics techniques to vital statistics and public health databases to describe public health characteristics and to evaluate public health programs or policies. Laboratory exercises, homework assignments, and a final project will be used to reinforce the topics covered in class. The course is intended for graduate students and health professionals interested in learning SAS programming and accessing and analyzing public use datasets from the web.
Prerequisite: BIOS 806/CPH 506 or an equivalent introductory statistics course, EPI 821/CPH 621, and permission of instructor.
Cross List: CPH 651.
Typically Offered: FALL

**BIOS 818 BIOSTATISTICAL METHODS II 3 Credit Hours**
This course is designed to prepare the graduate student to analyze continuous data and interpret results using methods of linear regression and analysis of variance (ANOVA). The major topics to be covered include simple and multiple linear regression model specification and assumptions, specification of covariates, confounding and interactive factors, model building, transformations, ANOVA model specification and assumptions, analysis of covariance (ANCOVA), multiple comparisons and methods of adjustment, fixed and random effect specification, nested and repeated measures designs and models, and diagnostic methods to assess model assumptions. Interpretation of subsequent analysis results will be stressed. Concepts will be explored through critical review of the biomedical and public health literature, class exercises, an exam, and a data analysis project. Statistical analysis software, SAS (SAS Institute Inc., Cary, NC, USA.), will be used to implement analysis methods. The course is intended for graduate students and health professionals who will be actively involved in the analysis and interpretation of biomedical research or public health studies.
Prerequisite: Permission of instructor, calculus (including differential and integral calculus), BIOS 806/CPH 506 or BIOS 816/CPH 516 or an equivalent statistics course, BIOS 810/CPH 651, or equivalent experience with SAS programming.
Cross List: CPH 652.
Typically Offered: SPRING

**BIOS 823 CATEGORICAL DATA ANALYSIS 3 Credit Hours**
Survey of the theory and methods for the analysis of categorical response and count data. The major topics to be covered include proportions and odd ratios, multi-way contingency tables, generalized linear models, logistic regression for binary response, models for multiple response categories, and log-linear models. Interpretation of subsequent analysis results will be stressed.
Prerequisite: Permission of instructor; BIOS 816/CPH 516 or equivalent course work (for example, calculus, BIOS 806/CPH 506 and BIOS 810/CPH 651 or equivalent experience with SAS programming).
Cross List: CPH 653.
Typically Offered: FALL

**BIOS 824 SURVIVAL DATA ANALYSIS 3 Credit Hours**
The course teaches the basic methods of statistical survival analysis used in clinical and public health research. The major topics to be covered include the Kaplan-Meier product-limit estimation, log-rank and related tests, and the Cox proportional hazards regression model. Interpretation of subsequent analysis results will be stressed.
Prerequisite: Permission of instructor, calculus (including differential and integral calculus); BIOS 806/CPH 506 or BIOS 816/CPH 516 or an equivalent statistics course; BIOS 810/CPH 651 or equivalent experience with SAS programming.
Cross List: CPH 654.
Typically Offered: FALL/SPR
BIOS 825 CORRELATED DATA ANALYSIS 3 Credit Hours
A survey of the theory and methods for analysis of correlated continuous, binary, and count data. Major topics to be covered include linear models for longitudinal continuous data, generalized estimating equations, generalized linear mixed models, impact of missing data, and design of longitudinal and clustered studies. Interpretation of subsequent analysis results will be stressed. Concepts will be explored through critical review of the biomedical and public health literature, class exercises, two exams, and a data analysis project. Computations will be illustrated using SAS statistical software (SAS Institute Inc., Cary, NC, USA.). The course is intended for graduate students and health professionals who will be actively involved in the analysis and interpretation of biomedical research or public health studies.
Prerequisite: Linear algebra, BIOS 818, one year of mathematical models and estimation of variance components.
APPLICATIONS
BIOS 918 BIOSTATISTICAL LINEAR MODELS: THEORY AND APPLICATIONS 3 Credit Hours
This course on linear models theory includes topics on linear algebra, distribution theory of quadratic forms, full rank linear models, less than full rank models, ANOVA, balanced random mixed models, unbalanced models and estimation of variance components.
Prerequisite: Linear algebra, BIOS 818, one year of mathematical statistics, and permission of instructor.
Typically Offered: FALL

BIOS 918 BIOSTATISTICAL LINEAR MODELS: THEORY AND APPLICATIONS 3 Credit Hours
This course on linear models theory includes topics on linear algebra, distribution theory of quadratic forms, full rank linear models, less than full rank models, ANOVA, balanced random mixed models, unbalanced models and estimation of variance components.
Prerequisite: Linear algebra, BIOS 818, one year of mathematical statistics, and permission of instructor.
Typically Offered: FALL

BIOS 921 ADVANCED PROGRAMMING SAS 3 Credit Hours
The objective of this course is to prepare students in advanced SAS programming. The main topics comprise advanced SAS programming techniques, SAS macro programming, using SQL with SAS, and optimizing SAS programs, which are similar to those covered on the SAS Advanced Programmer Exam offered through the SAS Institute, Inc.
Prerequisite: BIOS 810 or a similar course, and permission of instructor.
Typically Offered: SPRING

BIOS 924 BIOSTATISTICAL THEORY AND MODELS SURVIVAL DATA 3 Credit Hours
The course teaches the statistical theory and models for survival data analysis used in biochemical and public health research. Major topics include parametric, nonparametric, and semiparametric theory and models.
The statistical software SAS and R will be used.
Prerequisite: STAT 980 and STAT 982-983 (provided by UNL) or equivalent, BIOS 824 or equivalent, and permission of instructor.
Typically Offered: FALL

BIOS 935 SEMIPARAMETRIC METHODS FOR BIOSTATISTICS 3 Credit Hours
The fundamental theory and application of semi parametric methods in biomedical and public health studies. The major topics include additive semiparametric models, semiparametric mixed models, generalized semiparametric regression models, bivariate smoothing, variance function estimation, Bayesian semiparametric regression and spatially adaptive smoothing.
Prerequisite: BIOS 925, familiarity with the software R and SAS, and permission of instructor.
Typically Offered: SPRING

BIOS 941 BIOSTATISTICAL CONSULTANT APPLICATION AND PRACTICE 3 Credit Hours
This course is specific to doctoral level work in the College of Public Health. Content of this independent study may include research other than dissertation, directed readings, and other study of a doctoral level under the supervision of a graduate faculty member.
Prerequisite: Doctoral student status and program permission.
Typically Offered: FALL/SPR

BIOS 970 SEMINAR 1 Credit Hour
Attendance at weekly seminars offered by the department/program, or other activities specific to the degree program (contact the program director for more information).
Typically Offered: FALL/SPR

BIOS 996 DIRECTED READINGS AND RESEARCH 1-9 Credit Hours
This course is specific to doctoral level work in the College of Public Health. Content of this independent study may include research other than dissertation, directed readings, and other study of a doctoral level under the supervision of a graduate faculty member.
Prerequisite: Doctoral student status and program permission.
Typically Offered: FALL/SP/SU
BIOS 998 DOCTORAL SPECIAL TOPICS 1-4 Credit Hours
This course is for more advanced students who wish to pursue their research interests in selected areas of Medical Humanities.
Prerequisite: Permission of instructor Crosslist CPH 677
Typically Offered: FALL/SP/SU

BIOS 999 DOCTORAL DISSERTATION 1-15 Credit Hours
The dissertation represents original research on a defined problem in biostatistics. The PhD dissertation must be a significant, original piece of biostatistical research that makes a contribution to knowledge in the field.
Prerequisite: Permission of instructor.
Typically Offered: FALL/SP/SU