BIOSTATISTICS PHD PROGRAM OF STUDIES
STUDENT HANDBOOK
2020-2021

CONTENTS

Welcome to the Department of Biostatistics! This Handbook outlines the requirements, policies, and procedures for the operation of our graduate programs. Please keep in mind that policies may change. The department will make every effort to communicate changes in requirements, procedures, or policies.

CONTACT INFORMATION:

For all inquiries, please contact Mary Morris, Department Assistant at:

mary.morris@unmc.edu
Phone: 402-559-4112

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POLICIES

All Biostatistics students are bound by the policies and regulations below. Students should consult the UNMC Graduate Studies Catalogs & Policies for a complete listing of all policies and regulations.

Independent Development Plan (IDP)

Within 9 months after matriculation (12 months for part-time students), the student and his/her academic Advisor (or Advisory/Supervisory Committee, if already identified) must prepare and submit to the Graduate Studies Office a draft *Program of Studies* (POS) that includes designation of all required courses, options for electives (which may be TBD), and the general area of research for the dissertation (if applicable). Upon appointment of the Advisory/Supervisory Committee, the student should confer with that group and his/her Advisor regarding the draft POS. After incorporating any necessary revisions to the document, the approved Program of Studies must be submitted to the Graduate Studies Office within 13 months after matriculation (19 months for part-time students). The Program of Studies is considered to be a "living" document; however, any changes in the program or in the dissertation topic (if applicable) must be approved by the Advisory/Supervisory Committee and the action reported to the Graduate Studies Office. As a supplement to the academic and career guidance provided by his/her Advisory/Supervisory Committee, each Ph.D. student must complete an IDP within 1 year after matriculation. The student should consult with the Graduate Program Director to identify the specific IDP that must be utilized. Documentation that the student has completed an IDP (e.g. Certificate of Completion, if using myIDP) must be submitted via Seguidor.

Academic Integrity

The University of Nebraska Medical Center has established a policy on academic integrity and professional conduct. This policy may be found in the UNMC Graduate Studies Catalogs & Policies. All graduate students are expected to adhere scrupulously to this policy. Cheating, academic misconduct, fabrication, and plagiarism are viewed as serious matters and will lead to disciplinary action as described in the Procedural Rules Relating to Student Discipline under Student Policies.

Disabilities

Students with disabilities are encouraged to contact the coordinator of each course for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University to provide flexible and individualized accommodation to students with documented disabilities; however, faculty are not required to provide accommodation without prior approval. To be eligible to receive reasonable accommodation, students must be registered with the Services for Students with Disabilities (SSD) office. Once the request has been approved, an individualized accommodation plan will be formulated and an official "Letter of Disability Accommodation" will be issued to the student. To register, contact Kelly Swoboda, LMPH at 402-559-7276 or kelly.swoboda@unmc.edu .

Nondiscrimination

The University of Nebraska Medical Center (UNMC) is committed to creating a diverse and inclusive work and learning environment free from discrimination and harassment. UNMC is dedicated to creating an environment where everyone feels valued, respected and included. UNMC does not discriminate based on race, color, ethnicity, national origin, sex, pregnancy, sexual orientation, gender identity, religion, disability, age, genetic information, veteran status, marital status, and/or

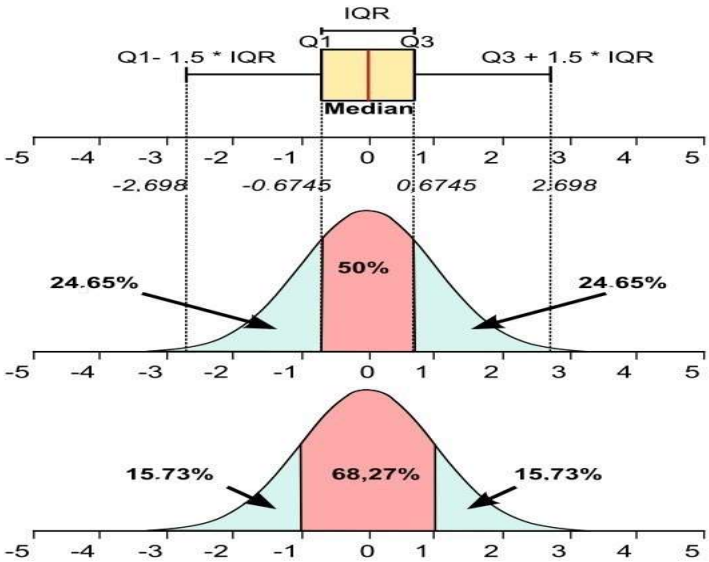
political affiliation in its programs, activities, or employment. UNMC complies with all local, state and federal laws prohibiting discrimination, including Title IX, which prohibits discrimination on the basis of sex. The following persons have been designated to handle student inquiries: Discrimination or Disability Inquiries: Philip D. Covington, Ed.D., Vice Chancellor for Student Success, Student Life Center – Office# 2033, Telephone: 402-559-4437, Email: philip.covington@unmc.edu ; Title IX Inquiries: Carmen Sirizzotti, MBA, Title IX Coordinator, Administrative Building (ADM), Office# 2010, Telephone: 402-559-2717, Email: csirizzotti@unmc.edu

BACKGROUND

Biostatistics is the science that applies statistical theory and methods to the solution of problems in the biomedical and public health sciences. The main areas of effort for biostatisticians include collaborative research and consulting, methodological research, and education. In collaborative research, biostatisticians work on research studies with investigators in the biomedical and health sciences. The biostatisticians' responsibilities include analysis of data and interpretation of results. Equally important, however, is the responsibility to collaborate in the designing and conducting of the study to ensure consistency with good statistical practice. Methodological research, such as developing statistical models to describe biomedical and public health phenomena, is conducted to enhance the existing bodies of knowledge in theoretical and applied biostatistics. Biostatisticians educate others about biostatistics through the teaching of graduate and continuing education courses, seminars, collaborative research, and consulting activities.

The Ph.D. program in Biostatistics at UNMC is designed for individuals with adequate quantitative training in college and genuine interest in conducting research in biomedical and/or public health sciences. It provides rigorous training in advanced statistical analysis skill, ability for conducting statistical methodology research, as well as consulting capability on statistical applications in a broad spectrum of biomedical and public health science problems. The primary goal of the program is to prepare the students for data science careers as biostatisticians in any life science related environment, such as professor in universities, research scientist in public health or government agencies, and senior data analyst in pharmaceutical/biotech industrials or any private health-related organizations.

Upon enrolling in a biostatistics Ph.D. program, students take courses in statistical methods and theory. The methods courses focus on ways to select and apply statistical techniques that are appropriate for different types of problems from biomedicine and public health. The theory courses provide rigorous instruction in the formal mathematical structure underlying the statistical techniques. Heavy use is made of computers in most biostatistics courses. Required and elective courses from other public health or biomedical fields are also included in the program of study.



ADMISSION

Any applicant who has received a Bachelor's or a Master's degree in quantitatively oriented fields from an accredited institution and shows promise for successfully completing all Ph.D. degree requirements will be considered for admission to this program. In addition to satisfying general UNMC graduate studies requirements for admission, applicants must have a GPA of 3.00 or higher on the 4.00-scale system in courses taken during their earlier degree studies and a grade of B (or 3.00) or higher in courses required as prerequisites for the program. The prerequisites for the program are the mathematics background consisting of an undergraduate course sequence in univariate and multivariate calculus and a course in linear algebra (including matrix theory). Prospective applicants who do not have this background must acquire it prior to admission to the program.

Applicants are required to take the Graduate Record Examination (GRE) General Test and those whose native language is not English must also take the Test of English as a Foreign Language (TOEFL) and achieve a score of 80 or higher on the internet-based test, or achieve a score of 6.5 or higher on The International English Language Testing System (IELTS). Final admission decision will be made by the Program Admission Committee.

Applicants are required to complete the online **Schools of Public Health Application Service (SOPHAS) application.** All application materials need to be submitted through SOPHAS. Prospective students should visit the Department of Biostatistics admissions page for department specific admission requirements.

PROGRAM COMPETENCIES

Upon graduation, a student with a Ph.D. in Biostatistics should be able to address the following competencies:

- Serve as an expert biostatistician on a collaborative team of investigators addressing a research question.
- Successfully conduct and disseminate original research on the theory and methodology of biostatistics.
- Effectively teach biostatistics to biostatistical and non-biostatistical audiences.
- Develop a perspective on public health and biomedical research.
- Demonstrate knowledge and expertise in a cognate field other than biostatistics.

PROGRAM REQUIREMENTS

Students with a master's degree in biostatistics or statistics enrolled in the Ph.D. program in Biostatistics are required to complete a minimum of 60 credit hours in course work, of which at least 48 credits of non-dissertation classes and a Ph.D. dissertation (at least 12 credits) in order to graduate. Students without a prior master's degree in Biostatistics or statistics enrolled in the Ph.D. program in Biostatistics are required to enroll additional 8 master level biostatistics courses described below before registering the Ph.D. core courses. In addition to the required coursework, the student will be required to pass the *qualifying* and *comprehensive* exams of the department. A detailed description of these exams is presented below.

Upon enrollment into the program, the student will develop, in consultation with the Graduate Program Director or his/her academic Advisory/Supervisory Committee (if already identified), a draft program of studies (POS). The student should have identified their official academic or thesis Advisory/Supervisory Committee within 12 months of matriculation. Moreover, the student should schedule semi-annual meetings with his/her Advisory/Supervisory Committee until completion of the degree. At these meetings, student's academic progress, including the POS, will be discussed. In addition to the courses in the POS, when appropriate, the student may register for the course BIOS 996 Directed Reading or Research, in order to prepare for the dissertation research. The course work comprises courses of two types – a) the six core courses (described below) that are required for all the Ph.D. students, and b) additional courses that include one required general public health course as well as those in the student's cognate area, which is chosen by the student after consulting with his/her academic advisor, and elective courses required to improve the student education and learning in their area of focus in Biostatistics. There are two exams, a *qualifying* and a *comprehensive* exam, that students are required to pass, in order to establish his/her Ph.D. candidacy. After the student passes the *qualifying* exam, he/she should talk to departmental faculty to identify a Ph.D. dissertation adviser(s) (who may or may not be their initial academic advisor) and to form his/her thesis-focused Advisory/Supervisory Committee of at least four graduate faculty members chaired by his/her dissertation adviser(s). In order to become eligible for the *comprehensive* exam, the student needs to complete the majority of the graded didactic courses required by the department and additional elective courses recommended by his/her Advisory/Supervisory Committee. *The majority of coursework* is defined as all but one didactic course. The student may take the *comprehensive* exam during the semester while they are completing their last didactic course. For more details, please refer to the UNMC Graduate Studies Catalogs & Policies. After passing the *comprehensive* exam, the student is considered to be a "candidate" (a.k.a. having advanced to candidacy). The student may register for the course BIOS 999 Biostatistics Dissertation Research after they become a candidate. The preparation for the Ph.D. dissertation work can begin anytime during their studies and the student should register for the course BIOS 996 Directed Reading or Research for the dissertation preparation and other relevant research work approved by his/her Advisor(s).

In addition to the requirements specified by the Biostatistics Ph.D. program, the student must satisfy other requirements specified by the College of Public Health (COPH) and the UNMC Graduate Studies Program. These requirements are described in the UNMC Graduate Studies Catalogs & Policies.

COURSEWORK

Core Biostatistics Courses (Total 18 credits)

- BIOS 901 Advanced Biostatistics Theory I (3 credits)
- BIOS 902 Advanced Biostatistics Theory II (3 credits)
- BIOS 918 Biostatistical Linear Models: Theory & Applications (3 credits)
- BIOS 924 Biostatistical Theory & Models for Survival Data (3 credits)
- BIOS 925 Theory of Generalized Linear & Mixed Models in Biostatistics (3 credits)
- BIOS 941 Biostatistical Consulting Application and Practice (3 credits)

Additional Required Courses (Total at least 9 credits)

- HPRO 830 Foundations of Public Health (3 credits)
- at least 6 graduate credits in a cognate area (other than biostatistics, statistics, and mathematics)

Elective Courses (Total at least 21 credits from the following, non-exhaustive list*)

- BIOS 935 Semiparametric Methods for Biostatistics (3 credits)
- BIOS 921 Advanced Programming for SAS (3 credits)
- BIOS 996 Directed Reading or Research (1-9 credits)
- BIOS 970 Seminar (1 credit)
- BIOS 998 Special Topics in Biostatistics: Doctoral Students (1-3 credits)
- EPI 910 Research Grant Proposal Development (3 credits)
- EPI 941-942 Epidemiologic Methods in Applied Clinical Genetics I & II (2 credits)
- EPI 945 Epidemiologic Research Methods (4 credits)
- STAT 950-951 Computational Statistics I & II (3 credits)
- STAT 973 Theory of Multivariate Analysis (3 credits)
- STAT 974 Nonlinear Regression Analysis (3 credits)
- STAT 981 Advanced Probability Measures (3 credits)
- STAT 984 Asymptotics and Applications (3 credits)
- BIOS 801 Biostatistics Theory I (3 credits)*
- BIOS 802 Biostatistics Theory II (3 credits)*
- BIOS 810 Intro to SAS Programing (3 credits)*
- BIOS 815 Biostatistical Computing (3 credits)
- BIOS 818 Biostatistical Methods II (3 credits)*
- BIOS 823 Categorical Data Analysis (3 credits)*
- BIOS 824 Survival Data Analysis (3 credits) *
- BIOS 825 Correlated Data Analysis (3 credits)*
- BIOS 829 Intro to Biostatistical Learning (3 credits)
- BIOS 835 Design of Medical Studies (3 credits)*
- BMI 810 Intro to Biomedical Informatics (3 credits)
- GSBA 815 Tools and Algorithms in Bioinformatics (3 credits)

* The BIOS Masters-level (i.e. the 800-level) courses are required for students entering the Ph.D. program without a prior master's degree in Biostatistics or Statistics, and are normally taken when a deficiency or a prerequisite is to be met.

COURSE DESCRIPTIONS

Please refer to the Biostatistics course descriptions in the UNMC Catalog; these descriptions are also provided in an Appendix at the end of this document.

TYPICAL PLAN OF DIDACTIC COURSE STUDY FOR STUDENTS ENTERING WITH A MASTER'S DEGREE IN BIOSTATISTICS or STATISTICS

TYPICAL COURSE SCHEDULE

Fall Semester, Year 1

BIOS 901 Advanced Biostatistical Theory I
BIOS 941 Biostatistical Consulting Application and Practice
BIOS 918 Biostatistical Linear Models: Theory and Application
or an Elective

Spring Semester, Year 1

BIOS 902 Advanced Biostatistical Theory II
BIOS 924 Biostatistical Theory & Models for Survival Data
BIOS 925 Theory of Generalized Linear and Mixed Models in Biostatistics
or Electives

Summer Session, Year 1

BIOS 996 Directed Reading & Research
BIOS Qualifying Exam (QE) – based on BIOS 901, 902, 941, 818, 823, 824, and 825

Fall Semester, Year 2

BIOS 918 Biostatistical Linear Models: Theory & Applications (If not taken in Year 1)
Courses in Cognate Area
Electives

Spring Semester, Year 2

BIOS 924 Biostatical Theory & Models for Survival Data (If not taken in Year 1)
BIOS 925 Theory of Generalized Linear and Mixed Models in Biostatistics (If not taken in Year 1)

Summer Session, Year 2

BIOS 996 Directed Reading & Research
HPRO 830 Foundations in Public Health

QUALIFYING EXAMINATION

The *qualifying* exam is designed to test the student's basic knowledge and skills acquired in the following Biostatistics courses: BIOS 818, BIOS 823, BIOS 824, BIOS 825, BIOS 901, BIOST 902, and BIOS 941. The exam consists of two components: (i) Theory of Biostatistics and (ii) Application of Biostatistics. The theory component is an in-class proctored exam, in which students are required to solve the problems on the materials from BIOS 818, BIOS 823, BIOS 824, BIOS 825, BIOS 901 and BIOS 902 in 4-5 hours. The application component is a week-long take-home exam, in which students are required to analyze the data and address the scientific problems given by a faculty examiner using the knowledge and skills they acquire from the BIOS 818, BIOS 823, BIOS 824, BIOS 825, and BIOS 941. The application component is a week-long take-home exam, in which students are required to analyze the data and address the scientific problems given by a faculty examiner using the knowledge and skills they acquire from the BIOS 818, BIOS 823, BIOS 824, BIOS 825, and BIOS 941. The preparation and the administration of the qualifying exam is overseen by the Program Graduate Examination Committee. It is normally administrated once a year in the summer. Students are expected to have completed the required courses before taking the exam and pass the exam before the deadlines outlined as follows:

- **Deadline for full-time students:** The deadline for passing the *qualifying* exam for full-time students who enter the program with a master's degree in Biostatistics/Statistics is August at the end of their second year; the deadline for full-time students who enter the program without the master's degree is August at the end of their third year.
- **Deadline for part-time students:** The deadline for passing the *qualifying* exam for part-time students who enter the program with a master's degree in Biostatistics/Statistics is August at the end of their third year; the deadline for part-time students who enter the program without the master's degree is August at the end of their fourth year.

A student will have at most two attempts to pass the *qualifying* exam. The first attempt for full-time students is suggested after the first-year study in the program for those who enter the program with a master's degree in Biostatistics/Statistics, and after the second-year study in the program for those who enter the program without the master's degree. If one or both components are not passed on the first attempt, then a second attempt on or before the deadline is allowed. During the final attempt, the student may only sit for the component(s) not passed in the first attempt. A student's first attempt at the *qualifying* exam will result in one of the following three outcomes:

a. **Pass Both Components:** The student has demonstrated fundamental understanding and skill of the core material and the examination committee believes he/she will be successful in completing the Ph.D. program.
b. **Pass One Component:** The student has demonstrated fundamental understanding and skill of one component but lacks adequate understanding of the other component. The student must sit for the component not passed at the next examination session.
c. **Fail:** The student has failed to demonstrate an adequate understanding or skill of the material from the required courses and thus fails the examination. The student must sit for both components at the next exam session.

A student's second and final attempt at the *qualifying* exam will result in one of the following two outcomes:

a. **Pass:** The student has demonstrated fundamental understanding and skill of the required material and the examination committee believes he/she will be successful in completing the Ph.D. program.
b. **Fail:** The student has failed to demonstrate an adequate understanding or skill of the material from the required courses and thus fails the examination, with privilege to continue in the program terminated.

Students who failed any part of the qualifying exam will be provided the opportunity to review their graded exam and appeal the exam outcome if they choose so to do within one month of the announced results, The Graduate Program Director will not accept for consideration any appeal beyond this one month period.

COMPREHENSIVE EXAMINATION

Full-time Ph.D. students must attempt the exam before the end of their third year of study. Part-time students must attempt the exam before the end of their fourth year of study. The Comprehensive Exam must be completed at least 7 months, but no more than 3 years, prior to the dissertation defense.

Note that only two attempts are allowed and that students must wait at least 3 months before retaking the exam (2nd attempt). Students who fail the initial attempt as a result of missing the deadline must take the exam (2nd attempt) a minimum of 3 months and no more than 6 months after the established deadline. Failure to do so will result in dismissal from the program.

Under extraordinary circumstances, the Dean of Graduate Studies may grant exceptions or extensions on a student-by-student basis. More details are provided in the UNMC Comprehensive Examination Policy for Ph.D. Students, which is also added as an Appendix to this Handbook.

Students become eligible to take the *comprehensive* examination after successfully passing the qualifying examination, This exam consists of an oral presentation on the methodological research topic(s) proposed by the student to the student's thesis Advisory/Supervisory Committee, which administers this examination. The oral *comprehensive* exam will normally be completed at or after the end of course work. The student must pass this exam before establishing the candidacy for the Ph.D.

There are two phases in the comprehensive exam.

- For Phase 1, the student must provide the committee with a research proposal (10 – 15 pages) outlining the advanced topic(s) to be covered, clearly indicating the scope and depth of the planned research along with relevant references. The Supervisory Committee will review the proposal.
- For Phase 2, the Supervisory Committee meeting will be convened for the student's oral presentation on the proposal no less than two weeks after the student submits the proposal. In the examination, the student is expected to display an in-depth understanding of the chosen subject matter and promising research outcomes. The committee will vote to pass or fail or

assign a conditional pass at this meeting. It only takes one non-affirmative vote to fail the student, or conditionally affirmative to conditionally pass. The committee is expected to provide students with detailed feedback shortly after the oral examination meeting. The student is responsible for scheduling the oral examination. It is suggested that at least two hours be reserved for this purpose. The assignments for the conditional pass need to be satisfactorily completed within 3 months of the oral exam. The student who failed the exam will have one more opportunity to retake the exam within 6 months. The student will be recommended as a candidate for the Ph.D. degree to the Graduate Studies Office if their performance on the oral examination is judged to merit a pass. After the student passes the *comprehensive* exam, the student is considered a candidate (aka having "advanced to candidacy").

DOCTORAL DISSERTATION

After passing the oral *comprehensive* exam, the student's work on the dissertation may officially begin. The dissertation authored by the student, must contain original and publishable statistical or biostatistical methodological research originating from and with application to well-defined life and health related problems. Depending on the progress of the dissertation research, the student may take more than 12 credit hours on dissertation research, but 12 credits are the minimum to satisfy the graduation requirement.

The completed written dissertation normally consists of three main chapters preceded by a comprehensive literature review chapter and followed by an integrative concluding chapter. The student is expected to submit at least one manuscript to a peer-reviewed statistical/biostatistical journal from the dissertation research before the oral defense, which manuscript needs to be approved by the Advisory/Supervisory Committee. The dissertation is considered complete when the Advisory/Supervisory Committee has approved both the written dissertation and the oral defense after the student makes the final corrections/editing requested by the Advisory/Supervisory Committee.

Dissertation Defense

The student must submit the completed written dissertation to the Supervisory Committee for reading and evaluation at least 4 weeks before the dissertation defense (Final Oral Exam). Members of the Advisory/Supervisory Committee should provide feedback within 2 weeks of receiving the document if there are major deficiencies. The student must present and defend the dissertation (Final Oral Exam) in a public forum that will be followed up by defense before the committee in a close meeting.

This announcement must follow a format available in the Guide to the Preparation of Theses and Dissertations ("The Format Guide"). The announcement should contain, among other things, a summary of the dissertation (not less than 150 words) which is informative and contains a brief statement of the principal results and conclusions.

The defense consists of two parts. For the first part, the student presents their dissertation within an hour and addresses raised questions by the audience on the dissertation. At the conclusion of the public presentation of the defense, the Advisory/Supervisory Committee must convene to an executive session with and without the student to further discuss the dissertation and its defense by

the student. The Advisory/Supervisory Committee will conclude its deliberation with a vote on the outcome of the defense and examination (pass or fail). The dissertation is finally approved when it is received by the UNMC Graduate Studies Office with an acceptance page signed by majority of the committee members.

Dissertation Submission Format

The dissertation must meet departmental and UNMC format requirements and timeline. Consult the Guide to the Preparation of Theses and Dissertations ("The Format Guide") - for use by students admitted to UNMC Graduate Studies Programs.

ADVISING

Academic Advisor: Students admitted to the program will be assigned an **initial academic advisor** who may be consulted for advice on all the academic issues and the program. The Graduate Program Director is also available for general consultation. The student may change advisor with the approval of the Graduate Program Director who will also inform the original advisor of this switch.

Ph.D. Dissertation Advisor: Within a year after the successful passing of the *qualifying* examination, the student should identify, in consultation with the academic advisor, professor(s) from the program's graduate faculty who will serve as the student's research advisor(s) and will direct the student's dissertation. The dissertation advisor(s) are expected to meet with students in weekly basis at advisor's discretion for research guidance.

Supervisory Committee: At least three months before the *comprehensive* examination, the student should form the Supervisory Committee chaired by his/her dissertation advisor. The Supervisory Committee consists of at least 4 graduate faculty members with at least three members being the program graduate faculty. This committee has the responsibility of administering the *comprehensive* examination, reading the dissertation, and conducting the Ph.D. dissertation defense.

SATISFACTORY ASSESSMENT THROUGHOUT THE PROGRAM

General Scholarship Requirements

Students are expected to perform at the level of B or above in any graded (A/B/C/D/F) course that is offered for graduate credit. A minimum grade of C may be acceptable for graduate-level courses, but receipt of two grades of C may be cause for dismissal. Any grade below C is not acceptable for graduate credit and may be cause for dismissal. Likewise, a grade of F in any Pass/Fail course (e.g., non-thesis research, Master's Thesis, Doctoral Dissertation, Practicum) may be grounds for dismissal. A student failing to receive a minimum acceptable grade in a course for graduate credit may not continue his/her program of studies without permission of their Advisory/Supervisory Committee or the program Graduate Committee. The Committee's recommendation, along with an appropriate explanation and justification, must be submitted to the Graduate Studies Office. Recommendations for dismissal require approval by the Dean of Graduate Studies.

Graduate students must maintain a cumulative GPA of at least 3.0 in order to be considered in good academic standing. Any student who fails to maintain a cumulative GPA of at least 3.0 at the end of any given semester may not continue his/her Program of Study without special permission of the Dean for Graduate Studies acting on the recommendation of the appropriate Graduate Committee or Advisory/Supervisory Committee. Hence, upon notification of a student's poor academic standing, the appropriate Committee must submit to the Dean for Graduate Studies a letter that includes 1) a review of the student's academic status (including any other information relevant to the student's performance), and 2) their recommendation for continuation or dismissal. If continuation is recommended, the letter must also include 3) a remediation plan for returning to good academic standing, and 4) any additional conditions established by the Committee for remaining in the program. Students permitted by the Dean for Graduate Studies to continue in the Graduate Studies program will be placed on academic probation and must remove the probationary status (i.e. return to a cumulative GPA of at least 3.0) within the next twelve (12) months. Failure to remove probationary status within this time frame, and/or to meet any other conditions established for remaining in the program, represents grounds for dismissal.

The above minimum scholarship requirements apply to ALL students enrolled in ANY course for graduate credit. Additional requirements may exist for certain graduate programs and departments as set forth in the Programs and Curriculum Requirements section of this Catalog, at websites maintained by each program, or in documents provided to students at the time of admission.

The above minimum scholarship requirements apply to ALL students enrolled in ANY course for graduate credit. Additional requirements may exist for certain graduate programs and departments as set forth in the Programs and Curriculum Requirements section of this Catalog, at websites maintained by each program, or in documents provided to students at the time of admission.

If a student finds it necessary to withdraw from the program, then he/she should provide a notice as soon as possible—especially if supported financially by the program. In the case of teaching or research assistants, students are expected to complete the semester once it has begun. Similarly, the program will provide a student with as much advance notice as possible if the student is dropped from the program for reasons of poor performance. In addition, the student must maintain continual enrollment (at least 1.0 credit hour per fall and spring semesters) in the program after advancing to candidacy (ie, after passing the *comprehensive* examination and all course work), not including summer sessions. The student must also be registered during the semester of graduation.

Annual Progress Review

The Departmental Graduate Program Committee will conduct an annual review for students' academic progress in the program regarding the course work and research progress (if applicable). For the students who lack of adequate progress, a remedy plan will be provided by the committee. Decision for continuing or terminating financial support to students based on the progress will be submitted to the departmental chairperson for approval.

Coursework Transfer

The student may request a transfer of no more than 50% of the course requirements (other than

dissertation) from an accredited graduate program. The residency requirement is that at least 50% of the course requirements (other than dissertation) be completed within a consecutive 18-month period, with the further provision that the courses be taken after receipt of the master's degree or equivalent. After the student is enrolled in the biostatistics Ph.D. program at University of Nebraska Medical Center (UNMC), the transfer request will be reviewed by the Graduate Program Director or, if already identified, the student's academic advisor (academic advisor will be assigned to students by the Graduate Program Director). A recommendation for approving or rejecting the request for credit transfer will be made on a case-by-case basis. The student who does not received an approval for credit transfer, will need to take additional courses as recommended by either the Graduate Program Director or the academic advisor (if assigned) to satisfy the 60-credit hour requirement (see link). Students must provide, at minimum, the syllabus for the course under evaluation. Other documentation may be requested, as needed.

Expired Coursework

A course may not apply towards degree requirements if was completed more than seven years prior to the passing of the preliminary examination.

Timeline for Completion

The student must receive acceptance of his or her dissertation and must submit a copy to the UNMC Graduate Studies Office within three years after passing the *comprehensive* examination, and complete the degree in entirety within seven years from time of admission into the program. Failure to meet this requirement will result in the termination of candidacy and of the student's enrollment in the degree program. Any student whose candidacy lapses will be required to apply to the UNMC Graduate Studies for reinstatement before further work toward the degree may be done formally.

FINANCIAL SUPPORT

The Program offers financial support to qualified students in the form of Teaching or Research Assistantships (TA, & RA) or in the form of University Fellowships. In addition, supported students receive tuition remission and payment of the mandatory student health insurance premium. Student's financial support is generally guaranteed for 5 years, provided that the recipient is making satisfactory progress toward the degree and is discharging the teaching or research assignment in a quality and professional manner. **A full-time student who is on an assistantship/fellowship at 20 hours per week cannot hold outside employment.**

Teaching Assistantships

Each semester the responsibilities of a teaching assistant will involve teaching related assignments (instruction, recitation, tutoring and or grading) of up to 20 hours per week during the Fall and Spring Semesters plus one if the six-weeks summer sessions. Students whose performance as a TA is unsatisfactory will be notified; if, at the end of the following semester, sufficient improvement has not been made, support will be terminated.

Research Assistantships

Some faculty of the program or UNMC investigators may have research grants that provide stipend and mandatory health insurance for qualified graduate students assigned to work on the funded research project. The availability of research assistantships will vary each year among the

investigators and the funded research projects in the departments. The awards are usually not made by the Department but rather are arranged with the UNMC faculty serving as a PI or the leading investigator of the funded research project.

Students supported in this manner are expected to devote up to 20 hours per week to their assigned responsibilities in the funded research project(s) during the academic year. Students whose performance as RA on the assigned funded research project(s) is lacking will be notified and given one semester to correct the deficiency, or support will be terminated.

Graduate students should expect, on average, to be allowed at least 14 days (regular workdays, M-F) of personal vacation in a given year. Students desiring longer break periods should expect to use the allowance accumulated over more than one year, as well as receive appropriate approval from their Advisor/Supervisor and program Graduate Committee. For more details, refer to the Guidelines for Graduate Assistant Work and Study.

University Fellowships

Senior Ph.D. students with outstanding credentials may apply for a competitive UNMC Graduate Studies Fellowships to support the dissertation research. The awarded students are expected to receive the same levels of financial support as TA/RA supported by the program.

LIST OF BIOSTATISTICSPROGRAM GRADUATE FACULTY AND THEIR RESEARCH INTERESTS

Hongying (Daisy) Dai, PhD
Professor
PhD Statistics, University of Kentucky
Dr. Dai's current research focuses on developing statistical methodology and applying advanced statistical methods in public health research including statistical modeling and assessment for tobacco policy research and national behavioral surveys; social media research using big data (Google Trends, Twitter data, disease surveillance); development of novel statistical methods for big data and high dimensional data, Genome Wide Association Study (GWAS); hierarchical modeling, asymptotic theory, and mixture modeling

Ran Dai, PhD
Assistant Professor
PhD Statistics, University of Chicago
Dr. Dai's research interest is in high dimensional inference in nonparametric modeling and shape-constrained regressions, multiple testing, and causal inference. In particular, she is interested in developing computationally efficient algorithms for these problems with statistical convergence guarantee and valid inference; and applying these methods towards real datasets in the areas of drug development, HIV mutation study and cancer study.

Jianghu (James) Dong, PhD
Assistant Professor
PhD Statistics, Simon Fraser University
Dr. Dong's current research is mainly focus in developing new statistical methodologies to solve the real clinical problems, especially in Diabetes, Chronic Kidney Disease and Kidney Transplant. He is also interested in functional data analysis; longitudinal analysis, survival analysis and joint modeling; clinical trials and measurement error models; cost-effectiveness analysis and decision tree.

Yeongjin Gwon, PhD
Assistant Professor
PhD Statistics, University of Connecticut
Dr. Gwon's research interest is in Bayesian statistical methodology, Bayesian computation, Network meta analysis, Latent class modeling, High-dimensional data, Longitudinal data, and Survival data analysis.

Gleb Haynatzki, PhD, DSc
Professor & Graduate Program Director
PhD Statistics & Applied Probability, University of California-Santa Barbara
DSc Mathematical Sciences, St K Ohridski U, Sofia, Bulgaria, Europe
Dr. Haynatzki's research interest is in statistical models in survival analysis, cancer epidemiology, carcinogenesis, cancer genetics, hereditary cancer, health disparities; quantitative modeling of bone biology and osteoporosis.

Jane Meza, PhD
Professor and Associate Vice Chancellor for Global and Student Support
PhD Statistics, University of Nebraska, Lincoln
Dr. Meza's methodological research focuses on statistical issues related to small-area estimation. These methods have been extended to disease mapping applications and combining national and state data to estimate the probability of a rare event.

Kendra Schmid, PhD
Professor and Assistant Dean of Graduate Studies
PhD Statistics, University of Nebraska, Lincoln
Dr. Schmid's current research is focused on statistical shape analysis using landmark data and in particular, methods for face recognition applications. She is also interested in statistics education.

Lynette Smith, PhD
Assistant Professor
PhD Statistics, University of Nebraska, Lincoln
Dr. Smith's current research is focused on spatial prediction of disease incidence and mortality. She is also interested in biomarker development in cancer, clinical trial design, and high dimensional data analysis.

Christopher Wichman, PhD
Assistant Professor
PhD Statistics, University of Nebraska, Lincoln
Dr. Wichman's current research is focused on detecting changes in closed networks using meta data. He is also interested in model misspecification in the presence of zero inflated counts, experimental design, meta-analysis, and social-network analysis.

Fang Yu, PhD
Professor and Director of Center for Collaboration on Research Design and Analysis
PhD Statistics, University of Connecticut
Dr. Yu's current research interest is in developing and applying statistical methods for analyzing high-dimensional data, missing data from biomedical research, and clinical trials.

Ying Zhang, PhD
Professor and Chair
PhD Statistics, University of Washington
Dr. Zhang conducts statistical methodology research in broad areas including non-/semi-parametric statistical inference, non-/semi-parametric models for panel count and interval-censored data analysis, causal inference, clinical and pragmatic trial design, statistical computing, and machine learning. He also actively collaborates with scientists in the fields of neurodegenerative diseases, neurosciences,

cancer, cardiovascular disease, diabetes, sports medicine and community health promotion by providing rigor in study design, statistical analysis plan and scientific interpretation of analytical results.

Cheng Zheng, PhD
Associate Professor
PhD Biostatistics, University of Washington
Dr. Zheng's methodological research interests are in causal inference, measurement error modeling, big data, survival analysis, longitudinal data, and biomarker evaluation.
Dr. Zheng's applied research interests are in cancer, Cardiovascular disease, diabetes, obesity, HIV, Nutritional Epidemiology, Environmental Epidemiology, and Behavioral

APPENDIX: Biostatistics Course Descriptions

BIOS 801 BIOSTATISTICS Theory I 3 Credit Hours

This course is designed to prepare students in the Master of Sciences in Biostatistics to have a solid understanding of the probabilistic tools and language (at a rigorous and advanced calculus level) needed as a foundation of biostatistical inference. Major topics to be covered include probability theory, transformations and expectations of random variables, families of distributions, random vectors, sampling distributions, and convergence.

Prerequisite: Calculus I, II and III, or equivalent courses; and instructor permission.

Cross List: CPH 657

Typically Offered: FALL

BIOS 802 BIOSTATISTICS Theory II 3 Credit Hours

This course is designed to prepare students to have a solid understanding of biostatistical inference. Major topics to be covered include random samples, data reduction, point estimation, hypothesis testing, interval estimation, and prediction for common parametric models.

Prerequisite: BIOS 801 Biostatistics Theory I or an equivalent course, and instructor permission.

Cross List: CPH 658

Typically Offered: SPRING

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 815 BIOSTATISTICAL COMPUTING 3 Credit Hours

This course is designed for graduate students that are interested in statistical computing. The course will introduce graduate students to the R statistical language, PYTHON and their uses in biostatistical computing. Topics include introductory R, data management and manipulation, loops, vectorising code, writing functions, coding shiny apps, pipe operators, coding numerical methods, resampling methods, data simulation and data visualization. In addition, students will be introduced to PYTHON and the R reticulate package for harnessing the power of PYTHON from within R.

Prerequisite: Biostatistics I (CPH506/BIOS806) or equivalent; Introduction to SAS Programming (CPH651/BIOS810) or instructor permission.

Cross List: CPH 656.

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 (eg, 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: Permission of instructor and BIOS 823/CPH 653.

Cross List: CPH 655.

Typically Offered: SPRING

BIOS 829 INTRODUCTION TO BIOSTATISTICAL MACHINE LEARNING 3 Credit Hours

This course is designed to prepare graduate students to use modern statistical learning methods for modeling and prediction from data. Major topics to be covered include linear regression, classification (logistic regression, linear and quadratic discriminant analysis, K-Nearest Neighbors), resampling methods (cross-validation, the bootstrap), linear model selection and regularization (subset selection, shrinkage methods, dimension reduction), nonlinear approaches (polynomial regression, splines, Generalized Additive Models), tree-based methods (Classification and Regression Trees, bagging, random forests, boosting), support vector machines, unsupervised learning (principal component analysis, clustering). The mathematical level of this course is modest, with only simple matrix operations. An introduction to the statistical programming language *R* will be provided.

Prerequisites: (i) At least one multivariable statistics course, eg BIOS 818, BIOS 823, BIOS 824, BIOS 825 or equivalent; (ii) BIOS 815 Biostatistical Computing; or (iii) equivalent courses with Instructor permission.

Cross List: CPH 665.

Typically Offered: SPRING

BIOS 835 DESIGN OF MEDICAL HEALTH STUDIES 3 Credit Hours

This course is designed to prepare the graduate student to understand and apply principles and methods in the design of biomedical and public health studies, with a particular emphasis on randomized, controlled clinical trials. The major design topics to be covered include sample selection, selecting a comparison group, eliminating bias, need for and processes of randomization, reducing variability, choosing endpoints, intent-to-treat analyses, sample size justification, adherence issues, longitudinal follow-up, interim monitoring, research ethics, and non-inferiority and equivalence hypotheses. Data collection and measurement issues also will be discussed. Communication of design approaches and interpretation of subsequent analysis results also will be stressed. Concepts will be explored through critical review of the biomedical and public health literature, class exercises, and a research proposal. The course is intended for graduate students and health professionals interested in the design of biomedical or public health studies.

Prerequisite: Permission of Instructor, BIOS 806/CPH506 or an equivalent introductory statistics course.

Cross List: CPH 517.

Typically Offered: SPRING

BIOS 896 RESEARCH OTHER THAN THESIS IN BIOSTATISTICS 1-4 Credit Hours

This course is for more advanced students who wish to pursue their research interests in selected areas of Medical Humanities.

Cross List: CPH 677.

Typically Offered: FALL/SP/SU

BIOS 898 SPECIAL TOPICS IN BIOSTATISTICS 1-4 Credit Hours

A course designed for Masters students that focuses on selected topics or problems in Biostatistics.

Cross List: CPH 679.

Typically Offered: FALL/SP/SU

BIOS 901 ADVANCED BIOSTATISTICS THEORY I 3 Credit Hours

This course is designed to prepare PhD students in Biostatistics to have a solid understanding of statistical theory and **its advanced use** in developing statistical methods for biomedical studies. Major topics to be covered include Theory of probability and distribution, Statistical inference problems, Asymptotic theory, Maximum likelihood theory I, Maximum likelihood theory II, Maximum likelihood theory III, and EM-algorithm.

Cross List: N/A

Typically Offered: FALL

BIOS 902 ADVANCED BIOSTATISTICS THEORY II 3 Credit Hours

This course is designed to give a solid understanding of statistical theory and its advanced use in developing statistical methods for biomedical studies. Major topics to be covered include Extended Likelihood Theory, Quasi-Likelihood and Generalized Estimating Equation (GEE), Missing Data Methodology, Group Sequential Methods for Clinical Trials, Bootstrap Methods, Causal Inference, and Lasso Regularization Methods. It is the second part of the advanced biostatistics theory sequence after BIOS 901.

Cross List: N/A

Typically Offered: SRING

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 925 THEORY OF GENERAL LINEAR AND MIXED MODELS IN BIOSTATISTICS 3 Credit Hours

This course focuses on the theory of generalized linear models for both continuous and categorical data. Major topics include generalized linear models, linear mixed models and generalized linear mixed models.

Prerequisite: BIOS 918 or equivalent.

Typically Offered: SPRING

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 designed to provide the graduate student with a fundamental understanding and insight into the practice of biostatistical consulting and give students practice in the skills required to become an effective consultant. Major topics include an overview of biostatistical consulting, communication skills, methodological aspects including design and analysis considerations, documentation and preparing reports.

Prerequisite: Minimum of 3 graduate-level statistics of biostatistics courses and permission of instructor.

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 ¿ all 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