Biochemistry and Molecular Biology

Graduate Committee

Dr. Steven Caplan (Chair)

Dr. Paul Sorgen; Dr.Kaustubh Datta

Dr. Keith Johnson

Dr. Duygu Dee Harrison-Findik

## Admission Requirements for the Ph.D. and M.S. degrees

Students seeking admission must have a baccalaureate degree and should submit Graduate Record Examination (GRE) and, if applicable, Test of English as a Foreign Language (TOEFL) scores as part of their application. Applicants must also have a comprehensive background in chemistry, including courses in general and organic chemistry. Courses in general physics, mathematics (including calculus), and general biology are also required.

## Master of Science degree

Students studying for the Master of Science degree must enroll in BRTP 821, 822, 823, and 824 and achieve a grade of B- or better in these courses. The number of other graduate-level courses required will vary with each student.

Individual programs of study will be designed for each student by their advisory committee with the approval of the Graduate Committee. Students must achieve a grade of "B-" or better in all graduate-level courses and maintain an overall 3.0 graduate GPA.

## Doctor of Philosophy degree

The Supervisory Committee will determine the curriculum to be followed by the student. The following are required of all students:

Satisfactory completion of BRTP 821, 822, 823, 824, and BIOC 935 with a minimum grade of B- in each course.

Registration for 1 credit of BIOC 970 (Seminar) and participation in the departmental journal club each semester. In addition, students with a Ph.D. objective will be required to present a formal research seminar in the regular departmental seminar during the following academic year after they become a Ph.D. candidate. All Ph.D. candidates must deliver a seminar-length presentation of their work in a publicly announced forum sometime between their formal seminar and their dissertation defense, as well as for their defense of dissertation; journal club presentations are not required at these times. Attendance at the departmental seminar and journal club is required as a component of BIOC 970.

Registration in Biochemistry 935 (Advanced Biochemistry and Molecular Biology).

## Combined degrees

Students enrolled in the College of Medicine may pursue a combined M.D. degree and a Ph.D. or M.S. degree. The student must meet all the Admission Requirements of the department and the Graduate College and be recommended by the Graduate Committee. Admission into this combined degree program requires approval by the Dean for Graduate Studies and the Dean of the College of Medicine.

The Department of Biochemistry and Molecular Biology will work actively with the student to develop a schedule that will make most effective use of his/her time while studying for the combined degrees. The student should plan to spend a considerable block of time working exclusively on thesis/dissertation research in order to complete the graduate program.

A detailed description of the department’s graduate program and advanced degree requirements are contained in the document, "A Guideline for Graduate Programs Leading to the Ph.D. and M.S. Degrees in Biochemistry and Molecular Biology.” *See the department's website:* [*http://www.unmc.edu/biochemistry*](http://www.unmc.edu/Biochemistry)

## BIOCHEMISTRY AND MOLECULAR BIOLOGY (BIOC)

*Fall Semester*

BIOC 880. Principles and Methodologies of Cancer Research (3 credits)

***Instructors:*** Xu Luo and Robert Lewis ***Offered:*** Annually

*Cross Listed:* CRGP 880, PAMM 880, PHSC 880, PHAR 880

***Prerequisites:***BRTP 821,822, 823 and 824 or equivalent, permission of instructor.

The course surveys the biology and biochemical mechanisms underlying cancer development, prevention, and therapy.

BIOC 935. Advanced Biochemistry and Molecular Biology (4 credits)

*Instructor:* Paul Sorgren ***Offered:*** Annually

***Prerequisites:***BRTP 821, 822, 823, and 824 or permission of instructor.

The objective of BIOC 935 is to teach Advanced Biochemistry and Molecular Biology topics to second-year graduate students in order to help prepare them for their Comprehensive Exam. Secondary goals of this course are to critically review manuscripts and deign experiments. This 4 credit course will provide in-depth material in the areas of metabolism, protein function, and nucleic acid function that are not provided in BRTP courses 821, 822, 823, and 824. BIOC 935 will be required for all second-year Biochemistry and Molecular Biology students.

*Spring Semester*

**BIOC 921. Biophysical Chemistry (3 credits)**

*Instructor:* Luis Marky ***Offered:*** Even Years Only

*Cross Listed:* PHSC 921

***Prerequisites:***Permission of instructor.

The course will cover the biophysical chemistry of nucleic acids and proteins including the study of these molecules using NMR, calorimetry and fluorescence.

***Multiple Semesters***

**BIOC 896. Research Other Than Thesis (1-8 credit[s]) Fall, Spring, Summer**

*Instructor:* Biochemistry Faculty ***Offered:*** Annually

**BIOC 899. Master’s Thesis (1-8 credit[s]) Fall, Spring, or Summer**

*Instructor:* Biochemistry Faculty ***Offered:*** Annually

**BIOC 940. Special Topics (1-3 credit[s])** **Fall, Spring, Summer**

*Instructor:* Biochemistry Faculty ***Offered:*** Annually

***Prerequisites****:* To Be Announced

Presented at intervals depending upon the interest of the faculty or the request of students. A description of each course with its prerequisites is announced at the time the course is offered.

**BIOC 970. Seminar (1 credit) Fall, Spring**

*Instructor:* Biochemistry Faculty ***Offered:*** Annually

***Prerequisites:*** Permission of instructor

**BIOC 999. Doctoral Dissertation (1-8 credit[s]) Fall, Spring, Summer**

*Instructor:* Biochemistry Faculty ***Offered:*** Annually

Biostatistics

## Graduate Committee:

Dr. Gleb Haynatzki (Chair)

James Anderson, PhD

Baojiang Chen, PhD

Gleb Haynatzki, PhD

Jiangtao Luo, PhD

Jane Meza, PhD

Kendra Schmid, PhD

Fang Yu, PhD

**Minimum Admission Requirements for the PhD degree**

Students seeking admission must have a MS or MA in Biostatistics/Statistics or equivalent degree (e.g. Biostatistics MPH plus courses in mathematical statistics and mathematical analysis at the Master’s level (equivalent to UNL STAT 882 & 883, MATH 825 & 826)), and should submit Graduate Record Examination scores (a minimum combined score of 1000 on the verbal and quantitative sections) taken in the previous five years as part of their application. A minimum cumulative grade-point average of 3.00/4.00 on all relevant graduate course work is also required for admission. All international applicants whose native language is not English are required to submit a TOEFL score with a minimum of 550 (paper), or 213 (Computer), or 80 (Internet). At least three, but no more than four, letters of recommendation are required for admission. At least two of these letters must be from faculty members from the applicant’s previous program who can attest to the applicant’s ability to pursue successfully a PhD program in Biostatistics.

**Doctor of Philosophy degree**

The expected completion time is 4-5 years. The PhD program in Biostatistics requires (i) successful completion of 60 semester hours of courses beyond Masters Level (including core, required, elective, and dissertation hours), (ii) passing comprehensive exam at PhD level based on the core courses, (iii) writing a PhD dissertation, and (iv) oral defense of the dissertation.

No more than one-third of credit hours for PhD may be master’s level or “introductory” courses (800 level with 600 or lower counterparts). Master’s level courses that may be taken by PhD students, for example, may be those in a cognate field, as well as the 800-level courses from the Biostatistics MPH program, the latter being Prerequisites: for some of the PhD-level courses.

At least 50% of the coursework for the doctoral degree must be completed at the University of Nebraska. No graduate credit will be accepted for transfer unless earned at an institution fully accredited to offer graduate work; nor should the student expect any graduate credit to be transferred unless the Biostatistics Graduate Committee evaluates the quality and suitability as equal or superior to the offerings available at the University of Nebraska.

A candidate must maintain a minimum cumulative grade point average of 3.0 for all graduate courses completed for the PhD. Failure to maintain a 3.0 GPA will result in suspension or termination from the PhD Program. Students must conform to all relevant requirements specified in the University of Nebraska Medical Center Graduate Studies Bulletin.

## BIOSTATISTICS (BIOS)

*Fall Semester*

BIOS 810. **Introduction to SAS Programming (3 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

*Cross Listed:* CPH 651

***Prerequisites:***BIOS 806 (CPH 506) or equivalent introductory statistics course, EPI 821 (CPH 621), and permission of the instructor.

This course is 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.

BIOS 823. **Categorical Data Analysis (3 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

*Cross Listed:* CPH 653

***Prerequisites:***Instructor permission; BIOS 816 (CPH 516) Biostatistical Methods I or equivalent course work such as Calculus, BIOS 806 (CPH 506) Biostatistics I, and BIOS 810 (CPH 651) Introduction to SAS Programming or equivalent experience with SAS programming.

This course surveys theory and methods for analysis of categorical response and count data. The major topics to be covered include proportions and odds ratios, multi-way contingency tables, generalized linear models, logistic regression for binary response, models for multiple response categories, and loglinear models. Interpretation of subsequent analysis results will be stressed.

BIOS 824. **Survival Data Analysis (3 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

*Cross Listed:* CPH 654

***Prerequisites:***Instructor permission; BIOS 816 (CPH 516) Biostatistical Methods I or equivalent course work such as Calculus, BIOS 806 (CPH 506) Biostatistics I, and BIOS 810 (CPH 651) Introduction to SAS Programming or equivalent experience with SAS programming.

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.

BIOS 918. **Biostatistical Linear Models: Theory and Applications (3 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:***Instructor permission; Linear Algebra; BIOS 818 (CPH 652) Biostatistical Methods II; One year of mathematical statistics

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.

BIOS 924. **Biostatistical Theory and Models for Survival Data** **(3 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:***STAT 980 Advanced Probability provided by UNL, STAT 982-983 Advanced Inference I & II provided by UNL, BIOS 824 Survival Data Analysis (or their equivalent), and instructor permission required.

The course teaches the statistical theory and models for survival data analysis used in biomedical and public health research. Major topics include parametric, nonparametric, and semi-parametric theory and models. The statistical software SAS and R will be used.

**BIOS 935. Semiparametric Methods for Biostatistics (3 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:***Instructor permission; Familiarity with Software R and SAS

This course teaches the fundamental theory and application of semiparametric 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.

*Spring Semester*

BIOS 818. **Biostatistical Methods II (3 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

*Cross Listed:* CPH 652

***Prerequisites:***Instructor permission; Calculus (including differential and integral); BIOS 806 (CPH 506) Biostatistics I or BIOS 816 (CPH 516) Biostatistical Methods I or equivalent statistics course; BIOS 810 (CPH 651) Introduction to SAS Programming or equivalent experience

This course focuses on the analysis of continuous data and the interpretation of results. Major topics include simple and multiple linear regression, and analysis of variance (ANOVA). SAS statistical software will be used.

BIOS 825. **Correlated Data Analysis (3 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

*Cross Listed:* CPH 655

***Prerequisites:***Instructor permission and BIOS 823 (CPH 653) Categorical Data Analysis

This course surveys the theory and methods for the analysis of correlated, continuous, binary, and count data. The 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.

BIOS 835. **Design of Medical Studies (3 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

*Cross Listed:* CPH 517

***Prerequisites:***Instructor permission, BIOS 806 (CPH506) Biostatistics I or an equivalent introductory statistics course

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 biomedical and public health literature, class exercises, and research proposal. This course is intended for graduate students and health professionals interested in design of biomedical or public health studies.

BIOS 921. **Advanced Programming for SAS (3 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:***Instructor permission; BIOS 810 (CPH 651) Introduction to SAS Programming or equivalent course.

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.

BIOS 925. **Theory of Generalized Linear and Mixed Models in Biostatistics (3 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:***BIOS 918 or equivalent

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*.*

**BIOS 941. Essentials of Biostatistical Consulting (2 credits)**

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:***Instructor permission; Minimum of three graduate level statistics or biostatistics courses

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.

***Multiple Semesters***

BIOS 896. **Research Other Than Thesis (Variable credits)** **Fall, Spring, Summer**

*Instructor:* Biostatics Faculty ***Offered:*** Annually

*Cross Listed:* CPH 677

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

**BIOS 970. Seminar (1 credit) Fall, Spring**

*Instructor:* Biostatics Faculty ***Offered:*** Annually

BIOS 998. **Special Topics (Variable credits)** **Fall, Spring**

*Instructor:* Biostatics Faculty ***Offered:*** Annually

*Cross Listed:* CPH 679

Independent study course focusing on selected topics or problems. The subject will be dependent on student demand and availability of staff.

**BIOS 999. Dissertation Research (1-15 credit[s]) Fall, Spring, Summer**

*Instructor:* Biostatics Faculty ***Offered:*** Annually

***Prerequisites:*** Instructor permission

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.

Biomedical Research Training Program (BRTP)

## *Fall Semester*

## BRTP 821. Macromolecular Structure And Function (4 credits)

*Instructor:* Drs. MacDonald, Ciborowski ***Offered:*** Annually

***Prerequisites:***Instructor permission

Introduction to fundamental concepts in the biochemistry of macromolecules, including structure, characterization, purification, and functional analysis of proteins and nucleic acids.

## BRTP 822. Molecular Cell Biology (3 credits)

*Instructor:* Drs. Joshi, Caplan ***Offered:*** Annually

***Prerequisites:***Instructor permission

Introduction to fundamental concepts of cell structure, cell division, the experimental study of cells, and the mechanisms of cellular transport/trafficking, communication, and adhesion.

## *Spring Semester*

## BRTP 823. Genetics And Gene Regulation (2 credits)

*Instructor:* Drs. Gould, Cox ***Offered:*** Annually

***Prerequisites:***Instructor permission

Fundamental concepts for understanding genetic analysis, gene expression, and mechanisms by which genes are regulated.

## BRTP 824. Cell Signaling (3 credits)

*Instructor:* Drs. Carmines, Solheim ***Offered:*** Annually

***Prerequisites:***Instructor permission

Introduction to fundamental concepts of cell signaling and cell regulation. Concepts include receptor systems, signal transduction, regulation of membrane potential, and the relationships between cell signaling and development, cancer, neurobiology, and immunobiology.

## *Multiple Semesters*

## BRTP 896. Research Other Than Thesis (1-9 credit[s])

*Instructor:* BRTP Faculty ***Offered:*** Annually

## BRTP 970. Seminar (1 Credit)

*Instructor:* BRTP Faculty ***Offered:*** Annually

Cancer Research

## Graduate Committee:

Dr. Joyce Solheim (Chair)

Dr. Tadayoshi Bessho

Dr. Jennifer Black

Dr. Pi-Wan Cheng

Dr. Xu Luo

Dr. Youri Pavlov

Dr. Angie Rizzino

## Admission Requirements for the Ph.D. and M.S. degrees

The Cancer Research Graduate Program (CRGP) is an individualized program that considers each applicant's educational background, career goals, and interests in the admissions process. Students interested in applying for the fall semester are encouraged to apply in January or February of that year. Students typically begin in the summer or fall semester. Spring admission is also possible.

CRGP admissions will require:

1. A bachelor's degree in chemistry, biology or a related science field.
2. Coursework in organic chemistry, biology, physics, and mathematics through calculus or statistics. Biochemistry is also recommended. Students can make up some deficiencies once admitted to the CRGP. For example, a summer school course can be completed prior to starting as a CRGP student.
3. Results from the Graduate Record Examination (GRE), including verbal, quantitative, and analytical writing scores. The advanced chemistry, biology, or biochemistry examination is recommended but not required.
4. Three letters of recommendation from scientists or other individuals who can assess the student's talents and training.
5. A statement of personal goals and career objectives. Research experience, while not required, is a major asset for admission. Applicants will be expected to interview with CRGP faculty unless there is a good reason to waive the interview. Foreign applicants will be required to meet UNMC Graduate Studies requirements for admission.

## Master of Science degree

The CRGP program is intended to be for the training of Ph.D. students. The faculty recognizes, however, that circumstances may warrant a student's leaving the program prior to completion of the requirements for the Ph.D. degree. The student may qualify for a master's degree provided that the following conditions have been met:

Completion of all didactic coursework (Macromolecular Structure & Function, Molecular Cell Biology, Principles and Methodologies in Cancer Research; at least two electives to be determined by the student's Supervisory Committee; the annual Short Course in Cancer Biology; attendance at seminars, including presentation of an annual research seminar beginning in the student’s second year; and the Journal Club in Cancer Biology [which is included in the CRGP Seminar course requirements]).

-Completion of a comprehensive examination consistent with the master’s level

-Completion of a research project consistent with a master's level achievement

-Completion and successful defense of a master's thesis

-Concurrence of the mentor and the other members of the student's Supervisory Committee

-Concurrence of the CRGP Graduate Committee

-Other requirements of UNMC Graduate Studies, such as Responsible Conduct in Research

## Doctor of Philosophy degree

Completion of all didactic coursework (Macromolecular Structure & Function, Molecular Cell Biology, Principles and Methodologies in Cancer Research; at least two electives to be determined by the student's Supervisory Committee; the annual Short Course in Cancer Biology; attendance at seminars, including presentation of an annual research seminar beginning in the student’s second year; and the Journal Club in Cancer Biology (which is included in the CRGP Seminar course requirements]).

-Completion of a comprehensive examination consistent with the Ph.D. level

-Completion of a research project consistent with a Ph.D. level of achievement

-Completion and successful defense of a doctoral dissertation

-Concurrence of the mentor and the student's Supervisory Committee.

-Concurrence of the CRGP Graduate Committee

-Other requirements of UNMC Graduate Studies, such as Responsible Conduct in Research

## CANCER RESEARCH (CRGP)

*Fall Semester*

CRGP 880. **Principles and Methodologies in Cancer Research (3 credits)**

*Instructor:* Xu Luo ***Offered:*** Annually

*Cross Listed:* BIOC 880, PAMM 880, PHSC 880, PHAR 880

***Prerequisites:***BRTP 821, 822, or equivalent, or permission of instructor.

The course surveys the biology and biochemical mechanisms underlying cancer development, prevention, and therapy.

***Summer Semester***

## CRGP 940. Short Course in Cancer Biology (1 credit).

*Instructor:* CGRP Faculty ***Offered:*** Annually

***Multiple Semesters***

**CRGP 896. Research Other Than Thesis (1-15 credit[s]) Fall, Spring, Summer**

*Instructor:* CGRP Faculty ***Offered:*** Annually

CRGP 970. Seminar (1 credit) Fall, Spring

*Instructor:* Joyce Solheim ***Offered:*** Annually

**CRGP 899. Master’s Thesis (1-15 credit[s])** **Fall, Spring, Summer**

*Instructor:* CGRP Faculty ***Offered:*** Annually

**CRGP 999. Doctoral Dissertation (1-15 credit[s]) Fall, Spring, Summer**

*Instructor:* CGRP Faculty ***Offered:*** Annually

Cellular and Integrative Physiology

**Graduate Committee:**

Dr. Pamela Carmines (Chair)

Dr. Steven Sansom

Dr. Babu Padanilam

Dr. Matthew Zimmerman

The Department of Cellular & Integrative Physiology offers programs of graduate training leading to the M.S. or Ph.D. degrees. The M.S. program is designed to provide background in physiology to enhance a career in allied fields such as medicine, bioengineering, or dentistry. The Ph.D. program is designed to provide comprehensive knowledge of mammalian physiology at the cellular and integrative levels, including the research and training required for the development of independent investigators. The Department of Cellular & Integrative Physiology participates in the Biomedical Research Training Program (BRTP).

## **Admission Requirements**

Enrollment in Cellular & Integrative Physiology degree programs requires matriculation in the fall semester, although summer enrollment can be arranged in special circumstances. Students interested in the Ph.D. program are encouraged to apply before February 1 (priority deadline). The final application deadline for the Ph.D. program is March 15. The application deadlines for the M.S. program are June 1st for domestic applicants and April 1 for international applicants. Admission to the M.S. or Ph.D. programs in Cellular & Integrative Physiology requires a bachelor's degree (or higher) in science from an accredited college or university. The following undergraduate courses are required for admission: 2 semesters of organic chemistry, 2 semesters of physics, and 2 semesters of biology (preferably in the zoological sciences). Deficiencies in the required undergraduate coursework must be eliminated by the end of the first year of graduate study. In addition, undergraduate courses in biochemistry and vertebrate or mammalian physiology are recommended. Research experience also enhances the applicant's preparation for graduate studies in Cellular & Integrative Physiology.

Applicants to either the M.S. program or the Ph.D. program must submit official transcripts and GRE (or MCAT) scores, with either a minimum undergraduate GPA of 3.0 on a 4.0 point scale or a minimum Verbal + Quantitative GRE score (1000 using 200-800 score scales, or 295 using 130-170 score scales). Applicants for whom English is a second language must meet or exceed the minimum score requirement on either the TOEFL (100 on iBT, 250 on CBT, or 600 on paper-based test) or the IELTS (7.0 Overall Band Score).

Students are selected for admission based on composite science and math GPA, overall undergraduate GPA, GRE scores, letters of recommendation, and the personal statement. The personal statement should reflect interest in Cellular & Integrative Physiology, including any relevant experience and/or educational training. Performance in graduate-level courses is also given consideration.

## M.S. Degree (Non-Thesis Option)

This option is recommended for most M.S. students in Cellular & Integrative Physiology. This degree program can be completed in 1.5 years (matriculate in the fall semester, graduate at the end of the following fall semester). Students pursuing the non-thesis option M.S. degree must complete a compulsory core curriculum composed of the following courses: Graduate Physiology (CIP 806, with a grade of B- or higher), Graduate Physiology Recitation (CIP 807), the 12 cr. BRTP curriculum (BRTP 821, 822, 823 & 824), two advanced physiology electives (choose among CIP 914, 916, 920, 922 & 930), Seminar (CIP 970, each semester beginning with the 2nd semester of enrollment), and two graduate-level electives (minimum of 5 total credits; choose among PHAR 901–922, CIP 814–930, or other courses upon approval of the Graduate Committee). No more than 3 cr. of CIP 896 can be applied toward the graduate-level electives requirement. The M.S. degree (non-thesis option) is awarded upon satisfactory completion of the core curriculum and passing the comprehensive examination (writing a review article in the style of *Annual Review of Physiology*).

## M.S. Degree (Thesis Option)

The Thesis Option M.S. Degree in Cellular & Integrative Physiology is recommended for individuals with a laboratory-based career goal (e.g. lab manager in the pharmaceutical industry or in academia) or those individuals who are considering the possibility of eventually pursuing the Ph.D. degree in physiology or another basic biomedical science. Students pursuing the M.S. degree (thesis option) must complete a compulsory core curriculum composed of Graduate Physiology (CIP 806, with a grade of B- or higher), Graduate Physiology Recitation (CIP 807), at least 6 credits from the BRTP curriculum (choose among BRTP 821, 822, 823 & 824), two advanced physiology electives (choose among CIP 914, 916, 920, 922 & 930), Seminar (CIP 970, each semester beginning with the 2nd semester of enrollment), Research Other Than Thesis (CIP 896), and 8-10 cr. of Masters Thesis (CIP 899). The M.S. degree (thesis option) is awarded upon completing the core curriculum, passing the comprehensive examination (writing a review article in the style of *Annual Review of Physiology*), and completing a research project that results in a written thesis with an oral defense.

## Doctor of Philosophy Degree

Didactic Training: Ph.D. students in Cellular & Integrative Physiology must complete a compulsory core curriculum composed of Graduate Physiology (CIP 806, with a grade of B- or higher), Graduate Physiology Recitation (CIP 807), the 12 cr. BRTP curriculum (BRTP 821, 822, 823 & 824), two advanced physiology electives (choose among CIP 914, 916, 920, 922 & 930) and Seminar (CIP 970; each semester beginning with the 2nd semester of enrollment). The student's Supervisory Committee may define additional course requirements on an individual basis. In addition, senior level Ph.D. students (primarily Ph.D. candidates) are required to serve annually as discussion facilitators for 2-3 class sessions in the Graduate Physiology Recitation course.

Research Training: During the first year of graduate study, students complete two semesters of Research Other Than Thesis (CIP 896), which entails a research rotation in a different laboratory each semester. These rotations introduce the student to research, in terms of specific questions and techniques as well as general aspects of research strategies and problem solving. After completion of the rotations, students select a faculty advisor and laboratory for their dissertation research project.

The Cellular & Integrative Physiology faculty provide research expertise in cardiovascular physiology (cellular cardiac electrophysiology, cardiovascular neuroscience including neural control of circulation), renal physiology (ion transport, mesangial cell function, neural control of volume homeostasis, renal microcirculation, acute kidney injury, mechanisms of cell injury & repair), reproductive endocrinology and sensory physiology (cardiopulmonary chemoreceptors, visual physiology). Most laboratories focus on pathophysiological mechanisms associated with disease — e.g., acute renal failure, amyotrophic lateral sclerosis, congestive heart failure, diabetes mellitus, glaucoma, and hypertension.

Ph.D. students must present a seminar in the Physiology Forum series prior to beginning the comprehensive examination. Students advance to Ph.D. candidacy by completion of a comprehensive examination consisting of the preparation (written) and defense (oral) of a grant proposal. This examination must be completed within 3 years of enrollment at UNMC as a Ph.D. student, either directly into Cellular & Integrative Physiology or via the BRTP. Failure to meet the Comprehensive Examination deadline results in dismissal from the CIP Graduate Program.

Ph.D. candidates must have at least one first-author research paper published or accepted for publication in a peer-reviewed journal prior to graduation. A research publication with shared first-authorship (e.g. “author X and author Y contributed equally to this study”) does not satisfy this requirement.

The Ph.D. is awarded upon the completion of the above requirements and a research program that results in a dissertation of publishable quality with an oral defense. Completion of the degree usually requires 5 years.

## M.D./Ph.D. Degree

Students enrolled in or accepted into the College of Medicine can apply to the CIP Graduate Program to work toward the combined M.D./Ph.D. degrees. Applications are reviewed by the CIP Graduate Committee separate from the College of Medicine application procedures. Admission into this combined degree program requires approval by the Dean for Graduate Studies and the Dean of the College of Medicine. The following modifications of the Ph.D. degree requirements in CIP apply specifically to M.D./Ph.D. students:

* Upon successful completion of the first 2 years of the medical school curriculum, the CIP graduate committee will waive the requirement for completing the BRTP curriculum (12 credits), CIP 806 (Graduate Physiology, 6 credits) and its associated recitation (CIP 807, 1 credit), and CIP 896 (Research other than Thesis).
* Student must complete the comprehensive exam by the end of 2nd year of graduate study.
* The student must enroll in CIP 970 (Seminar) each semester during his/her graduate school years, complying with all course requirements until successfully completing the dissertation defense.
* The student must meet all other requirements for Ph.D. degree in Cellular & Integrative Physiology, including the completion of 2 advanced physiology electives (choose among CIP 914, 916, 920, 922 & 930), participation as a discussion facilitator in CIP 807, the first author research publication requirement, and a successful dissertation defense.

M.D. /Ph.D. students in Cellular & Integrative Physiology can anticipate completing these requirements in year 3 or 4 of graduate study.

## **Financial Aid**

Full-time Ph.D. students in Cellular & Integrative Physiology receive stipend support in the form of fellowships or research assistantships that do not require teaching. Full tuition waivers are also provided, and the department covers the cost of health insurance and other mandatory university fees. Students awarded fellowships from extramural sources also receive an annual stipend supplement (25% of base stipend). Continuation of support depends on satisfactory progress in the program and availability of funds. M.S. students are ineligible for assistantship/fellowship support or tuition waivers, and are responsible for the cost of health insurance and other fees.

## CELLULAR AND INTEGRATIVE PHYSIOLOGY (CIP)

*Fall Semester*

CIP 806. **Graduate Physiology (6 credits)**

*Instructor:* Kurtis Cornish ***Offered:*** Annually

***Prerequisite****:* None

Introduction to the processes that regulate the activity of individual cells and organ systems. Lectures cover cell, neural, musculoskeletal system, cardiovascular, renal, respiratory, gastrointestinal, endocrine and reproductive physiology.

CIP 807. **Graduate Physiology Recitation (1 credit)**

*Instructor:* Pamela Carmines ***Offered:*** Annually

***Co-requisite:*** Must be taken concurrently with CIP 806Graduate Physiology*.*

Guided study in significant issues related to the content of CIP 806.

**CIP 916. Cardiopulmonary Function in Health and Disease (2 credits)**

*Instructor:* Irving Zucker, Lie Gao ***Offered:*** Odd Years

***Prerequisite****:* CIP 806 or equivalent; See Instructor

A lecture/discussion-based course concerned with in depth evaluation of cardiopulmonary physiology and current advances in the pathophysiology of cardiovascular and pulmonary diseases such as heart failure and hypertension.

## CIP 922. Redox Biology in Human Disease (2 credits)

*Instructor:* Matthew Zimmerman ***Offered:*** Even Years

***Prerequisite:***CIP 806 or equivalent; See Instructor

Biochemical sources and regulation of reactive oxygen species and reactive nitrogen species, and their role in diseases such as diabetes, hypertension, cancer, and neurodegeneration.

***Spring Semester***

**CIP 920. Ion Channels and Disease (2 credits)**

*Instructor:* George Rozanski, Steve Sansom ***Offered:*** Odd Years

***Prerequisite****:* CIP 806 (or equivalent) and permission of instructor

Biophysical mechanisms underlying diseases linked to abnormalities of ion channel or transporter function.

## CIP 930. Physiology and Pathophysiology of the Kidney (2 credits)

*Instructor:* Pamela Carmines, Babu Padanilam ***Offered:*** Even Years

***Prerequisite****:* CIP 806 or equivalent; Permission of instructor

Integrative, cellular, and molecular mechanisms of renal function, with emphasis on the alterations accompanying renal disease.

***Multiple Semesters***

## CIP 814. Scientific Writing (2 credits) Fall, Spring

*Instructor:* Harold Schultz, Myron Toews ***Offered:*** Annually

*Cross Listed:* PHAR 814

***Prerequisites:***Permission of Instructor

This course develops the writing skills needed to prepare each section of a manuscript for submission to scientific journals, as well as figure design, use of reference software and responding to reviewer critiques. Students must have sufficient research data to support a preliminary manuscript, which will be constructed through completion of individualized assignments throughout the course.

## CIP 896. Research Other Than Thesis (1-9 credit[s]) Fall, Spring, Summer

*Instructor:* CIP Faculty ***Offered:*** Annually

Research rotations in one laboratory (Ph.D. students) or two laboratories (M.S. students) within the Department of Cellular & Integrative Physiology.

## CIP 902. Special Topics (1-4 credit[s]) Variable

*Instructor:* CIP Faculty ***Offered:*** Variable

Presented at intervals depending upon the interest of the faculty or the request of students. A course description with its prerequisites is announced at the time the course is offered.

## CIP 914. Molecular Basis of Hormone Action (2 credits) Variable

*Instructor:* Shyamal Roy ***Offered:*** Variable

***Prerequisite****:* CIP 806 (or equivalent; See Instructor).

Cellular and molecular mechanism(s) underlying the physiology and pathophysiology of hormone action.

**CIP 970. Seminar (1 credit) Fall, Spring**

*Instructor:* Lie Gao ***Offered:*** Annually

This course provides students with experience in presenting their own research in the form of abstract-based 10 min oral presentations, as well as critical analysis of recent publications in the biomedical sciences.

## CIP 899. Master’s Thesis (1-9 credit[s]) Fall, Spring, Summer

*Instructor:* CIP Faculty ***Offered:*** Annually

Independent student research directly related to the M.S. thesis.

## CIP 999. Doctoral Dissertation (1-9 credit[s]) Fall, Spring, Summer

*Instructor:* CIP Faculty ***Offered:*** Annually

Independent student research directly related to the Ph.D. dissertation. This course may be utilized before or after successful completion of the comprehensive exam.

Epidemiology

## Epidemiology Graduate Committee:

Dr. Lorena Baccaglini (Chair)

Dr. Debbi Barnes-Josiah

Dr. KM Monirul Islam

Dr. Lina Lander

Dr. Tricia LeVan

Dr. Pinaki Panigrahi

Dr. Phil Smith

Dr. Shinobu Watanabe-Galloway

Lisa Weissenburger-Moser

Dr. Amr Soliman (*ex officio*)

## Doctor of Philosophy degree

Students enrolled in the Ph.D. program in Epidemiology are required to complete a minimum of 48 credit hours in course and dissertation work in order to graduate. Coursework includes a required course in the Foundations of Public Health, an epidemiology core consisting of 4 methods courses and a doctoral seminar (15 credit hours), three courses in biostatistics (9 credit hours), a minimum of 3 concentration courses (9 credit hours) approved by the student’s supervisory committee, and dissertation research (minimum of 12 credit hours). These courses are designed to help students build a foundation of multi-disciplinary knowledge and skills and in-depth knowledge of one or more research content areas. A period of 3-4 years is typically required for a student to complete the degree.

At least 50% of the coursework for the doctoral degree must be completed at the University of Nebraska. No graduate credit will be accepted for transfer unless earned at an institution fully accredited to offer graduate work; nor should the student expect any graduate credit to be transferred unless the Graduate Committee evaluates the quality and suitability as equal to the offerings available at the University of Nebraska. A candidate must maintain a minimum cumulative grade point average of 3.0 for all graduate courses completed for the PhD. Failure to maintain a 3.0 GPA will result in suspension or termination from the PhD Program. Students must conform to all scholarship requirements specified in the University of Nebraska Medical Center Graduate Studies Bulletin. Students are expected to complete the courses listed below or an equivalent. These courses are subject to change and other courses can be substituted at the discretion of the supervisory committee.

**EPIDEMIOLOGY (EPI)**

*Fall Semester*

## EPI 811. Emergency Preparedness: Protection (3 credits)

*Instructor:* Dr. Medcalf ***Offered:*** Annually Online

***Prerequisites:***None

This course is designed to introduce the graduate student to emergency preparedness concepts, in preparation for naturally occurring disasters, intentional acts of terrorism, and new emerging infectious disease threats. Students will explore Critical Infrastructure protection, agriculture, and food safety, surveillance, and detection of biological agents among other topics.

**EPI 812. Chronic Disease Epidemiology (3 credits)**

*Instructor:* Dr. Watanabe-Galloway ***Offered:*** Annually

***Prerequisite****:* EPI 820 or EPI 821; BIOS 806 or 816

Recommended Coursework: BIOS 808 or 818

The target audience for this course includes, but is not limited to, students, researchers, and practitioners in the field of public health. The course will cover risk factors for major chronic diseases such as cancer, diabetes, musculoskeletal disease, and chronic lung disease. Through the course, students will learn advanced concepts and methodology in chronic disease epidemiology research, including disease surveillance and etiologic and outcomes research.

**EPI 820. Epidemiology in Public Health (3 credits)**

*Instructor:* Drs. Elliott, LeVan ***Offered:*** Annually In Class or Online

***Prerequisite****:* None

This course provides an opportunity for graduate and professional students and fellows to gain knowledge and skills in basic epidemiological concepts and applications. Major topics to be covered include sources of data, study designs, and analytical strategies, interpretation of findings and applications to inferring causality and controlling public health problems.

## EPI 821. Fundamentals of Epidemiology (3 credits)

*Instructor:* Dr. Lander ***Offered:*** Annually

***Prerequisite:***None

This course presents basic principles and methods of Epidemiology in greater depth and detail than presented in EPI 820. The purpose of the course is to further develop the methodological concepts underlying the science of epidemiology. The material covered includes elements of study design, data analysis, and causal inference in epidemiological research including specific emphasis on bias and confounding, and is expected to serve as a foundation for advanced study of epidemiological methods. The primary goal is to provide working knowledge of the fundamentals of epidemiology to graduate students who wish to further their career in public health research and needing more expertise in advanced epidemiological methods, with the objective of applying these concepts to a broader public health context.

**EPI 830. Advanced Infectious Diseases Epidemiology (3 credits)**

*Instructor:* Dr. Islam ***Offered:*** Annually

***Prerequisite****:* EPI 820 or 821; EPI 825; Instructor permission

This is an advanced course that presents in-depth infectious diseases epidemiology of major global infections including tuberculosis, malaria, STls, and HIV/AIDS. The purpose of the course is to introduce infectious disease research methodology in international settings and the use of mathematical models. This course will generate graduates from UNMC who will be better prepared to meet the challenges of global infectious diseases.

EPI 900. Epidemiologic Analysis of Binary and Time-to-Event Data (3 credits)

*Instructor:* EPI Faculty ***Offered:*** Annually

***Prerequisite****:* EPI 845; BIOS 810 or 818; Equivalent statistical programming experience

Analysis of data from common epidemiological study designs using logistic, proportional hazards, and Poisson regression models. Covers model building, estimation, assessment of confounding and modification and threats to validity.

*Spring Semester*

**EPI 820. Epidemiology in Public Health (3 credits)**

*Instructor:* Drs. Elliott, LeVan ***Offered:*** Annually Online Only

***Prerequisite****:* None

This course provides an opportunity for graduate and professional students and fellows to gain knowledge and skills in basic epidemiological concepts and applications. Major topics to be covered include sources of data, study designs, and analytical strategies, interpretation of findings and applications to inferring causality and controlling public health problems.

**EPI 825. Infectious Disease Epidemiology (3 credits)**

*Instructor:* Dr. Islam ***Offered:*** Annually In Class and Online

***Prerequisite****:* EPI 820 or 821; Instructor permission

This course covers methods of infectious diseases, surveillance, outbreak investigation, and the epidemiology of communicable diseases. The course also critically reviews published literature in this field.

EPI 835. Health Information and Surveillance for Public Health Practice (3 credits)

*Instructor:* Dr. Watanabe-Galloway ***Offered:*** Annually

***Prerequisite****:* Graduate level public health research methodology course such as BIOS 806 or 816, and EPI 820 or 821; Instructor permission

This course covers the role of health information and health information systems for the practice of national, state- and community-level public health.

EPI 840. Epidemiological Measurements & Research in Maternal Child Health (2 **credits)**

*Instructor:* Dr. Barnes-Josiah ***Offered:*** Annually

***Prerequisite****:* EPI 820 or 821; BIOS 806 or 816; HPRO 880

This course focuses on methodological tools for Maternal and Child Health (MCH) research and practice. It introduces key theoretical frameworks for understanding health problems, then addresses indicators and measurements of health and disease, types of studies needed or used in this field, then applies these to topical issues from fertility through quality of care.

**EPI 845. Principles of Epidemiological Research (4 credits)**

*Instructor:* Dr. Baccaglini ***Offered:*** Annually

***Prerequisite****:* EPI 821; BIOS 806 or 816;

Recommended: introductory course to SAS programming (BIOS 810)

This is a comprehensive course in the concepts, principles, and methods of epidemiologic research. The course is both theoretical and practical. Emphasis is placed on primary and secondary study designs, including observational studies, clinical trials, and meta-analyses. The course covers sources and measurement of random and systematic error. Students are introduced to complex sampling and implications for statistical analysis. Students will learn to perform SAS categorical analyses, logistic regression and survival analyses.

**EPI 905. Epidemiologic Research Development (3 credits)**

*Instructor:* EPI Faculty ***Offered:*** Annually

***Prerequisite****:* EPI 821; EPI 845; BIOS 806 or 816

This course provides students the opportunity to apply principles leaned in epidemiological methods and biostatistics courses to the design of epidemiological studies. Emphasis is placed on study design and implementation strategies, approaches to minimize bias and improve data quality, and on strategies for valid analysis and interpretation of epidemiological data. Study protocols will be developed in the context of preparation for submission to the NIH.

*Multiple Semesters*

**EPI 897. Service Learning for MPH Students (3 credits) Fall, Spring, Summer**

*Instructor:* EPI Faculty ***Offered:*** Annually

***Prerequisite****:* All core and concentration MPH requirements; Instructor Permission

The course is intended for MPH students only

This practicum course provides students with a community-based experience that result in firsthand, scholarly, supervised experience in a practice setting. This course constitutes one-half (3 semester hours) of the six semester hour service-learning/capstone culminating experience required of all Master of Public Health students.

**EPI 898. MPH Capstone Experience (3 credits)** **Fall, Spring, Summer**

*Instructor:* EPI Faculty ***Offered:*** Annually

***Prerequisite****:* All core and concentration MPH requirements; Instructor Permission

The course is intended for MPH students only

The purpose of this course is to implement a capstone project proposal that clearly demonstrates integrated and applied knowledge, principles, and skills acquired through classroom instruction. Projects must demonstrate the development, enhancement, and application of core public health competencies in the MPH program competency domains. This course fulfills three semester hours of the six credit-hour requirement for MPH Service- Learning/Capstone Experience. It also fulfills requirement of 150 contact hours generally spent working on the research and paper.

**EPI 970. Epidemiology Doctoral Seminar (1 credit)**  **Fall, Spring**

*Instructor:* Dr. Islam ***Offered:*** Annually

***Prerequisite****:* Standing as a doctoral student in epidemiology

This seminar is a series of scientific sessions on current topics exploring advanced concepts and methods in epidemiology. The course will promote the development of knowledge of epidemiologic methods, analytic approaches, disease etiology, natural history, and current issues related to the application of these concepts for conducting epidemiologic research and practice.

**EPI 999. Dissertation Research (1-15 credit[s]) Fall, Spring, Summer**

*Instructor:* EPI Faculty ***Offered:*** Annually

***Prerequisite****:* Instructor permission

The dissertation represents original and significant research on a defined epidemiological problem. This research is the culmination of a training process designed to ready the student to do independent research including development of a research question, data collection, analysis, and interpretation.

Environmental, Agricultural, and

Occupational Health

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **PhD degree** | | | | | |  |
| **Program** | **Due Date**  **(days relative to enrollment)** | | |  |  | **Due Date**  **(from enrollment)** |
|  | Supervisor Assignment | Committee Formation | Program of Study | Program Rep for approval | Secondary Approval (if applicable) | Comprehensive Exam |
| MSIA | Day 0 | Day 120 | Day 275 | Program Chair | Sub-plan Representative | Plan to follow recommendation pending formal approval by MSIA Grad Committee |
| CIP | Day 260 | Day 330 | Day 365 | Program Chair | N/A | Must complete by end of three calendar year |
| EHOHT | Day 0 | Day 180 | Day 240 | Program Chair | Supervisory Com. Chair | Completion of didactic courses |

Environmental Health, Occupational Health and Toxicology

**Graduate Committee:**

Dr. Todd Wyatt (Chair, Environmental Health)

Dr. Chandran Achutan (Occupational Health)

Dr. Alan Kolok (Environmental Health)

Dr. JoEllyn McMillan (Toxicology)

Dr. Pat Shea (Toxicology)

Dr. Terry Stentz (Occupational Health)

**Admission Requirements for the Ph.D. degree**

Students seeking admission must have a baccalaureate degree and should submit official Graduate Record Examination (GRE) scores as part of their application. They should be able to demonstrate a satisfactory background in science and math areas relevant to environmental health, occupational health, and toxicology, including basic chemistry, basic biology, and calculus. Applicants whose native language is not English must present a TOEFL score of 550 (paper-based), 213 (computer-based) or 80 (internet-based) is required. The application must include a statement of intent (up to five double-spaced pages) describing the applicant's interest in pursuing an advanced degree in environmental health, occupational health and toxicology. At least three letters of recommendation are required, including at least two from academicians.

**Required courses**

All students are required to successfully complete the required courses listed for their chosen educational track. Core required courses are HPRO 830, Foundations of Public Health; EPI 820, Epidemiology Theory and Practice; BIOS 806, Biostatistics I; BIOS 808, Biostatistics II; and ENV 970, Seminar. Additional specialized courses are required for each track. The three tracks offered are Environmental and Occupational Hygiene, Occupational Biomechanics, and Toxicology. All students must participate in Doctoral Program seminar series every semester.

**Program of Study - Ph.D. requirements**

Ph.D. degree in each of three tracks includes satisfactory completion of required and elective courses (31-47 hours), completion of grant proposal outside student’s area of dissertation research with oral defense, submission of at least one article from dissertation research for publication in peer-reviewed journal, and completion of dissertation with oral defense.

## ENVIRONMENTAL HEALTH, OCCUPATIONAL HEALTH, & TOXICOLOGY (ENV)

*Fall Semester*

## ENV 804. Ergonomics and Human Factors for Health Sciences (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisite****:* Graduate student in health science disciplines; Instructor permission.

This course is an introduction to fundamental concepts of physical work, human abilities and capabilities including psychological and cognitive aspects of human work performance (human factors) for the reduction of occupational injuries and illnesses, reduced costs, productivity improvement, worker well-being and longevity, quality of work life, and job satisfaction.

## ENV 810. Principles of Occupational and Environmental Health (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisite****:* ENV 892 Public Health: Environment and Society or equivalent introductory environmental health sciences course; Instructor permission.

This course is designed to allow students to develop an understanding of human health outcomes associated from environmental and occupational exposures.  Students will learn how key issues in environmental health and environmental and occupational medicine are approached from a public health perspective.

## ENV 816. Environmental Exposure Assessment (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisite****:* ENV 892 Public Health: Environment and Society or equivalent introductory environmental health sciences course; Instructor permission. BIOS 806 Biostatistics I or equivalent introductory biostatistics course; Instructor permission.

The course will allow students to develop their understanding and knowledge of exposure assessment methods and their application to substantive issues in occupational and environmental health.  The course emphasizes methodological principles and good practice, and highlights the many similarities and some interesting differences between occupational and environmental health*.*

## ENV 892. Public Health, Environment, and Society (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

The purpose of this course is to introduce the students to environmental factors including biological, physical, and chemical factors which affect the health of a community.  The main focus of the course will be the effects of exposures that have been associated with human health and environmental problems in the Midwest, specifically water and air pollutants related to animal feeding operations, arsenic in ground water, pesticides, herbicides, lead and radiation.  The effects of global warming, ergonomic problems in the meat packing industry, and occupational and environmental problems in health care will also be discussed.

## ENV 950. Advanced Toxicology (3 credits)

*Instructor:* To Be Announced ***Offered:*** Odd Years

***Cross Listed:*** PHSC 950

***Prerequisite:*** ENV 888 Principles of Toxicity; Instructor permissionor equivalent.

This course deals with the adverse effects of chemicals on biological systems. Physiological and biochemical mechanisms of toxicity at the cellular and subcellular levels will be emphasized.

*Spring Semester*

## ENV 800. Elements of Industrial Safety for Health Sciences (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisite****:* ENV 892 Public Health, Environment and Society or equivalent introductory environmental health sciences course; Instructor permission

This course is an introduction to safety in the general work environment with emphasis on selected OSHA safety regulations, human costs of injuries, safety programs and management, field trip work observations, risk assessment, hazard/risk communications.  No previous experience or coursework in safety is required.

## ENV 840. Climate Change, Sustainability, and Public Health (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

This course surveys the dynamic public health features of global environmental and climate change expected during the 21st century.  This interdisciplinary course covers key public health impacts related to health sciences, policy, economics, and energy production, environmental footprint, climate dynamics, and global regional health effects, migration, agriculture, built environment, etc.  Strategies will be considered and evaluated for sustaining a high level of public health in the long term.

**ENV 875. Chemical Carcinogenesis (2 credits)**

*Instructor:* To Be Announced ***Offered:*** Even Years

***Cross Listed:*** PHSC 875

***Prerequisite:*** Biochemistry or Instructor permission

This course will present the basic concepts of chemical carcinogenesis, and introduce the major carcinogens, their biochemistry of activation and mode of action.

## ENV 888. Principles of Toxicology (3 credits)

*Instructor:* To Be Announced ***Offered:*** Variable

This course will introduce students to the principles and methods that are used to determine whether an adverse effect is a result of exposure to a specific agent.  A primary purpose of toxicology is to predict human toxicity and human health risk assessment relies heavily on toxicological data obtained from animal studies.  This course covers basic mechanisms of toxicity as they pertain to whole organisms, organ systems, and specific toxic agents.

*Multiple Semesters*

**ENV 850. Occupational Biomechanics (3 credits) Variable**

*Instructor:* To Be Announced ***Offered:*** Variable

Occupational Biomechanics is designed to prepare the graduate student, professional student, or fellow to recognize occupational health and safety through learning the biomechanical principals to common work tasks.

## ENV 896. Research other Than Thesis (1-4 credit[s]) Fall, Spring, Summer

*Instructor:* ENV Faculty ***Offered:*** Variable

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

## ENV 902. Special Topics (2-3 credit[s]) Fall, Spring, Summer

*Instructor:* ENV Faculty ***Offered:*** Variable

Independent study course focusing on selected topics or problems.  The subject will be dependent on student demand and availability of staff.

**ENV 970. Seminar (1 credit) Fall, Spring**

**ENV 899. Master’s Thesis (1-9 credit[s]) Fall, Spring, Summer**

**ENV 999. Doctoral Dissertation (1-9 credit[s]) Fall, Spring, Summer**

Genetics, Cell Biology and Anatomy

## Graduate Committee

Dr. Karen Gould (Chair)

Dr. Vimla Band

Dr. Andy Dudley

Dr. Shantaram Joshi

Dr. Runqing Lu;

Dr. San Ming Wang

**Objective**

The graduate program in the Department of Genetics, Cell Biology, and Anatomy is designed for qualified students who wish to pursue research and teaching careers in the broadly defined area of molecular genetics, cell biology and related areas, and/or to obtain a firm foundation for teaching anatomical sciences. Genetics, Cell Biology and Anatomy participates in the integrated Biomedical Research Training Program (BRTP). The program leads to a Ph.D. degree.

**Requirements for admission**

To be eligible for graduate admission in the Department of Genetics, Cell Biology and Anatomy a student must meet the requirements of the Graduate College and must present an academic record and background which is acceptable to the Graduate Committee of the department. Students are selected for admission on the basis of various factors, including composite science and math grade point average in addition to overall undergraduate grade point average, Graduate Record Examination scores, and research experience. The Graduate Record Examination is required of all applicants. Foreign applicants must submit TOEFL scores. Although we would like all applicants to take the new GRE including writing skills, we will consider applicants who have taken the old format GRE not more than two years from date of application.

**Lab rotations and mentor selection**

Students may be admitted directly to a lab or perform laboratory rotations to identify a mentor. Rotating students will be expected to complete rotations in three different faculty laboratories during their first year, spending a period of up to two months in each of these laboratories. A list of laboratories accepting student rotations will be made available to each student, and rotation selections from this list will be made by the students in conjunction with the graduate committee chair. Following these rotations, the students will select their faculty advisor and laboratory for their dissertation research project.

**Core course requirements**

Research Track Ph.D. students in Genetics, Cell Biology and Anatomy must complete a compulsory core curriculum composed of the following courses: Molecular Cell Biology ([BRTP 822](http://webmedia.unmc.edu/brtp/pdf/823Sched2005.pdf)), Genetics and Gene Regulation ([BRTP](http://webmedia.unmc.edu/brtp/pdf/822Sched_F04.pdf) 823), Presentation and Scientific Writing Skills (GCBA 806), either Human Microanatomy (GCBA 826) or Modern Approaches in Cell Biology and Molecular Genetics (GCBA 912) and one other graduate course. Students on the Anatomy PhD teaching track program will complete Molecular Cell Biology ([BRTP 822](http://webmedia.unmc.edu/brtp/pdf/823Sched2005.pdf)), Genetics and Gene Regulation ([BRTP](http://webmedia.unmc.edu/brtp/pdf/822Sched_F04.pdf) 823), Presentation and Scientific Writing Skills (GCBA 806), Human Microanatomy (GCBA 826), Human Neuroanatomy (GCBA812) and Gross Anatomy (GCBA 910/920). All Course descriptions can be found in the [Graduate Studies Bulletin](http://www.unmc.edu/gradstudies/).

All Ph.D. seeking students must register each semester for the Genetics, Cell Biology and Anatomy Seminar (GCBA 970) and Journal club (GCBA 902A).

Any additional course requirements will be defined on an individual basis by the student’s Supervisory Committee.

**Other requirements**

A comprehensive examination is required for admission to candidacy. This exam is to be completed by December 21st following the end of the fall semester of the student’s 3rd year of graduate school. Typically, the topic of the exam/proposal is the proposed thesis topic/research area of the student. However, with the approval of the mentor, a student’s supervisory committee may consider a different topic at the request of the student or mentor. The format of the written part of the exam is a grant proposal in the form of an NIH R01 application. The examination will include a written document, an open oral presentation, and closed oral defense.

Students must present their research in a department seminar. Typically this will occur during the student’s 3rd or 4th year in the program.

A dissertation based on original research in the candidate’s chosen field of study is required. The candidate must successfully defend his/her dissertation in an oral examination. The candidate must have a first author research paper (not review) published or accepted for publication prior to scheduling the dissertation defense.

## GENETICS, CELL BIOLOGY AND ANATOMY (GCBA)

*Fall Semester*

## GCBA 815. Introductory Workshop on Bioinformatics (1 credit)

*Instructor:* Dr. Guda ***Offered:*** Annually

The main objective of this course series is to provide an overview of the most commonly used data analysis tools for various bioinformatics-related tasks. Major topics include using BLAST tools for database searching, pair- wise and multiple sequence alignment, and microarray data analysis. Upon successful completion, students are expected to be able to apply the methods and tools to their research.

## GCBA 845. Clinically Oriented Human Anatomy (1-3 credit[s])

*Instructor:* Dr. Leuschen ***Offered:*** Annually

This is the first semester of a two semester clinically oriented human anatomy course. The content of the two courses includes human anatomy presented in a systems approach that utilizes a wide variety of imaging modalities and clinical correlations to understand gross anatomy with cell biology, histology, embryology and neuroanatomy followed by a review applying the information to anatomic regions of the human body. The sequence of the units has been adapted to correlate with RSTE Human Physiology 352 and 353 courses.

## GCBA 881. Fundamentals of Cancer Research (2 credits)

*Instructor:* Dr. Gould ***Offered:*** Variable

***Prerequisites:*** Permission of instructor*.*

This course includes an eight lecture introduction to basic concepts in cancer research. The introduction is followed by a six week independent study focusing on an instructor-approved topic in cancer biology.

## GCBA 910. Human Gross Anatomy I (5 credits)

*Instructor:* Dr. Lomneth ***Offered:*** Annually

***Prerequisites:*** Permission of instructor*.*

A study of the human body (upper limb, head, neck, and thorax) by means of gross dissection, cross section, lecture, demonstration, radiographs and scans. Readings in and oral reports from anatomic literature introduce students to research topics.

## GCBA 918 Developmental Biology I (3 credits)

*Instructor:* Dr. Turpen ***Offered:*** Variable

***Prerequisites:*** Permission of instructor*.*

An examination of the major areas of development, using current literature addressing well defined topics. The first semester covers oogenesis, fertilization, cleavage, establishment of the body axis, gastrulation, neurulation, and morphogenesis.

## GCBA 920 Human Gross Anatomy II (3 credits)

*Instructor:* Dr. Lomneth ***Offered:*** Annually

***Prerequisites:*** GBCA 910 Human Gross Anatomy I and Permission of instructor*.*

Course is a continuation of GBCA 910 covering the abdomen, pelvis, and lower limb*.*

## GCBA 922 Neurobiology I (3 credits)

*Instructor:* Dr. Rodriguez-Sierra ***Offered:*** Variable

***Prerequisites:*** Permission of instructor*.*

The course consists of presentation of current literature addressing the classical topics of neuroembryology, neurohistology, neuroanatomy, neurophysiology, neuropharmacology, and neuropathology.

## GCBA 940. Teaching Practicum: Human Gross Anatomy I (1-2 credit[s])

*Instructor:* Dr. Lomneth ***Offered:*** Annually

***Prerequisites:*** Appropriate GCBA course(s) and GCBA 806; Instructor permission

Anatomy Teaching Practicums are a series of courses designed to provide an opportunity for students to develop and apply skills requisite for effective teaching in the anatomical sciences.

## GCBA 949. Teaching Practicum: Human Histology I (2 credits)

*Instructor:* Dr. Joshi ***Offered:*** Annually

***Prerequisites:*** Appropriate GCBA course(s) and GCBA 806; Instructor permission

Anatomy Teaching Practicums are a series of courses designed to provide an opportunity for students to develop and apply skills requisite for effective teaching in the anatomical sciences.

*Spring Semester*

## GCBA 806. Presentation and Scientific Writing Skills (2 credits)

*Instructor:* Dr. Joshi ***Offered:*** Annually

An introduction to fundamental concepts in developing effective presentation and scientific writing skills.

## GCBA 812. Human Neuroanatomy (2 credits)

*Instructor:* Dr. Binhammer ***Offered:*** Annually

***Prerequisites:*** Instructor permission

A study of the neuronal organization of the nervous system and the way interneuronal relationships explain the function of the sensory and motor systems. Medical aspects of the structure and function are demonstrated from clinical case material.

## GCBA 823. Fundamentals in Genetics (2 credits)

*Instructor:* Dr. Gould ***Offered:*** Variable

***Prerequisites:*** Instructor permission

This course includes a ten lecture introduction to basic concepts in genetics as well as the current tools and technologies used in molecular genetics research. The introduction is followed by a six week independent study focusing on an instructor-approved topic in genetics.

## GCBA 830. Fundamentals of Electron Microscopy (2 credits)

*Instructor:* Dr. Todd ***Offered:*** Variable

***Prerequisites:*** Instructor permission; GCBA 826

Instruction in the general theory and techniques of electron microscopy, including special methods involved in the fixation, embedding, sectioning, and staining of specimens.

## GCBA 846. Clinically Oriented Human Anatomy II (2 credits)

*Instructor:* Dr. Leuschen ***Offered:*** Annually

***Prerequisites:*** Instructor permission; GCBA 826

This is the second semester of a two semester clinically oriented human anatomy course. The content of the two courses includes human anatomy presented in a systems approach that utilizes a wide variety of imaging modalities and clinical correlations to understand gross anatomy with cell biology, histology, embryology, and neuroanatomy followed by a review applying the information to anatomic regions of the human body. The sequence of the units has been adapted to correlate with RSRE Human Physiology 352 and 353 courses.

**GCBA 912. Modern Approaches in Cell Biology and Molecular Genetics (3 credits)**

*Instructor:* Drs. Gould, Lu ***Offered:*** Annually

***Prerequisites:*** Instructor permission

This advanced-level course will focus on current techniques and concepts in cell biology and genetics. This course includes a didactic component as well as discussion section where the students will be asked to present their interpretations and ideas on cutting edge research. Hands on workshops and demonstrations are also conducted weekly.

## GCBA 915. Advanced Workshop on Bioinformatics (1 credit)

*Instructor:* Dr. Guda ***Offered:*** Annually

***Prerequisites:*** GCBA 815 Introductory Workshop on Bioinformatics

The main objective of this course series is to provide an overview of specialized data analysis tools for various bioinformatics-related tasks. Major topics include genome analysis and assembly and biological network analysis. Upon completion, students are expected to be able to apply the methods and tools to their research.

## GCBA 924. Selected Problems in Electron Microscopy (1-2 credit[s])

*Instructor:* Dr. Todd ***Offered:*** Variable

***Prerequisites:*** GCBA 830 Fundamentals of Electron Microscopy; Instructor permission.

Problems will be selected involving the ultrastructure of cells, inter-relationships between cells and the characteristics of intercellular substances. Emphasis will be on operation and use of the electron microscope.

## GCBA 928. Developmental Biology II (3 credits)

*Instructor:* Dr. Turpen ***Offered:*** Variable

***Prerequisites:*** GCBA 918 Developmental Biology I.

A continuation of 918 with an emphasis on the molecular basis for the determination of cell fate and the generation of cell diversity.

## GCBA 932. Neurobiology II (3 credits)

*Instructor:* Dr. Rodriguez-Sierra ***Offered:*** Variable

***Prerequisites:*** GCBA 922 Neurobiology I and Instructor Permission

A continuation of selected topics from 922 with an emphasis on the molecular biology of the neuron and the function of the central nervous system. Current topics will vary every year.

## GCBA 942. Teaching Practicum: Human Neuroanatomy II (1 credit)

*Instructor:* Dr. Binhammer ***Offered:*** Annually

***Prerequisites:*** Appropriate GCBA course(s) and GCBA 806; Instructor permission

Anatomy Teaching Practicums are a series of courses designed to provide an opportunity for students to develop and apply skills requisite for effective teaching in the anatomical sciences.

## GCBA 945. Stem Cell Biology (1 credit)

*Instructor:* Dr. Turpen ***Offered:*** Variable

This course is designed for an in depth study of the basic science in stem cell biology as well as clinical applications of stem cells. Special emphasis will be on embryonic stem cells, adult stem cells, and stem cell plasticity.

## GCBA 949. Teaching Practicum: Human Histology I (2 credits)

*Instructor:* Dr. Joshi ***Offered:*** Annually

***Prerequisites:*** Appropriate GCBA course(s) and GCBA 806; Instructor permission

Anatomy Teaching Practicums are a series of courses designed to provide an opportunity for students to develop and apply skills requisite for effective teaching in the anatomical sciences.

*Summer Semester*

## GCBA 826. Human Microanatomy (3 credits)

*Instructor:* Dr. Joshi ***Offered:*** Annually

***Prerequisites:*** Instructor permission

A study of cells, fundamental tissues, and organ systems at both light and ultramicroscopic level.

*Multiple Semesters*

## GCBA 896. Research Other Than Thesis (1-6 credit[s]) Fall, Spring, Summer

*Instructor:* Dr. Gould ***Offered:*** Annually

## GCBA 899. Master’s Thesis (1-6 credit[s]) Fall, Spring, Summer

*Instructor:* Dr. Gould ***Offered:*** Annually

## GCBA 902. Special Topics in Anatomy (1-2 credit[s]) Fall, Spring

*Instructor:* Dr. Joshi ***Offered:*** Annually

***Prerequisites:*** Instructor permission; Maximum 8 students

Current problems, techniques, and literature pertaining to the major subdivisions of the field of anatomy. The student may participate in selected research topics, under the supervision of a selected instructor.

## GCBA 970. Seminar (1 credit) Fall, Spring

*Instructor:* Dr. Gould ***Offered:*** Annually

## GCBA 999. Doctoral Dissertation (1-6 Credit[s]) Fall, Spring, Summer

*Instructor:* Dr. Gould ***Offered:*** Annually

Health Promotion, Social, and Behavioral Health

## Graduate Committee

Dr. Mohammad Siahpush (Chair)

Dr. Denise Britigan

Dr. Terry Huang

Dr. Christopher Fisher

Dr. Asia Sikora

Dr. MelissaTibbits

Teresa Smith (Student Rep)

## Admission Requirements for the Ph.D. degree

Any applicant desiring admission into the Ph.D. in Health Promotion and Disease Prevention Research at UNMC must submit a fully completed application. Below is a complete list of all documents required for application. It is the applicant’s responsibility to request an official copy of the academic record be sent to the graduate office from each college or university that the applicant has attended.

A minimum cumulative grade-point average of 3.00/4.00 on all graduate course work attempted at a regionally accredited institution of higher education is required for admission. Masters or other advanced degrees are required for admission, although exceptional students with Bachelor’s degree will be considered. (Most successful applicants will have verbal and quantitative GRE scores at or above the 60th percentile.)

The official results from the GRE must be submitted to the graduate office. The GRE must have been taken no more than five years prior to the application date. All international applicants whose native language is not English and who do not have a MS from an accredited institution are required to submit a TOEFL of 550 (paper), 213 (Computer), or 80 (Internet). The TOEFL must have been taken no more than two years prior to the application date.

Each applicant must submit a written statement of career goals. This writing sample of 750-1000 words will be used to assess writing competence as well as career objectives.

Three letters of recommendation are required for admission. At least one of these letters must be a letter from a faculty member in the applicant’s previous program who can attest to the applicant’s ability to pursue successfully a PhD program. The remaining two letters may be academic or professional references.

## Complete list of documents and scores required of applicants:

* Fully completed application form
* Official copy of academic record- sent to the graduate office- minimum of 3.00 on a 4.00 scale GPA for all graduate course work
* Masters or other advanced degrees, although exceptional students with Bachelor’s degree will be considered.
* GRE results from test taken no more than five years prior to the application date. Most successful applicants will have verbal and quantitative GRE scores at or above the 60th percentile.
* International students: TOEFL of 550 (paper), 213 (computer), or 80 (internet)
* Written statement of career goals, 750-1000 words
* Three letters of recommendation; at least one from a faculty member in the applicant’s previous program. Remaining two letters- academic and/or professional

## Course requirements for the Ph.D. Degree

Students in the Health Promotion and Disease Prevention Research are required to complete all of the following courses. Successful completion of all the following courses is required prior to starting the dissertation.

## Health Promotion (18 credit hours)

* Health Behavior: 3 hours
* Interventions in Health Promotion: 3 hours
* Advanced Theories in Public Health: 3 hours
* Health Promotion Program Planning: 3 hours
* Complex Systems Thinking: 3 hours
* Foundations of Public Health: 3 hours

## Research (25 credit hours)

* Biostatistics I: 3 hours
* Biostatistics II: 3 hours
* Introduction to SAS Programming: 3 hours
* Fundamentals of Epidemiology: 3 hours
* Principles of Epidemiologic Research: 4 hours
* Applied Research in Public Health: 3 hours
* Humanistic Traditions in Qualitative Research: 3 hours
* Public Health Program Evaluation: 3 hours

## Writing (4 credit hours)

* Scientific Writing or Critical Writing or Publication Writing: 2 hours
* Grant Proposal Writing: 2 hours

## Ethics (3 credit hours)

All students completing the Ph.D. program will have successfully completed 3 credit hours in ethics.

## Directed Research (6 credit hours)

All students completing the PhD program will have successfully completed at least 6 credit hours (i.e., two courses at 3 credit hours each, three courses at 2 credit hours each) of directed research. The intent of the directed research course is to allow students to acquire new research skills, expand their exposure to new research, and increase publication opportunities. Each course involves hands-on research working closely with a faculty member and developing a publishable scholarly product (e.g., something that can be documented on a CV such as manuscript for peer-reviewed publication, national conference presentation, book chapter, policy brief, community report, technical report, or program manual). Under the supervision of the course instructor, the student is expected to develop and submit to the Graduate Program Director of HPSBH a course outline, timeline (including timeline for production of a scholarly product which may occur outside of the semester in which the credits are taken) and expected outcome(s) for each directed research course before the start of the semester on the Directed Research Course Agreement form. The instructor of the directed research course(s) does not have to be the student’s advisor.

## Elective Courses (26 credit hours)

All students completing the Ph.D. program will have successfully completed 26 credit hours of elective courses. Electives, which are selected by the doctoral student in concert with his/her Supervisory Committee, are used to strengthen and solidify the Program of Study.

## Dissertation Hours (8 credit hours)

After successfully completing the comprehensive exam, the student must register for 9 hours of dissertation research. Students must register for at least one credit hour of dissertation for each semester and summer session until the completion of the degree.

## HEALTH PROMOTION, SOCIAL, AND BEHAVIORAL HEALTH (HPRO)

*Fall Semester*

## HPRO 805. Applied Research in Public Health (3 credits)

*Instructor:* Dr. Sikora ***Offered:*** Annually Online

***Prerequisites:*** None

The purpose of this course is to provide an introduction to research methods in public health.  Students will learn about the steps of scientific research.  The  course will cover the following topics: formulation of research problem, purpose, objectives, and hypotheses;  the process of literature review; conceptual frameworks; ethical issues in research; sampling;  instrumentation; experimental, non-experimental, and qualitative designs; data analysis; and dissemination of research findings.  These topics will be discussed in detail in the context of critically reviewing several peer-reviewed scientific articles.

## HPRO 807. Introduction to Community-Based Participatory Research (3 credits)

*Instructor:* Dr. Fisher ***Offered:*** Annually

***Prerequisites:*** HPRO 805 (HED 8050) or equivalent course. Instructor permission will require demonstrable knowledge of research methods.

This course is designed to prepare the student to utilize Community-Based Participatory Research (CBPR) principles in research, evaluation, and practice.  A philosophical and practical approach will guide the examination of CBPR and its use. The course assumes students will come already grounded in multiple research methods, both qualitative and quantitative.

## HPRO 809. Introduction to Health Disparities and Health Equity (3 credits)

*Instructor:* Dr. Rajaram ***Offered:*** Annually

***Prerequisites:*** Instructor permission.

The course provides a critical understanding of health disparities in the U.S. and examines the underlying social, cultural, biological, behavioral, economic, and political factors that contribute to such disparities in society.

## HPRO 810. Emergency Preparedness: Prevention (3 credits)

*Instructor:* Dr. Medcalf ***Offered:*** Annually

This course is designed to introduce the graduate student to emergency preparedness concepts such as the Incident Command System, The National Response Framework, agencies, infrastructures, and assets in place to plan for, and respond to emergencies.

## HPRO 817. Community Oriented Primary Care (COPC): Principles & Practice (3 credits)

*Instructor:* Dr. Gofin ***Offered:*** Annually

This course covers the principals and methods needed to plan the application of community orientation of health services by integrating clinical care and public health through the community orientated Primary Care (COPC) approach.

## HPRO 827. Interventions in Health Education (3 credits)

*Instructor:* Dr. Britigan ***Offered:*** Annually

***Prerequisites:*** Instructor permission.

This course will provide health education candidates with an opportunity to investigate, contrast, develop, implement, and evaluate a variety of intervention activities, to be applied in different settings.  Theories regarding methods to enhance behavior change and teaching strategies to meet the health needs of a diverse population will be explored.

## HPRO 842. Applied Social Marketing (3 credits)

*Instructor:* Dr. Pounds ***Offered:*** Annually

***Prerequisites:*** CPH 501 and CPH 541

This course will explore the application of social marketing at the population, community, business, and government levels.  Students will examine the concepts of social marketing from perspectives of collaboration and co-creation, value and service driven design, and an ethical framework of dignity and honor.  Working with public health entities, students will develop a social marketing campaign for a specific public health issue*.*

## HPRO 875. Health Education: Instrumentation and Evaluation (3 credits)

*Instructor:* Dr. Tibbits ***Offered:*** Annually

***Prerequisites:*** CPH 501 and CPH 541

This course will build skills for selection, development, and analysis of various types of instruments and techniques for conducting process, impact, and outcome evaluations in health education and health promotion.  Evaluation of health behavior change and its antecedents, changes in community services programs, and community health status will be discussed.  Candidates will learn methods for developing choosing psychometric tools, choosing appropriate evaluation designs, procedures for data collection, and describing evaluation results.  Emphasis will be placed on political statistical and theoretical aspects of instrumentation and evaluation practices.

## HPRO 880. Introduction to Maternal and Child Health (MCH) (3 credits)

*Instructor:* Dr. Gofin ***Offered:*** Annually

***Prerequisites:*** EPI 820 (CPH 504), HPRO 860 (CPH 501).

This course will introduce the life course approach in Maternal and Child Health (MCH), and address specific MCH topics (i.e. immunizations, nutrition, pre-term births) from the local, regional, and global perspectives, and organization and policy issues in MCH care in the U.S.

## HPRO 902. Complex Systems Thinking (3 credits)

*Instructor:* Dr. Araz ***Offered:*** Annually

***Prerequisites:*** Instructor permission.

This course covers the major topics of systems thinking, including key terminology, general systems theory, systems analysis, systems mapping and dynamics, structural thinking, systems design, and modeling, and finally applications of simulation models for policy decision making.

*Spring Semester*

## HPRO 805. Applied Research in Public Health (3 credits)

*Instructor:* Dr. Siahpush ***Offered:*** Annually Online

***Prerequisites:*** None

The purpose of this course is to provide an introduction to research methods in public health.  Students will learn about the steps of scientific research.  The  course will cover the following topics: formulation of research problem, purpose, objectives, and hypotheses;  the process of literature review; conceptual frameworks; ethical issues in research; sampling;  instrumentation; experimental, non-experimental, and qualitative designs; data analysis; and dissemination of research findings.  These topics will be discussed in detail in the context of critically reviewing several peer-reviewed scientific articles.

## HPRO 812. Emergency Preparedness: Response (3 credits)

*Instructor:* Dr. Medcalf ***Offered:*** Annually

The course is designed to introduce the graduate student disaster response related concepts such as Responder Safety and Health, Citizen Evacuation, Weapons of Mass Destruction, and Medical Surge among other topics.

## HPRO 813. Emergency Preparedness: Respond and Recover (3 credits)

*Instructor:* Dr. Mecalf ***Offered:*** Annually

***Prerequisites:*** Instructor permission.

This course is designed to introduce the graduate student to emergency preparedness concepts.  Students will explore disaster response related concepts such as Medical Surge, Behavioral Health, and Mass Fatalities, in addition to short and long term disaster recovery.

## HPRO 818. Opportunities and Challenges in the Applicability of Community Oriented Primary Care (COPC) (3 credits)

*Instructor:* Dr. Gofin ***Offered:*** Annually

***Prerequisites:*** CPH 551 (HPRO 817), Instructor Permission.

The course is designed to prepare public health students on the critical analysis of the organization (levels of care, public/private partnership, insurance, coverage, access) and functions (curative/preventive, general practice, family medicine, specialties) of primary care services to be able to identify the opportunities and the challenges in the applicability of Community Oriented Primary Care (COPC).

## HPRO 840. Health Promotion Program Planning (3 credits)

*Instructor:* Dr. Rajaram ***Offered:*** Annually

An in-depth application of the health promotion program planning process utilizing a comprehensive model called PRECEDE-PROCEED.  Students submit six papers applying each phase of this model: 164 social diagnosis, epidemiological diagnosis, behavioral/ environmental diagnosis, educational/organizational diagnosis, administrative/policy diagnosis, and evaluation at the process, impact and outcome levels.

## HPRO 841. Introduction to Social Marketing and Health Communication (3 credits)

*Instructor:* Dr. Pounds ***Offered:*** Annually

This course provides an introduction to the basic concepts of social marketing and health communication principles including the application to health behaviors and public health issues.

## HPRO 843. Advanced Health Communication (3 credits)

*Instructor:* Dr. Britigan ***Offered:*** Annually

***Prerequisites:*** HPRO 860 (CPH 501), HPRO 842 (CPH 542)

This course is an in-depth study of health communication.  Students will build competencies in health communication (from theory and practice) to promote individual and community health and well-being.

## HPRO 869. Sexual Health: Ontology, Research, and Education (3 credits)

*Instructor:* Dr. Fisher ***Offered:*** Every Two Years

***Prerequisites:*** HPRO 830 or Instructor permission

This course is designed to prepare the graduate student to address sexual health issues in a culturally relevant manner through sound research and education practices.  A social ecological approach will guide the examination of the topic.

## HPRO 881. Advanced Maternal and Child Health (MCH) (3 credits)

*Instructor:* Dr. Gofin ***Offered:*** Annually

***Prerequisites:*** Graduate standing.

Critical analysis of current and emerging priority areas in Mother and Child Health (MCH), including biological, behavioral, and health care issues, based on defining the problem, identifying gaps in population health or health care and discussing alternative approaches towards gap reduction.

## HPRO 882. Child and Adolescent Growth and Development (2 credits)

*Instructor:* Dr. Tibbits ***Offered:*** Annually

***Prerequisites:*** HPRO 880 (CPH 546)

This course is designed to introduce students to study and assessment of child and adolescent growth and development from a public health perspective.  Physical, neurological, psychological, and social development will be discussed*.*

**HPRO 883. Women’s Health (2 credits)**

*Instructor:* Dr. Anthony ***Offered:*** Annually

***Prerequisites:*** HPRO 880 (CPH 546)

This course provides students with an overview of women’s health issues across the lifespan from a multidisciplinary perspective.

## HPRO 895. Public Health Leadership and Advocacy (3 credits)

*Instructor:* Dr. Britigan ***Offered:*** Annually

This course incorporates public health leadership theory and practices that are grounded in biomedical and social science and sanctioned by public law.  Also included is the politics of communities and organizations.  Advocacy is emphasized as a key tool to secure funding and to help assure that local, state, and federal policy-makers will adopt, implement, and maintain important public health regulations, policies and programs.

## HPRO 910. Humanistic Traditions of Qualitative Research (3 credits)

*Instructor:* Dr. Fisher ***Offered:*** Annually

***Prerequisites:*** HRPO 805 Applied Research in Public Health or equivalent.

The course provides a framework for a diverse group of qualitative research methods that emphasize approaches to inquiry drawn from the humanities, arts, and social sciences.  The course focuses on the philosophical grounding of such inquiry, study designs, methodological implementation, analysis of findings, and construction of concluding arguments.

*Summer Semester*

## HPRO 808. Public Health Law (3 credits)

*Instructor:* Dr. Anderson ***Offered:*** Annually

Conceptual foundations of public health law, including constitutional considerations, federal and state statutes and regulations, tort (civil) law, balancing competing interests (e.g. civil liberties v. monitoring, reporting, persuading, regulating at various levels), current issues, emerging trends.

**HPRO 935. Research Ethics (3 credits)**

*Instructor:* Dr. Jameton ***Offered:*** Annually

The course is intended for graduate students and health professionals who will be actively involved in design, analysis, and interpretation of biomedical research or public health studies involving human subjects.  There are no pre-requisites for this course, although some experience with research design or practice (or a course in research design or practice) is preferred.

*Multiple Semesters*

## HPRO 830. Foundations of Public Health (3 credits) Fall, Spring, Summer

*Instructor:* Drs. Gibbs, McCaskill ***Offered:*** Annually

***Prerequisites:*** HRPO 805 Applied Research in Public Health or equivalent

This is an introductory survey course, which will ensure that all MPH students, within their first full year of study, are exposed to the fundamental concepts and theories which provide the basis for the body of knowledge in the field of public health.  This course will prepare students to work in public health with a sound theoretical, conceptual, and historical basis for their work.

## HPRO 860. Health Behavior (3 credits) Fall, Spring, Summer

*Instructor:* Drs. Huang, Rajaram ***Offered:*** Annually

The purpose of this course is to study the theoretical foundations of health behavior.  Candidates will develop an understanding of the determinants of health behavior, the models, and theories that provide a framework for predicting health behavior, and the strategies employed to bring about behavioral changes for health and disease prevention in individuals and groups.

## HPRO 896. Research Other than Thesis (Variable credits) Fall, Spring, Summer

*Instructor:* HPRO Faculty ***Offered:*** Annually

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

## HPRO 998. Special Topics (Variable credits) Fall, Spring, Summer

*Instructor:* Drs. Sikora, Huang, Araz ***Offered:*** Variable

Independent study course focusing on selected topics or problems.  The subject will be dependent on student demand and availability of staff.

## HPRO 999. Doctoral Dissertation (Variable credits) Fall, Spring, Summer

*Instructor:* HPRO Faculty ***Offered:*** Variable

Health Services Research, Administration, & Policy

## Graduate Committee:

Dr. Jim Stimpson (Chair)

Dr. Ge Lin

Dr. Li-Wu Chen

Dr. Preethy Nayar

Dr. Alice Schumaker

**Admission Requirements for the Ph.D. degree**

Requirements for admission to the PhD program are listed below.

* Apply online to UNMC Graduate Studies. Please ensure that you select the Health Services Research, Administration, and Policy program to avoid delaying your application process.﻿
* Request that official transcripts from all graduate and undergraduate programs attended be sent to the Graduate Office
* Submit official Graduate Record Examination (GRE) scores taken within the past five years. Many factors are considered in evaluating an individual's application, but many successful applicants will have scores above the 40th percentile.
* Submit a resume or curriculum vitae
* Submit three letters of recommendation from academic and professional references
  + At least one letter should be from a faculty member in your previous academic program
  + It is strongly encouraged that one of the letters be from an individual who knows you in a professional setting
* Submit a statement of intent no longer than 1,000 words that describes your
  + Interest in and potential for contributing to the field of health services research, administration, and policy
  + Self-assessment of your fit into the PhD program
  + Self-assessment of your qualifications, experiences, and general preparation for succeeding in the PhD program
* International Applicants:
  + The Test of English as a Foreign Language (TOEFL) score is required for international students and students who have earned their undergraduate degree from a non-English speaking institution. Minimum scores required are 550 on the paper-based TOEFL, 213 on the computer-based TOEFL, and 80 for the Internet-based TOEFL. International students who have earned a graduate degree from a U.S. institution are not required to submit a TOEFL score. Further details about applications instructions for international applicants can be found on the UNMC Graduate Studies website.﻿
  + Official transcripts or mark sheets of college-level work not in English or in the standard U.S. grading scale must be sent to a foreign educational credential evaluation service for evaluation prior to submission to UNMC. The transcript evaluation must be a course-by-course evaluation that identifies and describes each diploma or certificate with periods of education and equivalency of each document. The preferred credential evaluation services are World Education Services (WES) and Educational Credential Evaluators, Inc. (ECE). Other services approved by the National Association of Credential Evaluation Services (NACES) will also be accepted. Transcripts must carry the signature of a responsible official at the academic institution where the work was done and the seal of that institution, or must be certified true copies of the original records. If photocopies are provided, the copies must be certified after duplication as true copies of the original document. Transcripts should clearly indicate the grades received or the standing attained on required examinations. If transcripts do not show the degree earned and the date on which it was conferred, official degree statements must also be provided.

## The Graduate Program Committee of the Department of Health Services Research and Administration (HSRA) determines standards for admission into the program. The committee considers the prospective student’s academic qualifications and professional experience.

## Doctor of Philosophy degree

Students enrolled in the PhD program without a Master’s degree are required to complete a total of 90 credit hours in course and dissertation work, including the following:﻿

|  |  |
| --- | --- |
| **Credits** | **Course Work** |
| 39 | Required courses |
| 15 | Area of emphasis courses |
| 12-18 | Elective courses |
| 18-24 | Dissertation |

The required courses are designed to help students build a strong foundation of multidisciplinary knowledge and skills for scholarship in health services research. After completing all required courses, students will then take area of emphasis courses. In addition to coursework, all PhD students are expected to attend monthly Doctoral Program Seminar throughout their studies.

|  |  |
| --- | --- |
| **Required Courses** | **Course Number** |
| US Healthcare System | HSRA 810 |
| Health Policy | HSRA 874 |
| Health Services Administration | HSRA 873 |
| Health Economics | HSRA 860 |
| Health Care Organizational Theory and Behavior | HSRA 830 |
| Biostatistics I | BIOS 806 |
| Biostatistics II | BIOS 808 |
| Epidemiology in Public Health | EPI 820 |
| Foundations of Public Health | HPRO 830 |
| Health Care Finance | HSRA 872 |
| Quantitative Methods in Health Services Research | HSRA 920 |
| **Required Courses** | **Course Number** |
| Design of Health Services Research | HSRA 930 |
| Qualitative Research Methods | HPRO 910 |
| **Area of Emphasis Courses** (selected—see advisor for more options) |  |
| Integrated Seminar in Economics and Health Services Research | HSRA 940 |
| Application of Medical Geography to Health Services Research | HSRA 950 |
| Seminar in Health Care Administration | HSRA 960 |
| Seminar in Health Policy | HSRA 980 |
| Research Other Than Thesis | HSRA 896 |

## HEALTH SERVICES RESEARCH, ADMINISTRATION, & POLICY (HSRA)

*Fall Semester*

## HSRA 810. The U.S. Health Care System: An Overview (3 credits)

*Instructor:* To Be Announced ***Offered:*** Variable

***Prerequisites:*** HPRO 860 (CPH 501), HPRO 842 (CPH 542)

This course will offer students an overview of the health and medical care delivery system in the U.S. Topics covered from a historical, economic, sociological, and policy perspective include the following: social values in health care; need, use, and demand for services; providers of health services (people and places); public and private payment systems; alternative delivery systems; and models from other countries. Current health care reform proposals will also be addressed.

## HSRA 820. Global Applications in Public Health (3 credits)

*Instructor:* To Be Announced ***Offered:*** Variable

***Prerequisites:*** Instructor permission

The course provides a survey of the field of global health including the health conditions, resources and programs, and deals with the application of the principles of public health to health problems of countries around the world, and global forces that affect health.

## HSRA 830. Health Care Organizational Theory and Behavior (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

This course focuses on introductory level of organizational theory (OT) and organizational behavior (OB) in health services research. Organizational theory is a macro examination of the organizations, focusing on the organization as a unit, and inter-organizational and environmental relationships. Organizational behavior is a micro approach to studying organizations, focusing on individuals in organizations as the unit of analysis*.*

## HSRA 860. Health Economics (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:*** UNO-ECON 2200 Principles of Economics or equivalent

This course is designed to help students understand how the theories and models of economics can be applied to the study of health and health care. The examination of the markets (demand and supply) for health, health care, and health insurance is stressed. In addition, the economic analytic tools such as microeconomic theories and economic evaluation methods will also be reviewed and introduced. Objective of this course is to equip students with the knowledge/tools to examine and analyze the problems/issues of health care from the perspective of economics.

## HSRA 872. Health Care Finance (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:*** UNO Course ECON 2200 Principles of Economics or equivalent

Health care finance represents an analysis of health care concepts, issues, and trends from a health care and an organizational perspective. Application of specific principles, concepts, and techniques of financial management to health care systems will be addressed. Examination of the role and responsibilities of health care administrators in relation to financial management will also be explored.

## HSRA 874. Health Policy (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

This course covers the fundamental issues of the health policy process by emphasizing the historical, social, economic, and political environment of contemporary US public health and health care policies. Students are expected to become knowledgeable about policy formation, implementation, modification, and evaluation within public health and health care systems. This course is intended for students who are enrolled in the MPH program and students from other graduate degree programs who have an interest in health policy.

## HSRA 950. Medical Geography and Spatial Methods in Health Services (3 credits)

*Instructor:* To Be Announced ***Offered:*** Variable

***Prerequisites:*** BIOS 808 or equivalent; Instructor permission requires introductory course in GIS or 1 credit hour short course on GIS for public health to be approved by the instructor. Instructor permission required.

The course provides theoretical and analytical aspects of medical geography, spatial analysis, and geographic information systems (GIS) in health services. It examines the role of geographic contexts in shaping health outcomes and how location contexts shape the health of residents.

*Spring Semester*

## HSRA 841 Human Resources Management in Health Organizations (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:*** Not open to non-degree students

This course explores human resources management and workforce planning in healthcare organizations. Students will gain in depth knowledge of the legal environment and major rules and regulations governing recruitment, selection and retention processes, as well as methods and techniques used in job analysis and interviews and organizational development. Another major focus area will be given to health professions workforce planning, succession planning, health safety preparedness, global issues facing healthcare workforce and future trends affecting human resources in healthcare organizations. The course is intended for students who are enrolled in MPH program and students from other graduate degree programs that have an interest in managing human resources in health organizations.

## HSRA 853. Strategic Planning & Management in Public Health Administration (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:*** Instructor permission

Course examines theory and practice of strategic planning and management in public health, health services, voluntary health, and welfare organizations. Application of specific principles, concepts, and techniques of strategic planning and management for these organizations will be addressed. Roles and responsibilities of public health and health services administrators in developing, implementing, monitoring, and revising strategy will also be examined.

## HSRA 867. Health Policy Analysis & Evaluation (3 credits)

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:*** HSRA 874 and HSRA 805

This course will provide a framework for understanding how to analyze and evaluate the impact of health policies in public health and health care settings. Topics include structuring policy problems, gathering data for policy analysis, monitoring and evaluating policy performance, and communicating the results of policy analysis.

## HSRA 920. Quantitative Methods in Health Services Research (3 credits)

*Instructor:* To Be Announced ***Offered:*** Variable

***Prerequisites:*** BIOS 806 or 808 or an equivalent statistics course.

This course is designed to equip students with in-depth understanding of theories and applications of some more advanced quantitative methods to conduct independent health services research. The course emphasizes the application of quantitative methods to answer causal questions using observational data.

## HSRA 930. Design of Health Services Research (3 credits)

*Instructor:* To Be Announced ***Offered:*** Variable

***Prerequisites:*** BIOS 808; Instructor permission.

The course provides an overview of health services research design and methods. The course focuses on the logic of causal inference, the formulation of testable hypotheses and the design of methods and measures to facilitate the study of questions in health services research.

## HSRA 940. Integrated Seminar in Economics and Health Services Research (3 credits)

*Instructor:* To Be Announced ***Offered:*** Variable

***Prerequisites:*** HSRA 960; Instructor permission.

This doctoral seminar course emphasizes the application of economics to the study of health services and health policy. This course is a doctoral seminar course for the PhD program in Health Services Research, Administration, and Policy. This course is also expected to be useful for health professionals or students of other PhD programs on campus who seek an in-depth understanding of the application of economics to health services research and policy analysis**.**

## HSRA 980. Seminar in Health Policy (3 credits)

*Instructor:* To Be Announced ***Offered:*** Variable

***Prerequisites:*** Instructor permission.

The course is an in-depth examination of the formation and implementation of health policy in the United States, including comparisons to policy formation and implementation in other developed nations. The course includes both seminar sessions and independent research activities. Graduate students will complete research projects analyzing a particular policy or implementation question.

*Multiple Semesters*

## HSRA 873. Health Services Administration (3 credits) Fall, Spring

*Instructor:* To Be Announced ***Offered:*** Annually

This course is designed to prepare graduate students, professional students, and fellows to manage and take on leadership roles in health services organizations. In this course, students will develop an understanding of: US health services organizations, their relative strengths and weaknesses, and the external environment that impacts their structures and processes; the role and challenges of being a health services manager or leader; and the tools and principles of effective healthcare systems management. The course is intended for graduate students and health professionals with an interest in health systems administration.

## HSRA 896. Research Other Than Thesis (1-4 credit[s]) Fall, Spring, Summer

*Instructor:* To Be Announced ***Offered:*** Annually

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

## HSRA 897. Service Learning for MPH Students (3 credits) Fall, Spring, Summer

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:*** Completion of all core and concentration MPH requirements; Instructor permission. The course is intended for MPH students only.

This practicum course provides students with a community-based experience that results in firsthand, scholarly, supervised experience in a practice setting. This course constitutes one-half (3 semester hours) of the six semester hour service-learning/capstone culminating experience required of all Master of Public Health students.

## HSRA 898. MPH Capstone Experience (3 credits) Fall, Spring, Summer

*Instructor:* To Be Announced ***Offered:*** Annually

***Prerequisites:*** All MPH Core and Concentration course work; Instructor permission.

The purpose of this course is to implement a capstone project proposal that clearly demonstrates integrated and applied knowledge, principles, and skills acquired through classroom instruction. Projects must demonstrate the development, enhancement, and application of core public health competencies in the MPH program competency domains. This course fulfills three semester hours of the six credit-hour requirement for MPH Service- Learning/Capstone Experience. It also fulfills requirement of 150 contact hours generally spent working on the research and paper.

## HSRA 970. Seminar (1 credit) Fall, Spring, Summer

*Instructor:* HSRA Faculty ***Offered:*** Annually

**HSRA 998. Special Topics (1-3 credit[s]) Fall, Spring, Summer**

*Instructor:* HSRA Faculty ***Offered:*** Variable

***Prerequisites:*** Instructorpermission.

Independent study course focusing on selected topics or problems. The subject will be dependent on student demand and availability of staff*.*

**HSRA 999. Doctoral Dissertation** **(Variable credits)** **Fall, Spring, Summer**  
*Instructor:* HSRA Faculty ***Offered:*** Annually

Medical Sciences Interdepartmental Area

## Departments Cooperating:

Clinical And Translational Research

Genetics

Cell Biology and Anatomy

Cytotechnology

Biomedical Informatics

Internal Medicine

Obstetrics and Gynecology

Oral Biology

Orthopedic Surgery

Medical Nutrition

Monroe Meyer Institute

Pathology and Microbiology

Pediatrics

Pharmacology and Experimental Neuroscience

Physical Therapy Education

Preventive and Societal Medicine

Psychiatry

Radiology

Surgery

## Graduate committee:

*Co-Chairs:*

Laura Bilek, PT, Ph.D. Physical Therapy Education, SAHP

David Shaw, Ph.D. Oral Biology, COD

*Members:*

Fausto Loberiza Jr., MD, MS Clinical and Translational Research

Keshore Bidasee, Ph.D. Pharmacology & Experimental Neuroscience

Joe Norman, PT, Ph.D. Physical Therapy Education

James McClay, M.D. Biomedical Informatics

Carol Casey, Ph.D. Internal Medicine

John S. Davis, Ph.D. Obstetrics & Gynecology

Hani Haider, Ph.D. Orthopedics

Warren G. Sanger, Ph.D. Pediatrics

Wayne Stuberg, Ph.D. Monroe Meyer Institute (MMI)

Valerie Volkert, Ph.D. MMI Applied Behavior Analysis

Andrew Jameton, Ph.D. Preventive & Societal Medicine

Dennis P McNeilly, M.D. Psychiatry

Michael D. Boska, Ph.D. Radiology

Iraklis Pipinos, M.D. Surgery

Amber Donnelly, Ph.D. Cytotechnology

Corrine Hanson, Ph.D. Medical Nutrition

Karen Gould, Ph.D. Genetics, Cell Biology, & Anatomy

Rakesh Singh, Ph.D. Pathology and Microbiology

The Medical Sciences Interdepartmental Area is intended for those who wish to pursue individually designed programs of an interdisciplinary nature within medical sciences leading to Master of Science and/or the Doctor of Philosophy degree. For example, individual programs of study may be developed in the following research areas: immunology, drug metabolism, human genetics, neurological sciences, oral biology, health services research, and others.

Admission to the Medical Sciences Interdepartmental Area (MSIA) Graduate Program: In addition to the general requirements governing admission to the Graduate College the following requirements must also be met: The Graduate Record Examination (GRE) is required. Individuals who have completed the Dental Admissions Test (DAT), the Medical College Admission Test (MCAT), or the Veterinary Aptitude Test (VAT) may substitute these tests for the GRE. Scores on the GRE, DAT, MCAT, and VAT serve only as general guidelines for admission.

**Course requirements for the M.S. degree**

The Master of Science degree in the Medical Sciences Interdepartmental Area may be earned only under Option One (see *Graduate Bulletin,* section *Requirements for the Master’s Degree*).

**Course requirements for the Ph.D. degree**

Please see the document entitled "Procedures Governing the Admission and Progress of Students in the Medical Sciences Interdepartmental Area Graduate Program."

## MEDICAL SCIENCES (MSIA)

## MSIA 899. Master’s Thesis (Variable credits) Fall, Spring, Summer

*Instructor:* Dr. Bilek ***Offered:*** Annually

## MSIA 970. Seminar (1 credit) Fall, Spring, Summer

*Instructor:* Dr. Bilek ***Offered:*** Annually

***Prerequisites:*** Enrolled in MSIA graduate program or by Instructor permission.

This seminar allows a unique seminar plan to be generated for each student regarding attendance and presentation. The plan will include attendance and presentation at research seminars in your home department and across campus and participation in journal clubs.

## MSIA 999. Doctoral Dissertation (Variable credits) Fall, Spring, Summer

*Instructor:* Dr. Bilek ***Offered:*** Annually

## BIOMEDICAL INFORMATICS (BI)

## BI 810. Introduction to Biomedical Informatics (3 credits) Fall

*Instructor:* Dr. McClay ***Offered:*** Annually

An introduction to the field of biomedical informatics. The historical development of the field and the current state of the art will be discussed. Issues related to bioinformatics, clinical informatics, and public health/population informatics will be discussed. Prereq: Admitted to BMI program or permission of the instructor.

## BI 850. Advanced Topics in Clinical Informatics (3 credits) Spring

*Instructor:* Dr. McClay ***Offered:*** As Needed

***Prerequisites:*** BI810; Graduate standing in health information sciences or informatics concentration in ISQA masters program; Instrctor Permission

Overview of topics in clinical information systems (CIS) with readings covering history of clinical computing, the current regulatory environment, structure of CIS and the electronic health record. Purpose is to provide integrative knowledge of theory and applications in clinical informatics. Students will complete assigned readings and participate in discussions.

## BI 970. Seminar (1 credit) Fall, Spring

*Instructor:* Dr. McClay ***Offered:*** Annually

***Prerequisites:*** Enrolled in MSIA Bioinformatic Graduate Program; Instructor permission

This seminar consists of the student and faculty presentations on current research and topics in Health informatics. The course focuses on creating a venue for student and faculty Health informatics researches to present discuss and received constructive criticism on their research.

## CLINICAL AND TRANSLATIONAL RESEARCH (CTR)

## CTR 901. Seminar In Clinical Translational Research Grantsmanship I (2 credits) Fall

*Instructor:* Drs. Loberiza, Zimmerman ***Offered:*** Annually

***Prerequisites:*** Bachelor degree in health sciences, basic statistics knowledge, permission of instructor; Instructor permission

This course is designed to understand the concepts and guidelines involved in the writing of clinical and translational research grant applications. Emphasis will be given to learning the art and science of grant writing using the NIH format. Detailed discussions of sample funded K, R21, and R01 grants will be performed. Elements of NIH grant applications will be discussed from research strategy, subject recruitment, IRB regulations, and budget.

## CTR 928. Translational & Interdisciplinary Outcomes Research (3 credits) Fall

*Instructor:* Dr. Zimmerman ***Offered:*** Annually

***Prerequisites:*** Multi-variate statistics, or Instructor permission

This course focuses on outcomes: measurement, management, and evaluation of health care outcomes and translational research as a process that drives the clinical research engine. The Medical Outcomes Study conceptual framework (Structure of Care, Process of Care, and Outcomes) with an emphasis on the broad categories of outcome types: clinical end points, functional status, general well-being, satisfaction with care, and economic evaluations will be employed. Different translational approaches will be discussed T1-T4 (with an emphasis on T2-T4) along with common and unique research methods used. Legal, ethical, political and economic implications for practice and research will be discussed.

## CTR 998. Special Topics (1 credit) Fall

*Instructor:* Drs. Loberiza, Zimmerman ***Offered:*** Every 2 Years

***Prerequisites:*** Instructor permission required

## CTR 923. Rural Health Research: Considerations And Implications (3 credits) Spring

*Instructor:* Drs. Zimmerman, Pullen, Johansson ***Offered:*** Every 2 Years

***Prerequisites:*** Multi-variate statistics, or Instructor permission

This course focuses on understanding the issues to conducting research in rural and disparate populations. Emphasizing content related to challenges and disparities in rural health, health care access and health care policy, and strategies for conducting research such as the use of technology, considerations of the environment and community needs. Legal, ethical, political, and economical indications for research in rural areas will be discussed.

## CYTOLOGY (CYTO)

## CYTO 804. Cytology Of The Urinary Tract (1 credit) Fall

*Instructor:* Dr. Donnelly ***Offered:*** As Needed

***Prerequisites:*** Admission to the Cytotechnology Program; Instructor Permission

This course will present the cytology of benign disorders, infections, malignancies and therapeutic effects as seen in the urinary tract.

## CYTO 805. Cytology Of Bodily Fluids And Cerebrospinal Fluid (1 credit) Fall

*Instructor:* Dr. Donnelly ***Offered:*** As Needed

***Prerequisites:*** Admission to the Cytotechnology Program; Instructor Permission

This course covers the cytologic evaluation of cerebrospinal fluid and pleural, peritoneal, pericardial, and pelvic washing fluids. The student will be able to identify normal cells and cellular markers of infectious diseases, benign conditions, and malignancies associated with these body fluids.

## CYTO 810. Cytology Of The Gastrointestinal Tract (1 credit) Spring

*Instructor:* Dr. Donnelly ***Offered:*** As Needed

***Prerequisites:*** Admission to the Cytotechnology Program; Instructor Permission

This course prepares the student in the collection and evaluation of scrapings, brushing, and washings from the oral cavity, esophagus, stomach, duodenum, colon, and rectum. This student will be able to identify normal cells, non-cellular material, and the cytologic markers of infections, benign conditions, and malignancies of the gastrointestinal (GI) tract.

## CYTO 811. Fine Needle Aspiration (3 credits) Spring

*Instructor:* Dr. Donnelly ***Offered:*** As Needed

***Prerequisites:*** Admission to the Cytotechnology Program; Instructor Permission

This course is designed to familiarize the student with the collection of cellular specimens using find need aspiration (FNA) from a variety of body sites. During this course, the student will develop the skill to interpret FNA specimens obtained from the breast, thyroid, salivary gland, lymph nodes, soft tissue, bone, mediastinum, liver, pancreas, kidney, adrenal gland and all metastatic tumors.

## CYTO 812. Immunocytochemistry (1 credit) Spring

*Instructor:* Dr. Donnelly ***Offered:*** As Needed

***Prerequisites:*** Admission to the Cytotechnology Program; Instructor Permission

Immunocytochemistry is a staining technique used to demonstrate cellular antigens. It is used as an adjunctive test to the standard morphology of cells. During this course, students will lean the principle of staining process as well as its utility and appropriateness. The staining procedure will be observed, performed, and the students will learn to interpret the staining results.

## CYTO 813. Cytology Laboratory Management (1 credit) Spring

*Instructor:* Dr. Donnelly ***Offered:*** As Needed

***Prerequisites:*** Admission to the Cytotechnology Program; Instructor Permission

This course will introduce students to activities required for the management of a cytopathology laboratory. Of particular emphasis will be the compliance with federal and accrediting agency mandates. This includes quality control, quality assurance, proficiency testing, procedure manuals, statistics, workload, and accreditation. Other topics discussed will be personnel issues, financial management, and basic principles of clinical investigation.

## GENETICS, CELL BIOLOGY AND ANATOMY

In addition to participating in the Medical Sciences Interdepartmental Area graduate program, Genetics, Cell Biology and Anatomy has an independent program leading to the M.S. and Ph.D. degrees.

[**See Course Listings offered by Genetics, Cell Biology and Anatomy**](http://app1.unmc.edu/gradstudies/index.cfm?L1_ID=2&amp;L2_ID=7&amp;L3_ID=10&amp;CONREF=26)**.**

## INTERNAL MEDICINE (IMED)

## IMED 810. Developing Clinical Research (1 credit) Fall

*Instructor:* Dr. Kratochvil ***Offered:*** Annually

***Prerequisites:*** Instructor permission required

This course details the writing of a grant, IRB submission, consent forms, ethics of clinical research, using a database, and beginning statistical terminology and methods. It is offered in seminar format in a period of 1 week during the fall semester each year.

## IMED 840. Clinical Systems Architecture and Function (3 credits) Fall

*Instructor:* Dr. Campbell ***Offered:*** Annually

***Prerequisites:*** ISQA students will be required to have completed foundation requirements for the MS program in MIS before admission. All students must have completed PSM 810 US Healthcare System, or have comparable healthcare experience, before taking this course. All clinical applicants from the Colleges of Medicine or Nursing must have completed ISQA 8050 and CIST 2050 or equivalence before admission. Waiver of requirements is contingent upon review and permission of the instructor.

This course will explore and integrate multiple topics in health care information systems history, architecture, function and design in order to create an understanding of the complexities of clinical care systems and prepare the student to create and manage the next generation of clinical information systems. The needs of multiple clinical disciplines will be explored to understand how they can share, communicate and manage patient information using clinical information standards and principles of clinical informatics.

## IMED 840. Clinical Systems Architecture & Function (3 credits) Fall

*Instructor:* Dr. Campbell ***Offered:*** Annually

***Cross Listed:*** ISQA 8400 (UNO Course)

***Prerequisites:*** Instructor permission required

This course serves to integrate multiple topics into an understanding of clinical health care information system history, architectures, and design. The needs of multiple disciplines will be explored to understand how they can share, communicate and manage patient information using clinical information standards.

## IMED 937. Diabetes Mellitus (1 credit) Fall, Spring

*Instructor:* Dr. Hamel ***Offered:*** Annually

***Prerequisites:*** Instructor permission required

Selected topics of interest in diabetes mellitus. The emphasis is investigational. The laboratory emphasis must relate to studies under way in the Division.

## IMED 972. Medical Seminar (1 credit) Fall, Spring

*Instructor:* Dr. Casey ***Offered:*** Annually

***Prerequisites:*** Instructor permission required

## MONROE MEYER INSTITUTE (MMI)

## *Fall Semester*

## MMI 901. Developmental Neurobiology (3 credits)

*Instructor:* Drs. Kim, Arrikath, Bonesera, Stuberg***Offered:*** Every 2 Years

***Prerequisites:*** Instructor permission required

The purpose of this course is to introduce students to the fundamental mechanisms underlying neural development with an understanding that the brain continues to develop throughout life. Further, the course is designed to promote the abilities of students to critique research in the area of developmental neurobiology.

## MMI 904. Behavioral Parent Training (3 credits)

*Instructor:* Dr. Warzak ***Offered:*** Every 2 Years

Course addresses research and conceptual models of behavioral parent training. Course is designed to provide a foundation for trainees interested in integration of applied behavior analysis and clinical intervention with families using structured parent training treatment model.

## MMI 908, Assessment And Treatment Of Child Psychopathology (3 credits) Fall Biennial

*Instructor:* To Be Announced ***Offered:*** Every 2 Years

The purpose of this course is to teach students in the Applied Behavior Analysis Program about behaviorally based assessment and therapeutic approaches and techniques that have been empirically supported with children. Course content will focus on the theoretical conceptualization and assessment of clinical problems and the conceptual rationale for selecting and implementing behavior therapy techniques. Students will also have the opportunity to observe and practice specific techniques in clinical settings.

## MMI 915 Behavioral Pediatric Psychology (3 credits)

*Instructor:* Dr. Allen ***Offered:*** Every 2 Years

***Prerequisites:*** Master’s degree in related area; Master’s level coursework in applied behavior analysis; Preparation and classes leading to eventual certification as a behavior analyst (i.e., BCBA credential). With instructor, permission Master’s students in joint UNO-MMI Program may also take course.

This course provides the student with an understanding of the interdisciplinary area of behavioral pediatrics, defined as the integration of behavioral science and pediatric medicine to understand and treat behavior associated with medical disorders and problems in pediatric health care.

## MMI 920. Assessment and Treatment Of Severe Behavior Disorders (2 credits)

*Instructor:* To Be Announced ***Offered:*** Every 2 Years

The goals for this course are: (a) to grasp a basic understanding of the etiology of severe behavior disorders, (b) to develop an in-depth evaluation of the primary types of assessment methods used to evaluate the occurrence of severe behavior disorders, and (c) to develop an in-depth understanding of how one identifies empirically derived treatments for severe behavior disorders given the outcome of a behavioral assessment.

## MMI 940. Verbal Behavior (3 credits)

*Instructor:* Dr. Luczynski ***Offered:*** Every 2 Years

The purpose of this course is to provide an analysis of human language in objective terms. The goals for this course are: (a) to distinguish language from non-language behavior by the way it achieves its effect on the environment, (b) to develop an understanding of elementary verbal relations with some emphasis on motivational variables, (c) to provide a conceptual understanding of a behavioral approach to language, and (d) to develop skills to program curricula for teaching language to individuals with disabilities.

## *Spring Semester*

## MMI 835. Experimental And Quantitative Analysis Of Behavior (3 credits)

*Instructor:* Drs. Luczynski, Rodriguez***Offered:*** Every 2 Years

A graduate-level introduction to basic behavioral research. This course covers seminal and current research in the experimental and quantitative analysis of behavior and relates this work to research and practice in applied behavior analysis.

## MMI 906. Applied Behavior Analysis In Education (3 credits)

*Instructor:* Dr. Shriver ***Offered:*** Every 2 Years

This course provides knowledge of how applied behavior analysis principles and research methods can be employed in academic school settings form pre-school to elementary to secondary educations settings. Emphasis will be upon applying ABA to address academic and behavior problems in the schools.

## MMI 907. Community Applications Of Applied Behavior Analysis (3 credits)

*Instructor:* Dr. Mathews ***Offered:*** Every 2 Years

This course identifies models of community Applied Behavior Analysis interventions with an emphasis on using the website The Community Tool Box (CTB) to involve individuals and agencies in participatory research into community and public health problems. Prerequisite: By permission of the instructor.

## MMI 911. Behavioral Psychology of Development Across the Life Span (3 credits)

*Instructor:* Dr. Rodriguez ***Offered:*** Every 2 Years

This course identifies models of development across the life span and provides a basis for understanding using applied behavior analysis principles. Emphasis is upon exploring various developmental approaches and theories from a behavioral assessment perspective.

## MMI 916. Behavioral Psychology in Autism and Related Disorders (3 credits)

*Instructor:* To Be Announced ***Offered:*** Every 2 Years

The goals for this course are to: (a) provide a summary of characteristics related to the diagnosis of an ASD, (b) evaluate etiological theories related to an ASD diagnosis, (c) familiarize students with a variety of behaviorally-based treatments that are utilized in the treatment of children with an ASD, (d) evaluate the treatment outcome research, and (e) allow students to demonstrate their ability to write behavioral-acquisition programs for individuals with ASD.

## MMI 950. Advanced Single-Subject Design in ABA (3 credits)

*Instructor:* Dr. Volkert ***Offered:*** Every 2 Years

The purpose of this course is to provide (1) readings anddiscussion of tactics of scientific research (e.g., experimental design), (2) readings and discussion of the analysis of behavior within a scientific context, (3) readings and discussion of various discussion and data-based articles (4) readings and discussion of empirical applications. The course is designed to provide students with an advanced understanding of the application of single-subject research design.

## *Multiple Semesters*

## MMI 896. Research Other Than Thesis (Variable credits) Fall, Spring, Summer

*Instructor:* Dr. Volkert ***Offered:*** Every 2 Years

Each doctoral student participates in ongoing research project(s) other than dissertation under the direction of MMI Applied Behavior Analysis faculty. Doctoral students must take at least two semesters and a minimum of 6 credits.

## MMI 902. Infant Development (3 credits) Fall, Spring, Summer

*Instructor:* Dr. Harbourne ***Offered:*** Every 2 Years

***Prerequisites:*** Instructor permission required

Course focuses on developmental time period of infancy, with critical review of research examining selected aspects of motor behavior, perception, cognition, language, emotion and social relationships. Theoretical issues considered will be interaction of all of the above, embodied cognition, continuity and discontinuity in development, systems theory, and individual differences affecting developmental trajectory. Conditions that put infants at risk for poor development will also be considered including prematurity, early medical complications, early experience and sensitive periods for development of different systems. Research methods will be discussed in context of examining change over time and intra- and inter-individual differences.

## MMI 980. Practicum in Applied Behavior Analysis (Variable credits)

*Instructor:* Dr. Volkert **Fall, Spring, Summer**

***Prerequisites:*** None  ***Offered:*** Annually

This course consists of in- depth practical, hands on learning experiences in applied behavior analysis with children, adolescents and families. Practicum in Applied Behavior Analysis is taken every semester and involves clinical supervision from an ABA faculty member.

## MMI 990. Internship In Applied Behavioral Psychology (Variable credits)

*Instructor:* Dr. Volkman **Fall, Spring, Summer**

***Prerequisites:*** Completion of all required coursework ***Offered:*** Annually

This course within the ABA program is designed to provide training in, and supervised application of, evidence- based behavioral intervention practiced, including data-driven decision making and the implementation of empirically derived behavioral treatment technology. This course is repeated over three (3) semesters and provides supervised application of functional diagnostic and behavioral treatment procedures in Applied Behavioral Psychology at MMI. Students will also participate in applied research during their year-long internship sequence. Each student will have two (2) rotations that are supervised by program faculty and will involve either or both program tracks of the ABA program.

## MMI 999. Doctoral Dissertation (Variable credits) Fall, Spring, Summer

*Instructor:* Dr. Volkert ***Offered:*** Annually

## MEDICAL NUTRITION (MNED)

## MNED 875. Research Methods in Medical Nutrition (3 credits) Fall

*Instructor:* Dr. Hanson ***Offered:*** Annually

***Prerequisites:*** Instructor permission required

This course introduces students to the basic components of the medical nutrition research process including formulation of a valid research hypothesis and appropriate research methodology in a clinical practice setting. Students will be introduced to the fundamental concepts of research methods, enabling them to critically evaluate published research in medical nutrition. Course content includes appropriate procedures for conducting a comprehensive literature review, hypothesis development, study design, and statistical analysis. Students will develop a research proposal and will complete CITI training.

## MNED 877. Medical Nutrition & Diagnosis Related Care (3 credits) Fall

*Instructor:* Dr. Hanson ***Offered:*** Annually

***Prerequisites:*** Instructor permission required

This course focuses on nutrition care for patients with varied medical diagnoses. Format includes lectures by practicing clinicians and case studies from clinical settings to apply knowledge of nutrition assessment, diagnosis and intervention.

## MNED 975. Applied Medical Nutrition Research II (3 credits) Spring

*Instructor:* Dr. Hanson ***Offered:*** Annually

***Prerequisites:*** MNED 875; Instructor permission required

This course is designed to familiarize students with evidence based research and libraries, provide experiences designed to develop oral presentation and professional writing skills, and provide the experience of conducting medical nutrition research in the clinical setting. Students will obtain IRB approval for their research proposal developed in MNED 875, and execute the research project using appropriate methods, ethical procedures, and statistical analysis. Students will present their findings orally in class and in poster format at the SAHP Forum on Evidence-Based Medicine. Students will be assigned published papers and specific sections of books to read, and websites to visit prior to classes five through seven. Papers will be used as examples of study design. Website provides current information on dietary supplements and their regulation.

**MNED 977. Medical Nutrition & Nutrition Care Process (3 credits) Spring**

*Instructor:* Dr. Hanson ***Offered:*** Annually

***Prerequisites:*** MNED 877; Instructor permission required

This didactic course is designed to analyze nutrition care practice using the American Dietetic Association Nutrition Care Process. Students will engage in application of strategies associated with evidence based practice and outcome measures in the medical nutrition

## MNED 998. Special Topics in Medical Nutrition (1-3 credits) Spring

*Instructor:* Dr. Hanson ***Offered:*** Annually

***Prerequisites:*** MNED 875; Instructor permission required

This independent study course allows students to explore in depth a specific topic not offered in existing curriculum. Topics may include an evidence for specific nutrition therapy or other medical nutrition issues.

## OBSTETRICS AND GYNECOLOGY (OBGY)

**The Department of Obstetrics and Gynecology participates in the Medical Sciences Interdepartmental Area Graduate Program, but does not offer any graduate courses**

## ORAL BIOLOGY (OBIO)

## *Fall Semester*

## OBIO 840. Craniofacial Growth and Development I (1 credit)

*Instructor:* To Be Announced ***Offered:***  Annually

***Prerequisites:*** Instructor permission required

A lecture and seminar study of prenatal and postnatal growth and development of the head with special emphasis on osteology, prenatal and postnatal factors influencing growth, and clinical management of craniofacial growth disorders.

## OBIO 849. Biophysical Principles I (1 credit)

*Instructor:* Dr. Premaraj ***Offered:***  Annually

***Prerequisites:*** Instructor permission required

The study of the construction, application, and operations of orthodontic appliances with special consideration given to the physiological reaction of oral and dental tissues to the forces involved.

## OBIO 855. Advanced Oral Biology (3 credits)

*Instructor:* Dr. Crouch ***Offered:***  Even Years

***Prerequisites:*** Instructor permission required

Didactic study of development, molecular, cell biology, histology, and physiology of orofacial structures. Oral microbial ecology and resultant diseases, dental asepsis and OSHA are discussed

## OBIO 860. Advanced Anatomy (2 credits)

*Instructor:* Dr. Harn ***Offered:***  Annually

***Prerequisites:*** Instructor permission required

Studies of general and special gross anatomy, embryology, and neuroanatomy of the human body with emphasis on the head and neck. Lectures and labs as arranged.

## OBIO 866. Immunology and Microbiology of Oral Infectious Disease (3 credits)

*Instructor:* Dr. Petro ***Offered:***  Odd Years

***Prerequisites:*** Instructor permission required

A study of the immune system, secretory immunology, immunopathology, and resistance mechanisms of the human body. Pathogenic microbes related to oral diseases and dental asepsis, their pathogenesis and epidemiology are discussed.

## OBIO 870. Advanced Periodontology I (2 credits)

*Instructor:* Dr. Reinhardt ***Offered:***  Annually

***Prerequisites:*** Instructor permission required

The study of etiology, diagnosis, and treatment of periodontal diseases.

## OBIO 895. Advanced Oral Pathology (2 credits)

*Instructor:* Dr. Giannini ***Offered:***  Annually

***Prerequisites:*** Instructor permission required

Common oral lesions result from developmental, inflammatory, metabolic, neoplastic changes.

## *Spring Semester*

## OBIO 803. Biostatistics (3 credits)

*Instructor:* Dr. Marx ***Offered:***  Even Years

***Prerequisites:*** Instructor permission required

A course emphasizing the fundamental concepts of statistical inference for application to the planning and executing of scientific studies in biomedical, translational, and clinic research.

## OBIO 818. Human Physiology (5 credits)

*Instructor:* Dr. Housh ***Offered:***  Annually

***Prerequisites:*** Instructor permission required

A study of the physiology of cells and organ systems. Provides an in depth survey of cell membrane, neural, respiratory, cardiovascular, renal, gastrointestinal, and endocrine physiology. Topics are presented to provide a basis for understanding normal function in the human, with an emphasis on the oral cavity.

## OBIO 841. Craniofacial Growth and Development II (1 credit)

*Instructor:* To Be Announced ***Offered:***  Annually

***Prerequisites:*** Instructor permission required

A lecture and seminar study of prenatal and postnatal growth and development of the head with special emphasis on osteology, prenatal and postnatal factors influencing growth, and clinical management of craniofacial growth disorders.

including hard and soft tissues.

## OBIO 850. Biophysical Principles II (1 credit)

*Instructor:* Dr. Premaraj ***Offered:***  Annually

***Prerequisites:*** Instructor permission required

The study of the construction, application, and operations of orthodontic appliances with special consideration given to the physiological reaction of oral and dental tissues to the forces involved.

## OBIO 851. Advanced Dental Biomaterials (3 credits)

*Instructor:* Dr. Beatty ***Offered:***  Even Years

***Prerequisites:*** Instructor permission required

Advanced topics in biomaterials science and their application to clinical dentistry and dental specialty practice. Topics include Hooke’s Law, viscoelasticity, structure-property relationships of biological materials, failure and strengthening mechanisms of metals, ceramics, polymers, composites and elastomers.

## OBIO 871. Advanced Periodontology II (2 credits)

*Instructor:* Dr. Reinhardt ***Offered:***  Annually

***Prerequisites:*** Instructor permission required

The study of etiology, diagnosis, and treatment of periodontal diseases.

## OBIO 970. Seminar (1 credit)

*Instructor:* Dr. Oakley ***Offered:***  Annually

***Prerequisites:*** Instructor permission required

Student led discussions of their own research and/or analysis of recent publications in the biomedical sciences.

## *Summer Semester*

## OBIO 848. Light and Electron Microscopy Methods (2 credits)

*Instructor:* Dr. Feely ***Offered:***  Annually

***Prerequisites:*** Instructor permission required

Lectures and laboratory with individual participation in light and electron microscopy techniques

## OBIO 862. Advanced Dental Pharmacology (1 credit)

*Instructor:* Dr. Fung ***Offered:***  Odd Years

***Prerequisites:*** Instructor permission required

An advanced didactic study of the pharmacological principles of drug action at the cellular and organ levels. Emphasis is placed on drugs utilized in dentistry.

## *Multiple Semesters*

## OBIO 992. Special Topics (1-3 credits) Fall, Spring, Summer

*Instructor:* OBIO Faculty ***Offered:***  Variable

***Prerequisites:*** Instructor permission required

## ORTHOPEDIC SURGERY (ORTH)

**The Department of Orthopedic Surgery participates in the Medical Sciences Interdepartmental Area Graduate Program but does not offer any graduate courses**

## PEDIATRICS (PEDS)

## PEDS 911. Human Genetics And Cytogenetics Principles (2 credits) Fall

*Instructor:* Drs. Sanger, Dave ***Offered:*** If 5 students enroll

***Prerequisites:*** Instructor permission required; Must have bachelor or Masters degree in a biological or related field and have taken at least one undergraduate course

Human genetics principles, etiologies of disease, genetic syndromes, counseling issues, population genetics and ethical considerations in genetics.

## PEDS 912. Human Cytogenetics Laboratory (2 credits) Fall

*Instructor:* Drs. Sanger, Dave ***Offered:*** If 5 students enroll

***Prerequisites:*** PEDS 911 or concurrent enrollment; Instructor permission required; Must have bachelor or Masters degree in a biological or related field and have taken at least one undergraduate course

Development of research tools in human genetics. Includes culture of peripheral blood and human chromosome methodology, analysis and identification.

## PEDS 896. Research in Pediatrics (Variable credits) Fall, Spring, Summer

*Instructor:* Dr. Bilek ***Offered:*** Annually

## PEDS 913. Advanced General Pediatrics (3 credits) Fall, Spring, Summer

*Instructor:* Dr. Bilek ***Offered:*** Annually

***Prerequisites:*** Instructor permission required

In depth study in any of pediatric subspecialties. This course may include lectures, conferences, readings, or research.

## PEDS 970. Seminar (1 credit) Fall, Spring, Summer

*Instructor:* Dr. Bilek ***Offered:*** Annually

## PHARMACOLOGY AND EXPERIMENTAL NEUROSCIENCE (PEN)

In addition to participating in the Medical Sciences Interdepartmental Area graduate program, PEN has an independent program leading to the M.S. and Ph.D. degrees.

[**See Course Listings by Pharmacology & Experimental Neuroscience**](http://app1.unmc.edu/gradstudies/index.cfm?L1_ID=2&amp;L2_ID=7&amp;L3_ID=10&amp;CONREF=16)

**PHYSICAL THERAPY EDUCATION (PHYT)**

**PHYT 942. Special Topics (1-6 credit[s]) Fall, Spring, Summer**

*Instructor:* Drs. Norman, Bilek ***Offered:*** Annually

***Prerequisites:*** Instructor permission required

This is a directed independent study graduate course. The course is designed to address a specific and limited area of content at depth. The course is not intended for students whose focus is on an overview or global content course.

**PHYT 943. Laboratory Practicum (2-6 credit[s])** **Fall, Spring, Summer**

*Instructor:* Drs. Norman, Bilek ***Offered:*** Annually

***Prerequisites:*** Instructor permission required

Students devise and execute a research project with emphasis on developing proficiency in data collection and data analysis pertinent to the study of motor control or physical activity.

**PSYCHIATRY (PSYC)**

**The Department of Psychiatry participates in the Medical Sciences**

**Interdepartmental Area Graduate Program, but does not offer any graduate courses**

## RADIOLOGY (RADI)

## RADI 850. Introduction To Biomedical Imaging and Image Analysis (3 credits) Fall

*Instructor:* Drs. Liu, Sajja ***Offered:*** Annually

***Prerequisites:*** *Undergraduate or graduate level course in physics or mathematics, and undergraduate or graduate level course in mammal anatomy or physiolog;, Instructor permission.*

This course is aimed to teach the principles and applications of biomedical imaging and image analysis technologies employed in current biomedical research. The first part of the course will provide the students the underlying principles of biomedical imaging including the basic physics and mathematics associated with each modality including X- ray CT, SPECT, PET, and MRI. The second part of the course provides the descriptions of the methods currently being used for biomedical image processing and analysis. Concepts of digital images and image enhancement are first introduced. Advanced image analysis technologies such as image segmentation, registration and morphologicalanalysis will then be described.

## SURGERY (SURG)

**The Department of Surgery participates in the Medical Sciences**

**Interdepartmental Area Graduate Program, but does not offer any graduate courses.**

Nursing

**Graduate Committee:**

Dr. Ann Berger (Chair)

Dr. Bunny Pozehl

Dr. Carol Pullen

Dr. Bernice Yates

Dr. Lani Zimmerman

Dr. Sue Barnason (ex-officio)

Dr. Marlene Cohen (ex-officio)

Dr. Dr. Karen Grigsby (ex-officio)

Dr. Julian Sebastian (ex-officio)

Student Representative

The College of Nursing offers a program leading to the Doctor of Philosophy.

Graduate level nursing courses are offered by the Graduate Faculty at the College of Nursing. Graduate level cognate courses in the basic, behavioral, and social sciences may be taken at the University of Nebraska at Omaha, Lincoln, Kearney, or the Medical Center, or from any other accredited graduate program. All programs of study are planned with the major advisor after acceptance into the graduate program.

**DOCTORAL PROGRAM.**

**PURPOSE.** Doctoral education in nursing prepares nurses for leadership roles in the development and application of nursing knowledge in the health care system. The PhD program prepares nurse scientists to discover knowledge to improve health. Nurse scientists improve the health of human beings through the development, testing, and dissemination of nursing science. All nurses should be prepared to understand and work to promote well-being and ameliorate health care problems within their scope of practice at local, state, national, and global levels.

**OUTCOMES.** The doctoral program prepares beginning nurse scientists who are recognized for their focused area of expertise and who receive this recognition based on:

**Essential Competencies for a PhD Program.**

**UNMC – PhD in Nursing Program Competencies**

1. Master in-depth theoretical and research knowledge in an area of emphasis.
2. Generate and test knowledge for patient care, health systems, or nursing education.
3. Collaborate with interdisciplinary colleagues to conduct team science.
4. Utilize professional judgment in the conduct of research with regard to legal, ethical, political, cultural, and economic implications.
5. Analyze the evolution of nursing science and the implications for the roles and responsibilities of nurse scholars.
6. Demonstrate leadership in education, professional organizations, and various professional and public groups.
7. Communicate research findings, as well as their implications for policy, nursing practice, and the profession, to lay and professional audiences

## Essential Attributes of Nurse Scholars

1. Demonstrates high ethical standards and behavior
2. Examines alternative ethical stances to arrive at reasoned choices in the research process
3. Recognizes personal strengths and areas that need improvement
4. Seeks and uses feedback on ideas and oral/written communication skills consistent with scholarly work
5. Demonstrates respect for alternative perspectives
6. Recognizes limits of own knowledge and seeks life-long learning
7. Develops negotiation skills or conflict management skills
8. Demonstrates mentor/mentee role skills

| **COMPETENCIES** |
| --- |
| 1. Defines and analyzes health and/or health-related concepts as the phenomenon of concern for nursing science and for own research focus. |
| 1. Defines and analyzes problems in nursing education and/or practice that require development of new knowledge and application of research findings |
| 1. Leads discussions pertinent to knowledge in a focus area |
| 1. Evaluates potential sources of funding in focus area |
| 1. Demonstrates collaborative skills required to build and work in a multidisciplinary research team |
| 1. Develops and presents a convincing written and oral argument that supports the dissertation topic and method of choice for extending knowledge |
| 1. Articulates national priorities in focus area |
| 1. Identifies unique contributions of nursing knowledge to the interdisciplinary enterprise of the student’s own research focus area |
| 1. Develops a personal identity as a nurse scholar |
| 1. Demonstrates and maintains skill in use of emerging technology for education and research |
| 1. Explores social, legal, ethical, political, environmental and economic context within which research is conducted |
| 1. Discusses a futuristic perspective of the discipline and takes risks to move the discipline forward |
| 1. Uses effective collaboration skills to develop projects within an interdisciplinary context |
| 1. Represents nursing science in interdisciplinary debates about ethics and social justice issues, e.g., right to health care or universal access |
| 1. Considers societal needs for knowledge pertinent to specified problem within a focus area |
| 1. Engages in inter-professional policy (global, national & state level) discussions that shape the research, education and practice of nursing |
| 1. Explains types of knowledge and methods for knowledge generation and philosophy of science underpinnings |
| 1. Articulates the development of nursing as a scientific discipline |
| 1. Evaluate theories related to individual’s focus area |
| 1. Identifies a conceptual framework related to research |
| 1. Develops evidence-based tables to synthesize empirical literature (integrative review) and identify gaps in focus domain of research to build on background knowledge |
| 1. Seeks critical review of work pertinent to synthesis of theory and research in focus area |
| 1. Describes research designs and methods for application to research questions |
| 1. Synthesizes knowledge from psychometric theories and research as it relates to selection of reliable and valid measurement instruments for dissertation |
| 1. Understands how theories are developed, adapted, and utilized in nursing research from other sciences |
| 1. Synthesizes knowledge from cognates to apply to focus domain |
| 1. Demonstrates skill in critiquing literature, manuscripts, proposals, etc. |
| 1. Submits 3 or more articles for publication or prepares dissertation tome and 1 article for publication |
| 1. Establishes and communicates effectively with colleagues to conduct research |
| 1. Demonstrates knowledge of qualitative and quantitative design and analytical methods |
| 1. Gains more in-depth knowledge of methods to apply to research focus (e.g. advanced qualitative or quantitative methods courses) |
| 1. Applies knowledge and skills of both qualitative and quantitative methods to answer research questions |
| 1. Demonstrates ability to logically link a significant researchable problem with a research hypothesis, methods, and application to practice |
| 1. Performs data management and analysis in all research experiences. Conducts own data analysis for dissertation (quantitative or qualitative) |
| 1. Critically analyzes various forms of analytical and empirical methods to generate nursing knowledge and scholarship |
| 1. Explores potential dissemination and adoption of knowledge in clinical practice |
| 1. Critiques scholarly work of others and provides constructive feedback through mock or actual review panels |
| 1. Develops and considers submitting a grant proposal for funding in student’s focus area |
| 1. Understands components of grant management |
| 1. Communicates research that advances the body of scientific knowledge through abstracts, manuscripts, and oral or poster presentations at professional meetings |
| 1. Interprets research findings from the dissertation appropriately for application to practice and policy |
| 1. Attends and constructively participates in professional conferences and organizations |
| 1. Communicates research findings to the public and those who set policy |
| 1. Develops a career transition plan (including career goals and developmental action plan) that demonstrates an understanding of developing a program of research while balancing organizational responsibilities such as teaching, service, and citizenship / governance) |

**Admission Requirements.**  Following receipt of the completed application and a complete set of transcripts from all education institution attended, students will be selected from a pool of qualified applicants meeting the following requirements:

In addition to the requirements of the Graduate College of the University of Nebraska, the College of Nursing considers students for admission to the PhD Program. Requirements for admission to the PhD Program in addition to those listed in the Graduate Studies Bulletin include:

1. BSN or Master’s degree in nursing from an accredited school. Students without a master’s degree in nursing may be accepted into the BSN to PhD program. Necessary master’s course work will be completed under the supervision of the advisor.
2. General congruence between research interests of the applicant with a faculty research advisor, the program’s goals, and the resources of the University.
3. Professional accomplishments as evidenced by a biographical sketch including a description of the applicant’s goals relative to his/her professional career.
4. A minimum grade point average of 3.2 in the BSN and/or master’s program.
5. Graduate Record Examination (GRE) scores.
6. Evidence of capacity for original scholarship and research in nursing.
7. Evidence of the ability to communicate in a scholarly manner both orally and in writing.
8. Participation in an interview with a minimum of two doctoral program faculty members with one of the two faculty being a potential research interest match.
9. Three letters of reference (preferably from persons holding a doctorate): two academic references, preferably one reference focusing on the applicant’s research ability, and one professional performance reference.

United States citizens, prior to admission to the graduate program, must have successfully passed the NCLEX and be legally licensed to practice nursing in one of the 50 states. Foreign citizens entering the MSN-PhD program will need to successfully pass the NCLEX before being accepted to the program, and be legally licensed to practice nursing in the United States and shall provide evidence that they have the equivalent of a master’s degree in nursing. Exceptions may be made on an individual basis. Foreign citizens entering the BSN-PhD will be expected to pass the NCLEX as part of their degree program.

If applicable, students must meet Registered Nurse Licensure requirements in the particular state/states in which they will be performing data collection.

Procedures:

1. The PhD program faculty recommends applicants for admission to the PhD program to the PhD Affairs Council. The PhD Affairs Council then recommends applicants for admission to the Dean for Graduate Studies. The applicant may appeal the recommendation of the PhD Affairs Council according to Graduate College policy as listed in the Graduate College Bulletin.
2. Applications for admission are reviewed by the PhD Program Faculty and the PhD Affairs Council annually in January

Recommendations for admission are made in early spring.

**Program of Study**: In addition to meeting Graduate College requirements for the Ph.D. degree, completion of NRSG 909, 916, 930, 931, 932, 933, 934, 935, 936, 937, 998, and 999 are required. A multivariate statistics course is required. In addition, at least three graduate-level cognates are required to support the student’s area of research and career goals. Students must participate in departmental research seminars.

## NURSING (NRSG)

## NRSG 905. Advanced Seminar (2-3 credits)

***Prerequisites:*** Instructor permission; Admission to PhD Program in Nursing

Students focus on selected research problems, methods and/or other specific topic areas. Topics will vary depending upon the needs and interests of students.

## NRSG 909. Health Care Policy (3 credits)

***Prerequisites:*** Instructor permission or NRSG 930 or NRSG 931

This course provides an in depth look at health policy in the US government system and to the role of research in shaping health policy. Students will critically appraise a policy relevant to an area of research or practice and plan implementation strategies for policy change at the appropriate level of government. Students will develop verbal and written communication skills for effective translation of research and policy implication to lay and professional audiences.

## NRSG 910. Health-Related Instrument Construction and Evaluation (3 credits)

***Prerequisites:*** Instructor permission; Two statistics courses: either BIOS 806 and 808 or two courses that meet requirements of the doctoral program

This course provides a knowledge base and experience in the inductive and deductive process for constructing and evaluating instruments to measure psychosocial, behavioral, biophysiological and clinical phenomena.

## NRSG 914. Management of Chronic Illness (3 credits)

***Prerequisites:*** Instructor permission; Multi-variate statistics

Chronic Illness is the major health problem today, and requires interdisciplinary teams to prevent and manage such illnesses. The course will focus on chronic disease theories and models and research strategies in order to be prepared for a program of studies that addresses the management of chronic illnesses. Concepts such as adoption of healthy lifestyle behaviors, adherence to medical regimens, patient activation to adhere to therapeutic regimen, patient and family resilience; caregiving, risk, vulnerability and disability, symptom management, economic considerations, and planning for the future are examined. Creative and innovative ways to promote patients’ self-manage of chronic illnesses will be explored.

## NRSG 916. Independent Study in Nursing Science (1-6 credit[s])

***Prerequisites:*** Instructor permission; Admission to PhD program

## NRSG 923. Rural Health Research: Considerations and Implications (3 credits)

***Prerequisites:*** Instructor permission; Multi-variate statistics

This course focuses on understanding the issues to conducting research in rural and disparate populations. Emphasizing content related to challenges and disparities in rural health, health care access and health care policy, and strategies for conducting research such as the use of technology, considerations of the environment and community needs. Legal, ethical, political, and economic indications for research in rural areas will be discussed.

## NRSG 928. Translational and Interdisciplinary Outcomes Research (3 credits)

***Prerequisites:*** Instructor permission; Multi-variate statistics

This course focuses on outcomes: measurement, management, and evaluation of health care outcomes and translational research as a process that drives the clinical research engine. The Medical Outcomes Study conceptual framework (Structure of Care, Process of Care, and Outcomes) with an emphasis on the broad categories of outcome types: clinical end points, functional status, general well-being, satisfaction with care, and economic evaluations will be employed. Different translational approaches will be discussed T1-T4 (with an emphasis on T2-T4) along with common and unique research methods used. Legal, ethical, political, and economic implications for practice and research will be discussed.

## NRSG 930. Socialization to the Scholarly Role (3 credits)

***Prerequisites:*** Instructor permission; Admission to PhD program

Doctoral graduates are poised to assume critical leadership roles in academia, the health care system, and/or other entities. Future roles of nurse educators, scholars, and scientists are explored. Strategies for promoting the student’s own professional development and success as a doctoral student are examined. Students develop an understanding of scholarship including discovery, application, integration, and teaching. Students engage in processes to explore and develop their research focus.

## NRSG 931. Transformational Leadership Amid Health Care Crisis and Reform: Bold Ideas, New Results, and Lasting Change (3 credits)

***Prerequisites:*** Instructor permission; Admission to PhD program

This doctoral course introduces the PhD and DNP students to the concepts and principles of transformational leadership within the health care context, and focuses on developing bold ideas, new behaviors, and new vulnerabilities with increasing interconnectedness and complexity in order to achieve new results. Leaders are challenged to implement and sustain organizational and information change to support the healing and care that lead to lasting change. The three major constructs of transformational leadership include: Self transformation, Patient centered transformation, Health systems transformation.

## NRSG 932. Philosophy of Nursing Science (3 credits)

***Prerequisites:*** Instructor permission; Admission to PhD program

This course explores nursing science in the context of classic and contemporary ideas in philosophy of science. Perspectives on scientific progress and the growth of nursing as a scientific discipline are analyzed and applied to students’ research interests. Integrative and translational frameworks for the future are analyzed*.*

## NRSG 933. Theory Development in Nursing and Health Sciences (3 credits)

***Prerequisites:*** Instructor permission; Admission to PhD program

This course provides students with opportunities to critically review theory development in nursing and examine how theories are adapted from other sciences. Students learn how to critically analyze key concepts and substruct selected theories related to their research focus. Students learn to synthesize the literature related to the selected concepts to identify relationships between concepts and gaps in knowledge. The course culminates in students creating a beginning conceptual framework OR adaptation of an established conceptual framework*.*

## NRSG 934. Qualitative Research Methods (3 credits)

***Prerequisites:*** Instructor permission; Admission to PhD program

This course introduces students to philosophic foundations of qualitative research and principals of research designs and methods. Students will critically appraise qualitative studies in their own area of research and apply course content by analyzing a small data set.

## NRSG 935. Qualitative Research Methods (3 credits)

***Prerequisite*:** Must have taken or concurrently taking ANOVA and regression statistics course

This course focuses on experimental and non- experimental designs applicable to the investigation of nursing research questions. The focus of the course is aims/hypothesis development, sampling, data collection methods, reliability, validity of measurement, data analysis, and critique of these elements in published research. Laboratories focus on selected analytic skills and quantitative research techniques.

## NRSG 936. Research Practicum (3 credits)

***Prerequisites:*** Instructor permission

PhD in Nursing core courses NRSG 930, 931, 932, 933, 934, 935

This course extends the content and experience of the previous research courses.  The student’s science-based model will be used to prepare and/or pilot one or more aspects of the methods for the proposed dissertation research.  The practice experience includes initiation or continuation, but not necessarily conclusion of the conduct of a pilot research project with the population and environment of interest.

## NRSG 937. Proposal Development and Grant Administration (3 credits)

***Prerequisites:*** Instructor permission

PhD in Nursing core courses NRSG 930, 931, 932, 933, 934, 935

This course focuses on essential aspects of the development of a grant proposal, including analyzing appropriate funding sources, proposal writing and critiquing, and administering funded proposals. Learning Scientific Writing classes will assist students in writing and components of the research plan.

## NRSG 970. Doctoral Research Other than Dissertation (1-6 credit[s])

***Prerequisites:*** For students admitted in 2009 and prior years only

Each doctoral student participates in an ongoing research project (other than dissertation) under direction of faculty. Doctoral students must take at least 2 semesters and minimum of 4 credits.

## NRSG 998. Doctoral Seminar (1 credit)

***Prerequisites:*** Doctoral students must enroll in this course each semester between completion of all core courses and successful dissertation defense.

Students actively participate in seminar discussion in the area of their dissertation research, including but not limited to application of research conceptualization and methods, synthesis of work from prior course.

## NRSG 999. Doctoral Dissertation (1-9 credit[s])

***Prerequisites:*** Doctoral students must enroll in this course each semester between completion of all core courses and successful dissertation defense, minimum 15 credit hours required prior to graduation.

Independent student research directly related to dissertation. This course may be utilized before or after successful completion of the comprehensive exam.

**PhD in Nursing Program: Courses Offered by Semesters**

|  |  |  |  |
| --- | --- | --- | --- |
| Summer | Fall | Spring | Continuous |
| NRSG 910 (E)  Health-Related Instrument Construction and Evaluation  (EVEN years)  Instructor: B. Pozehl, PhD | **NRSG 928** (E)  Translational & Interdisciplinary Outcomes Research  **(Starting Fall 2013 ODD years)**  **Instructor:**  **L. Zimmerman**, **PhD** | **NRSG 909** (C)  Health Care Policy  **(Every year)**  **Instructor:**  **M. Cramer, PhD** | **NRSG 916** (C)  Independent Study in Nursing Science – State of the Science  **Instructor:**  **PhD Advisor** |
| NRSG 930 (C)  Socialization to the Scholarly Role  (Every year)  Instructors: A. Berger , PhD and L. Zimmerman, PhD | **NRSG 932** (C)  Philosophy of Science  **(Every year)**  **Instructor:**  **K. Schumacher, PhD** | **NRSG 934** (C)  Qualitative Research Methods  **(Every year)**  **Instructor:**  **K. Schumacher, PhD** | **NRSG 916** (I)  Independent Study in Nursing Science – Topic TBD  **Instructor:**  **PhD Advisor** |
| NRSG 931 (C)  Transformational Leadership Amid Health Care Crisis and Reform: Bold Ideas, New Results, and Lasting Change  (Every year)  Instructor: S. Ryan, PhD | **NRSG 933** (C)  Theory Development in Nursing & Health Sciences  **(Every year)**  **Instructor:**  **A. Berger**, **PhD** | **NRSG 935** (C)  Quantitative Research Methods  **(Every year)**  **Instructor:**  **B. Yates, PhD** | **NRSG 936** (C)  Research Practicum  **Instructor:**  **PhD Advisor** |
| Yet to be determined | **NRSG 937** (C)  Proposal Development & Grant Administration  **(Every year)**  **Instructor:**  **C. Pullen, EdD** | **NRSG 998** (C)  Doctoral Seminar  **(Every year)**  **Instructor:**  **A. Berger**, **PhD** | **NRSG 999** (C)  Doctoral Dissertation  **Instructor:**  **PhD Advisor** |
| NRSG 914 (E)  Self Management in Chronic Illnesses  Instructor: A. Berger, PhD | **NRSG 998** (C)  Doctoral Seminar  **(Every year)**  **Instructor:**  **A. Berger**, **PhD** | **Legend:**  **(C)** = Core Course  **(E)** = Elective Course  **(I)** = Independent Study |
| NRSG 923 (E)  Rural Health Research: Considerations & Implications  Instructor: C. Pullen, EdD | PhD Core courses are held on Thursdays  and PhD Elective courses are held on Tuesdays | |

Updated March 2013 – ABerger

Pathology and Microbiology

## Graduate Committee:

Dr. Rakesh Singh (Chair)

Dr. Nora Chapman

Dr. Paul Fey

Dr. Kai Fu

Dr. Tammy Kielian

Dr. Zhixin (Jason) Zhang

An applicant may apply to either the Master of Science degree program or the Doctor of Philosophy degree program.

For admission to the program, the applicant should have a Bachelor’s degree in Science with a broad background in biological sciences, including courses in organic and quantitative chemistry, biochemistry, mathematics, and physics. The applicant must present an academic record and background that are acceptable to the Graduate Committee. To be acceptable, the record and background must include the following or their equivalent:

* Baccalaureate degree with a major in biological or physical sciences
* One academic year of general physics
* Two academic years of chemistry, including organic chemistry
* Twelve semester credit hours in biological sciences
* Three semester credit hours of calculus

Applicants who are deficient in one or two of the course requirements for admission, but who are otherwise well qualified, may be admitted on the provision that deficiencies are removed prior to admission to candidacy.

All application materials required by the Graduate Studies Office must be supplied before action can be taken on a candidate’s application. Written letters of recommendation, and personal motivation as judged by the student’s personal statement influence evaluating the potential and ability of the applicant to complete a rigorous course of advanced and original studies in a field of modern biology.

If it is considered appropriate and necessary to the evaluative process, the applicant will be invited for an interview. For favorable consideration by the departmental Graduate Committee, it is strongly recommended that the applicant’s grade point average be at the level of B or higher. Ph.D. applicants must take the GRE examination and score above the 40th percentile.

There are a series of core courses required to be completed by all M.S. and Ph.D. students in the department of pathology and microbiology. These courses are in the biomedical research training program (BRTP) series and in the pathology and microbiology (PAMM) series. As a graduate student, you will be required to actively participate in several seminar series within the department throughout your educational career within the department. Further, all graduate students in pathology and microbiology are required to attend the UNMC seminar series on matters of ethics related to research at least once during their program.

## PATHOLOGY AND MICROBIOLOGY (PAMM)

## *Fall Semester*

## PAMM 830. Clinical Laboratory Management I (3 credits)

***Instructors:*** Dr. Honeycutt ***Offered:*** Annually

*Cross Listed:* CRGP 880, PAMM 880, PHSC 880, PHAR 880

***Prerequisites:***Instructor permission; Enrolled MS Program in PAMM for CLS training

This course introduces the theory, practical application, and evaluation of laboratory management principles in health care and laboratory information systems, research, educational methodology, quality control, ethics, laboratory operations, and laboratory accreditation standards. Opportunities for building critical thinking, problem-solving, teamwork, communication, professionalism, research, management, and leadership skills are provided.

**PAMM 857. Medical Immunology (2 credits)**

***Instructors:*** Dr. McDonald ***Offered:*** Annually

A study of the basic concepts and mechanisms of modern immunology with discussion of the applications of these principles to the study of diseases.

PAMM 880. Principles and Methodologies of Cancer Research (3 credits)

***Instructors:*** Drs. Luo, Lewis ***Offered:*** Annually

*Cross Listed:* BIOC 880, CRGP 880, PHSC 880, PHAR 880

***Prerequisites:***BRTP 821,822, 823 and 824 or equivalent, permission of instructor.

The course surveys the biology and biochemical mechanisms underlying cancer development, prevention, and therapy.

## PAMM 890. The Molecular Biology of Viruses (3 credits)

***Instructors:*** Dr. Chapman ***Offered:*** Every 2-3 Years

The principles of molecular biology and their application to the study of virology will be presented. The contributions of virology to the understanding of general mechanisms of pathogenesis will be discussed.

## PAMM 902. Protein Mass Spectrometry and Proteomics (2 credits)

***Instructors:*** Dr. Ding ***Offered:*** Annually

***Prerequisites:***Instructor permission required;BRTP 821

This course explores the concept and history of proteomics (2 lecture hours), basic components of mass spectrometry (4), protein identification and quantification techniques (6), proteomic analysis of post-translational modifications (4), protein-protein interactions (2), cellular organelles (20, as well as proteomics in medical applications (6). Laboratory work of identifying cheese proteins using mass spectrometry will be included (6).

***Spring Semester***

## PAMM 871. Antibiotics: Mechanisms of Action and Resistance (3 credits)

***Instructors:*** Dr. Fey ***Offered:*** Every 2-3 Years

***Prerequisites:***Instructor Permission; PAMM 898 Microbiology is recommended

This course is designed to give students an in-depth understanding of how antibiotics inhibit growth in bacterial cells. Genetics of the mechanisms of resistance to multiple classes of antibiotics within both gram-negative and gram-positive bacteria will be covered extensively. In addition, pros and cons of various antimicrobial-resistance testing methodologies will be assessed and discussed.

## PAMM 873 Introduction To Genetic Sequence Analysis (2 credits)

***Instructors:*** Dr. Bastola ***Offered:*** Annually

***Prerequisites:***Instructor Permission; Introductory course to Computational Molecular Biology; Undergraduate course in biochemistry or molecular biology

Fundamentals of using online search techniques for analysis of genetic sequence databases. Course will be taught in UNMC computer clusters by lecture and by completion of assignments using computer programs available on campus. Programming experience is not required.

## PAMM 898. Bacterial Genetics (3 credits)

***Instructors:*** Dr. Bayles ***Offered:*** Every 2 Years

This course will cover the principles of bacterial genetics including genome structure, DNA replication and recombination, transcription and translation, as well as quorum sending and environmental sensing.

## PAMM 922. Neuroimmunology (3 credits) (PHAR 930)

***Instructors:*** Dr. Mosley ***Offered:*** Variable

***Cross-Listed:***PHAR 930

***Prerequisites:***Second semester of 2nd and 3rd year graduate students who have completed BRTP 821 or 822, 824, and one GCBA Neurobiology course (922 or 932) or M.D. /Ph.D. students fully engaged in graduate studies*.* Background in immunology such as Medical Immunology recommended.

The objective of this course is to provide essential knowledge towards a better understanding of the principles of Neuroimmunology and Pharmacology as they apply to the pathogenesis and pharmacotherapeutics of neurodegenerative disorders and disorders in which the immune system is implicated. The course is designed for in depth study of neurobiology, neuroimmunology, neuropharmacology, immunotherapy, and neurodegenerative disorders.

## PAMM 940. Molecular Basis of Human Disease (3 credits)

***Instructors:*** Dr. Carson ***Offered:*** Every 2 Years

***Prerequisites:***Instructor permission or 800 Level Biochemistry course

Beginning with an overview of human genetics, including classical and contemporary methods of genetic analysis, the course explores the relationship between genetic diversity and disease. Human biochemical genetics and inborn errors of metabolism illustrate how specific phenotypes result from specific gene changes. Genetic polymorphism, selection and fitness are also explored with regard to the interactions among human populations and with the environment.

## PAMM 955. Advanced Immunobiology (3 credits)

***Instructors:*** Dr. Johnson ***Offered:*** Every 2 Years

***Prerequisites:***Instructor permission or PAMM 857, BRTP 824

Conceptual study of cellular and biomolecular immunology. Includes mechanisms of immune recognition, regulatory and effector functions, interleukins and clinical immunology, with discussion of current literature.

## PAMM 956. Advanced Immunology Laboratory (2 credits)

***Instructors:*** Dr. Johnson ***Offered:*** Variable

***Prerequisites:***Prior or concurrent PAMM 955, BRTP 824

Techniques of immunology with emphasis on T and B cell identification, studies of lymphokine activities, lymphocyte effector function, monoclonal antibodies, and biotechnology.

***Multiple Semesters***

## PAMM 896. Research Other than Thesis, (Variable credits) Fall, Spring, Summer

***Instructors:*** PAMM Faculty ***Offered:*** Annually

## PAMM 910. Bacterial Pathogenesis (3 credits) Variable

***Instructors:*** Dr. Fey ***Offered:*** Variable

***Prerequisites:***Instructor permission required; BRTP 821-824

This course explores the genetic mechanisms of bacterial pathogenesis in both Gram-positive and Gram-negative bacteria, as well as the immunological response of the host to these pathogens. Particular importance will be placed on major pathogens including Staphylococcus aureus, Salmonella enterica, pathogenic Escherichia coli, and Mycobacterium tuberculosis. However, lesser studied pathogens will also be discussed.

## PAMM 945. Stem Cell Biology (1 Credit) Fall, Spring

***Instructors:*** Dr. Sarvetnick ***Offered:*** Annually

***Prerequisites:***Instructor permission required

This course is designed for an in depth study of the basic science in stem cell biology as well as clinical applications of stem cells. Special emphasis will be on embryonic stem cells, adult stem cells, and stem cell plasticity.

## PAMM 950. Special Topics (1-3 Credit[s]) Variable

***Instructors:*** PAMM Faculty ***Offered:*** Variable

***Prerequisites:***Instructor permission required

Advanced study of current concepts and findings in selected areas of pathobiology, microbiology, immunology. Includes review of current literature, research, clinical problems.

## PAMM 970. Seminar (1 Credit) Fall, Spring

***Instructors:*** Drs. Singh, Bayles ***Offered:*** Variable

## PAMM 992. Advanced Topics in Microbiology - Biomedical Literature (1 Credit)

***Instructors:*** Dr. Kuszynski **Fall, Spring**

***Prerequisites:***Instructor permission required ***Offered:*** Annually

Study of the current scientific literature with emphasis on new and emerging diseases, treatment, and technologies.

**PAMM 899. Master’s Thesis (Variable Credits) Fall, Spring, Summer**

***Instructors:*** PAMM Faculty ***Offered:*** Annually

**PAMM 999. Doctoral Dissertation (Variable Credits) Fall, Spring, Summer**

***Instructors:*** PAMM Faculty ***Offered:*** Annually

Pharmaceutical Sciences

## Graduate Committee:

Dr. Yazen Alnouti (Chair)

Dr. Joseph Vetro

Dr. Matthew Kelso

Dr. Jered Garrison

Dr. Jonathan Vennerstrom (Advisor)

The Pharmaceutical Sciences Graduate Program is intended for those who wish to pursue a Program of Study leading to the Master of Science or Doctor of Philosophy degrees.

**Admission Requirements**

Applicants should have a B.S. degree in pharmacy, biology, chemistry, engineering, mathematics, or related areas with a grade average of 3.0 or better on a 4.0 scale. The Graduate Record Examination is required for all applicants.

**Course requirements**

The course of study for M.S. and Ph.D. students will be determined by the advisory or supervisory committee, respectively.

## PHARMACEUTICAL SCIENCES (PHSC)

## PHSC 820. Selected Topics in Pharmaceutical Sciences (1-2 credit[s])

***Instructors:*** PHSC Faculty Advisor ***Offered:*** Annually

***Prerequisites:***Instructor permission required Every Semester

A detailed study of specific subject areas related to the pharmaceutical sciences. Evaluation and discussion of the scientific literature is an integral part of the course.

## PHSC 821. Organic Chemistry and Applications to Biomolecules (2 credits)

***Instructors:*** Dr. Dong ***Offered:*** Even Years

Course deals with basic principles to understand structure, reactivity, and synthesis of bioactive organic molecules. The focus is on types of key organic reactions used in drug synthesis, mechanism of reactions, scope and limitations of reactions, design of synthetic route for bioactive target compound, and application of biocompatible reactions to biomedical systems.

## PHSC 825. Ophthalmic Drug Discovery (3 credits)

***Instructors:*** Dr. Kador ***Offered:*** Variable

This course will survey ocular diseases, their pathogenesis, current drug treatment, and approaches to the development of drug treatment. Special methods for the evaluation of ocular drugs as well as use of animal models will be included.

**PHSC 830. Advanced Medicinal Chemistry (3 credits)**

***Instructors:*** Dr. Vennerstrom ***Offered:*** Odd Years

***Prerequisites:***PHSC 626 or equivalent

Course will apply essential concepts of medicinal chemistry at advanced level. Receptor theory, stereochemistry, chemical bonding, and bioisosterism will be discussed relating to drug design.

## PHSC 84.3 Spectroscopic Organic Structural Analysis (3 credits)

***Instructors:*** Dr. Vennerstrom ***Offered:*** Even Years

***Prerequisites:***First Year Organic Chemistry Variable Semesters

This course deals with a theoretical and practical understanding of UV, IR, NMR and MS applied to organic structural elucidation. The advantages, disadvantages, limitations, and appropriate use of each spectroscopic technique will be described*.*

## PHSC 845. Quantitative Pharmaceutical Analysis (3 credits)

***Instructors:*** Dr. Marky ***Offered:*** Even Years

***Prerequisites:***Instructor Permission; First Year Organic Chemistry Fall Semester Lecture and laboratory course covering the theory and applications of current analytical methods for the quantitative determination of drugs, metabolites, and other biologically active agents.

## PHSC 848. Nanoimaging And Bioimaging (3 credits)

***Instructors:*** Dr. Lyubchenko ***Offered:*** Odd Years

This course will review various nanotechnology approaches to imaging, probing and manipulation at the nanoscale and discuss significance and impact of these technological advances on pharmaceutical and biomedical industries.

## PHSC 851. Innovative Drug Delivery Systems (3 credits)

***Instructors:*** Dr. Wang ***Offered:*** Even Years

***Prerequisites:***Instructor Permission Spring Semester

This course will examine the innovations in the design, preparation, and evaluation of modern drug delivery systems.

## PHSC 852. Pharmaceutical Chemistry for Drug Delivery and Nanomedicine (3 credits)

***Instructors:*** Dr. Wang ***Offered:*** Odd Years

This course will review various chemical reactions and their applications in pharmaceutics, drug delivery, and nanomedicine. Practical and laboratory experiments will be included.

## PHSC 861. Advanced Pharmacokinetics And Pharmacodynamics (3 credits)

***Instructors:*** To Be Announced ***Offered:*** Varies

***Prerequisites:***Instructor Permission or PHSC 674 Fall Semester

Mathematical description of rate and extent of drug absorption, distribution, elimination, action.

## PHSC 875. Chemical Carcinogenesis (2 credits) II even yrs.

***Instructors:*** Dr. Rogan ***Offered:*** Even Years

***Prerequisites:***Instructor Permission or Biochemistry course Spring Semester

This course will present the basic concepts of chemical carcinogenesis, and introduce the major carcinogens, their biochemistry of activation and mode of action.

PHSC 880. Principles and Methodologies of Cancer Research (3 credits)

***Instructors:*** Drs. Luo, Lewis ***Offered:*** Annually

*Cross Listed:* BIOC 880, CRGP 880, PAMM 880, PHAR 880 Fall Semester

***Prerequisites:***BRTP 821,822, 823 and 824 or equivalent, permission of instructor.

The course surveys the biology and biochemical mechanisms underlying cancer development, prevention, and therapy.

## PHSC 885. Physical Pharmacy (4 Credit)

***Instructors:*** To Be Announced ***Offered:*** Odd Years

*Prerequisite:* Instructor Permission or PHSC 870 Spring Semester

A study of physicochemical principles applicable to drug delivery systems, with emphasis on solubility, diffusion, dispersed systems, and stability testing.

## PHSC 890. Polymer Therapeutics (3 credits)

***Instructors:*** To Be Announced ***Offered:*** Even Years

*Prerequisite:* Instructor Permission Fall Semester

A study of the physicochemical and biomedical properties of synthetic polymers with an emphasis on their application as modern therapeutics*.*

## PHSC 896. Research Other Than Thesis (1-8 Credit[s])

***Instructors:*** PHSC Faculty Advisor ***Offered:*** Even Years

*Prerequisite:* Instructor Permission Every Semester

## PHSC 902. Drug Delivery and Nanomedicine Research (3 credits)

***Instructors:*** Dr. Bronich ***Offered:*** Annually

*Prerequisite:* Instructor Permission Fall Semester

This is a webcast seminar course based on the lectures presented by outside and internal Faculty speakers in the seminar program of the Center of Drug Delivery and Nanomedicine (CDDN). Videos of these seminars are posted online (<http://cddn.unmc.edu/seminarchive>).

## PHSC 921. Biophysical Chemistry (3 credits)

***Instructors:*** Dr. Marky ***Offered:*** Even Years

*Prerequisite:* Instructor Permission Spring Semester

The course will cover the biophysical chemistry of nucleic acids and proteins including the study of these molecules using NMR, calorimetric, and fluorescence.

## PHSC 924. Drug Metabolism and Disposition (3 credits)

***Instructors:*** To Be Announced ***Offered:*** Even Years

*Prerequisite:* Instructor Permission; Biochemistry Course Fall Semester

An in-depth consideration of the various factors which influence the metabolism of drugs and foreign chemicals (xenobiotics).

## PHSC 950. Advanced Toxicology (3 credits)

***Instructors:*** Dr. JoEllyn McMillan ***Offered:*** Odd Years

*Prerequisite:* Instructor Permission Spring Semester

This course deals with the adverse effects of chemicals on biological systems. Physiological and biochemical mechanisms of toxicity at the cellular and subcellular levels will be emphasized.

## PHSC 960. Current Topics in Pharmaceutical Sciences (1 Credit)

***Instructors:*** PHSC Faculty ***Offered:*** Annually

*Prerequisite:* Mandatory for students Every Semester

This course is mandatory each semester for all students enrolled in the Pharmaceutical Sciences Graduate Program.

## PHSC 970. Seminar in Pharmaceutical Sciences (1 Credit)

***Instructors:*** PHSC Faculty ***Offered:*** Annually

*Prerequisite:* Instructor Permission required Every Semester

This course is mandatory each semester for all students enrolled in the Pharmaceutical Sciences Graduate Program.

## PHSC 899. Master’s Thesis (Variable Credits)

***Instructors:*** PHSC Faculty ***Offered:*** Annually, Every Semester

## PHSC 999. Doctoral Dissertation (Variable Credits)

***Instructors:*** PHSC Faculty ***Offered:*** Annually, Every Semester

Pharmacology and Experimental Neuroscience

**Graduate Committee**

Dr. Keshore Bidasee (Chair)

Dr. Shilpa Buch;

Dr. Daniel Monaghan

Dr. Huangui Xiong

Dr. Tony Wilson

**For Degree Tracks and Requirements, please refer to PEN Graduate Studies Website:**

http://www.unmc.edu/pharmacology/graduate\_students.htm

**PHARMACOLOGY AND EXPERIMENTAL NEUROSCIENCE (PHAR)**

***Fall Semester***

**PHAR 815. Medical Pharmacology I (5 credits)**

***Instructor:*** Dr. David McMillan ***Offered:*** Annually

General principles governing drug absorption, distribution, and excretion, the molecular mechanisms of drug action, and the basic and clinical pharmacology of the autonomic, endocrine, and cardiovascular systems.

## PHAR 901. Receptors and Cell Signaling (3 credits)

***Instructor:*** Dr. Bidasee ***Offered:*** Annually

*Prerequisite:* Instructor Permission or PHAR 815 Spring Semester

Detailed description of receptors in terms of their roles in the recognition of neurotransmitters, drugs, and hormones, and their regulation of signal transduction pathways in the cell. Discussion of the methods for in vitro and in vivo analysis of receptors is included.

## PHAR 922. Neurobiology I (3 credits)

*Instructor:* Dr. Rodriguez-Sierra ***Offered:*** Variable

***Prerequisites:*** Permission of instructor

The course consists of presentation of current literature addressing the classical topics of neuroembryology, neurohistology, neuroanatomy, neurophysiology, neuropharmacology, and neuropathology.

## *Spring Semester*

## PHAR 816. Medical Pharmacology II (4 credits)

***Instructor:*** Dr. David McMillan ***Offered:*** Annually

***Prerequisites:*** Permission of instructor and PHAR 815

Basic and clinical pharmacology of agents affecting central nervous system, pulmonary and musculoskeletal systems, kidney, gastrointestinal tract, and infectious and malignant processes. *.*

**PHAR 820. Current Methods in Neurosciences (2 credits)**

***Instructor:*** Dr. Xiong  ***Offered:*** Annually

***Prerequisites:*** Permission of instructor

The primary goal of this course is to provide graduate students, through lectures and practical laboratory exposure, with current techniques and methodologies in neurosciences, which are most likely used in their thesis research.

## PHAR 930. Neuroimmunology (3 credits) (PHAR 930)

***Instructors:*** Dr. Mosley ***Offered:*** Variable

***Cross-Listed:***PAMM 922

***Prerequisites:***Second semester of 2nd and 3rd year graduate students who have completed BRTP 821 or 822, 824, and one GCBA Neurobiology course (922 or 932) or M.D. /Ph.D. students fully engaged in graduate studies*.* Background in immunology such as Medical Immunology recommended.

The objective of this course is to provide essential knowledge towards a better understanding of the principles of Neuroimmunology and Pharmacology as they apply to the pathogenesis and pharmacotherapeutics of neurodegenerative disorders and disorders in which the immune system is implicated. The course is designed for in depth study of neurobiology, neuroimmunology, neuropharmacology, immunotherapy, and neurodegenerative disorders. The course is based on the textbook *Neuroimmune Pharmacology,* edited by Ikezu and Gendelman. This is an essential course for Neuroscience Track in Department of Pharmacology and Experimental Neuroscience.

**PHAR 950A. Special Topics Pharmacology: Pharmacology Graduate Students (2 credits)**

***Instructor:*** Drs. Bidasse, David McMillan ***Offered:*** Annually

*Prerequisite:* Instructor Permission

Consult the current listing of graduate course offerings for the particular topic being offered.

***Multiple Semesters***

**PEN 814. Scientific Writing (2 credits) Fall, Spring**

*Instructor:* Drs. Toews, Schultz ***Offered:*** Annually

*Cross Listed:* CIP 814

***Prerequisites:***Permission of Instructor

This course develops the writing skills needed to prepare each section of a manuscript for submission to scientific journals, as well as figure design, use of reference software and responding to reviewer critiques. Students must have sufficient research data to support a preliminary manuscript, which will be constructed through completion of individualized assignments throughout the course.

## PHAR 896. Research Other Than Thesis (1-9 Credit[s]) Fall, Spring, Summer

***Instructor:*** PEN Faculty ***Offered:*** Annually

*Prerequisite:* Instructor Permission

**PHAR 950. Special Topics in Pharmacology (Variable credits) Fall, Spring**

***Instructor:*** Dr. Toews ***Offered:*** Annually

*Prerequisite:* Instructor Permission

Consult the current listing of graduate course offerings for the particular topic being offered.

## PHAR 970. Seminar (1 credit) Fall, Spring

***Instructor:*** PEN Faculty ***Offered:*** Annually

## PHAR 999. Doctoral Dissertation (Variable credits) Fall, Spring, Summer

***Instructor:*** PEN Faculty ***Offered:*** Annually