

COURSE LISTINGS

INTERDISCIPLINARY COURSES

IDSP 111 Basic Biochemistry, Molecular and Cellular Biology I (2 credits, letter grade)

Faculty Member in charge: Stephan Witt, Ph.D.

(Department of Biochemistry and Molecular Biology)

When course is offered: Fall, Annually

Prerequisites for course: None

Textbook: *Biochemistry*, Voet and Voet, 4th Edition

Description of course: This course provides an introduction to the basic biochemical properties of amino acids and proteins, a discussion of protein assembly and folding into the three dimensional structures required for function and an introduction to basic principles of enzyme kinetics, examples of enzyme active site structure and mechanism of action. Topics on membrane transport, carbohydrates and the important biochemical processes and enzymes that cells utilize to generate metabolic energy are also included in this section.

IDSP 112 Basic Biochemistry, Molecular and Cellular Biology II (2 credits, letter grade)

Faculty Member in charge: Brent Reed, Ph.D.

(Department of Biochemistry and Molecular Biology)

When course is offered: Fall, Annually

Prerequisites for course: IDSP 111

Textbook: *Biochemistry*, Voet and Voet, 4th Edition

Description of course: Selected features of the metabolism of carbohydrates, lipids, amino acids and nucleotides are presented with discussions of the important mechanisms cells utilize to regulate these processes. The course concludes with a basic introduction to nucleic acids structure and function: replication, transcription, RNA processing and protein synthesis.

IDSP 113 Genetics (1 credit, letter grade)

Faculty Member in charge: Kenneth Peterson, Ph.D.

(Department of Microbiology and Immunology)

When course is offered: Spring, Annually

Prerequisites for course: IDSP 111,112

Textbook: *Molecular Biology of the Cell*, Alberts et al, 5th Edition

Description of course: This course will provide the student with an overview of classical genetics as well as an in-depth consideration of several fundamental processes involving DNA, including its recombination and repair. The course will also explore the emerging areas of genomics and proteomics. Lectures and discussions of the current literature will comprise the course.

IDSP 114 Cell Biology (2 credits, letter grade)

Faculty Member in charge: Kelly Tatchell, Ph.D.

(Department of Biochemistry and Molecular Biology)

When course is offered: Spring, Annually

Prerequisites for course: IDSP 111, 112, 113

Textbook: *Molecular Biology of the Cell*, Alberts et al, 5th Edition

Description of course: An introduction to cell structure and the mechanisms underlying cell division and protein trafficking. The course will focus on the cell biology of the nucleus, regulation of the cytoskeleton, secretory pathways, endocytosis, protein targeting, ubiquitin-mediated proteolysis, apoptotic mechanisms, mechanisms of cell division and cell cycle control, the mechanisms involved in protein and membrane trafficking, and adhesion-mediated biology. Lectures and discussions of the current literature will comprise the course.

IDSP 115 Molecular Signaling (1 credit, letter grade)

Faculty Member in charge: Andrew Yurochko, Ph.D.

(Department of Microbiology and Immunology)

When course is offered: Spring, Annually

Prerequisites for course: IDSP 111, 112, 113, 114

Textbook: *Molecular Biology of the Cell*, Alberts et al, 5th Edition

Description of course: A modern comprehensive course concerning the regulation of cellular signaling processes in eukaryotic cells. Emphasis will be placed on the molecular mechanisms involved and approaches used to understand receptor-mediated signaling and signal transduction pathways. Attention is also focused on the current molecular and cellular biological techniques used today in the investigation of these important cellular processes.

IDSP 116 Methods in Biomedical Sciences: Biochemical and Molecular Methods

(1 credit, letter credit)

Faculty Member in charge: Donard Dwyer, Ph.D.

(Department of Pharmacology, Toxicology and Neuroscience)

When course is offered: Fall, Annually

Prerequisites for course: none

Textbook: *Principles and Techniques of Practical Biochemistry*, Wilson and Walker, 5th Edition

Description of course: Methods in Biomedical Sciences is a discussion of principles and application of common methods used for detection and analysis of macromolecules and their structure, function, and interaction. This course covers biochemical methods of separation and detection of macromolecules as well as structural analysis. There will be some form of out-of-class work for most lecture topics, including problems, literature reviews and visits to core facilities and major equipment. The goals of the course are: to develop an understanding of basic methods applied to the study of proteins and nucleic acids; to become familiar with the instrumentation used for these methods- (students should be aware of what instrumentation is required to use a particular method and have a basic idea how it is used), and to become aware of the ways that these methods and techniques are applied to biomedical study, i.e., understand what methods could/should be used to study a particular scientific problem. There will be one exam at the end of the course.

IDSP 117 Methods in Biomedical Sciences: Recombinant DNA and Cell Biology

(1 credit, letter grade)

Faculty member in charge: Rona Scott, Ph.D.

(Department of Microbiology and Immunology)

When course is offered: Fall, Annually

Prerequisites for course: none

Description of course: Goals are the same as for IDSP 116. This course covers recombinant DNA methods including cloning and gene expression, DNA sequencing, PCR, and mutagenesis. The course also covers analysis of nucleic acids and proteins, including interaction detection methods,

genomics and proteomics and also covers direct observation methods of analysis and immunological methods. There will be one exam at the end of the course.

IDSP 119 Gene Expression (1 credit, letter grade)

Faculty Member in charge: David Gross, Ph.D.

(Department of Biochemistry and Molecular Biology)

When course is offered: Spring, Annually

Prerequisites for course: IDSP 111, 112, 113, 114, 115

Textbook: *Molecular Biology of the Cell*, Alberts et al, 5th Edition

Description of course: This course will provide the student with an overview of fundamental processes of transposition and transcription in procaryotes and eukaryotes. The course will also explore the emerging areas of gene transfer, siRNA and model systems of eukaryotic gene expression. Lectures and discussions of the current literature will comprise the course.

IDSP 201 Introduction to Human Cancer-Research, Treatment and Prevention (2 credits, letter grade)

Faculty member in charge: Hari Koul, Ph.D.

(Department of Biochemistry and Molecular Biology)

When course is offered: As needed

Prerequisites for course: Permission of course director.

Description of course: This will be a two credit introductory course team-taught by basic scientists and clinical scientists. Four topics will be covered including: 1) An introduction and overview of cancer; 2) cancer cell biology; 3) the diagnosis, treatment and prevention of cancer and 4) the molecular pathogenesis and treatment of specific cancers. The focus of this course will be to provide information concerning what is currently understood about the biochemical mechanisms operating during neoplasia and will include up-to-date information about oncogenes, tumor suppresser genes, metastasis, angiogenesis, tumor immunology, diagnostic approaches (conventional and molecular) and treatment modalities. The course will consist of lectures that stress the research approaches and finding that currently form the basis for our understanding of how neoplastic cells arise and form cancers. This course will form the basis for more advanced courses in the cell and molecular biology of cancer.

IDSP 202 Mechanisms of Cancer Invasion and Metastasis (1 credit, letter grade)

Faculty Member in charge: Hari Koul, Ph.D.

(Department of Biochemistry and Molecular Biology)

When course is offered: As needed

Prerequisites for course: IDSP 201, Approval by Course Director

Description of course: An advanced course, involving lecture and discussion, to study the processes involved in the development of metastatic disease. Students will learn the fundamentals, including the key molecules, events and signaling pathways that are directly involved in the invasive/metastatic processes. Important seminal papers as well a current literature will be used in student discussion.

IDSP 203 Discussions in Cancer Biology (0.5 credit, S/U)

Faculty member in charge: Jason Bodily, Ph.D.

(Department of Microbiology and Immunology)

When course is offered: Fall and Spring semesters

Prerequisites for course: none

Description of course: A journal club/research in progress format is used for the discussion of published and unpublished findings in cancer biology. Emphasis is on critical evaluation of experimental design and interpretation. Students will present and also participate in overall discussions. Grading will be based on participation and attendance. The class will meet once a week for 1 hr.

IDSP 211 Foundations of Biomedical Sciences I - General Principles (1 credit, letter grade)

Faculty member in charge: Norman Harris, Ph.D.

(Department of Molecular and Cellular Physiology)

When course is offered: Fall, Annually

Prerequisites for course: None

Description of course: An integrative introduction to cell physiology/anatomy and to the general principles of pharmacology.

IDSP 212 Foundations of Biomedical Sciences I - Cardiovascular System (2 credits, letter grade)

Faculty member in charge: Steven Alexander, Ph.D.

(Department of Molecular and Cellular Physiology)

When course is offered: Fall, Annually

Prerequisites for course: None

Description of course: An integrative approach to the physiology, anatomy, histology and pharmacology of the cardiovascular system.

IDSP 213 Foundations of Biomedical Sciences I - Renal System (1 credit, letter grade)

Faculty member in charge: Karen Stokes, Ph.D.

(Department of Molecular and Cellular Physiology)

When course is offered: Spring, Annually

Prerequisites for course: None

Description of course: An integrative approach to understanding the kidney's role in maintaining homeostasis. Emphasis will be on global regulation of salt, water and acid/base balance seen from a traditional as well as molecular perspective. Where available "knockout" animals and functional expression analyses are incorporated.

IDSP 214 Foundations of Biomedical Sciences I - Respiratory System (1 credit, letter grade)

Faculty member in charge: Christopher Pattillo, Ph.D.

(Department of Molecular and Cellular Physiology)

When course is offered: Spring, Annually

Prerequisites for course: None

Description of course: An integrative course covering the physiology, anatomy/histology and pharmacology of the respiratory system.

IDSP 216 Foundations of Biomedical Sciences II - Gastrointestinal System (1 credit, letter grade)

Faculty member in charge: Felicity Gavins, Ph.D.

(Department of Molecular and Cellular Physiology)

When course is offered: Fall, Annually

Prerequisites for course: None

Description of course: Integrative course in the anatomy, physiology and pharmacology of the gastrointestinal tract.

IDSP 217 Foundations of Biomedical Sciences II - Endocrine System (1 credit, letter grade)

Faculty member in charge: Norman Harris, Ph.D. /Diana Cruze-Topete, Ph.D.

(Department of Molecular and Cellular Physiology)

When course is offered: Spring, Annually

Prerequisites for course: None

Description of course: An integrative course covering the physiology, anatomy, histology and pharmacology of the endocrine system.

IDSP 218 Foundations of Biomedical Sciences II - Nervous System (2 credits, letter grade)

Faculty member in charge: Elizabeth Disbrow, Ph.D.

(Department of Pharmacology, Toxicology and Neuroscience)

When course is offered: Spring, Annually

Prerequisites for course: None

Description of course: Integrative anatomical, physiological and pharmacological examination of the nervous system.

IDSP 219 Foundations of Biomedical Sciences II - Inflammation, Immunity and Infection
(1 credit, letter grade)

Faculty member in charge: Martin Muggeridge, Ph.D.

(Department of Microbiology and Immunology)

When course is offered: Summer, Annually

Prerequisites for course: None

Description of course: An integrative approach to the anatomy, histology, physiology and pharmacology of inflammation and immunity to include discussion of antimicrobial and anti-cancer therapy.

IDSP 226 Basic Biostatistics (1 credit, letter grade)

Faculty member in charge: Sandra C. Roerig, Ph.D.

(Department of Pharmacology, Toxicology and Neuroscience)

When course is offered: annually, spring semester

Prerequisites for course: none

Textbook: *Understanding Statistics in the Behavioral Sciences*, R. Pagano, 10th edition

Description of course: This course is designed for graduate students who have little background in statistics. The lectures and associated homework assignments will provide working knowledge of basic statistical methods and their applications. Lectures will be based on chapters from the textbook. Topics will include frequency distribution, correlations, regression analysis, probability, distributions and hypothesis testing. Examples of use of these methods, descriptions of experimental design incorporating these methods and ethical treatment of data will be considered in all aspects of the course.

IDSP 227 Advanced Biostatistics (1 credit, letter grade)

Faculty member in charge: Clif Frilot, Ph.D.

(School of Allied Health Professions)

When course is offered: annually, spring semester, after IDSP 226

Prerequisites for course: none

Textbook: *Understanding Statistics in the Behavioral Sciences*, R. Pagano, 10th edition

Description of course: This course is designed for a graduate student who has knowledge of basic statistics. The lectures and homework assignments will provide working knowledge of more advanced statistical methods/concepts and their applications. Lectures will be based on chapters from the textbook. Additional material will supplement this text. Topics will include power analysis, parametric and non-parametric analysis, analysis of variance and components and factor analyses. Examples of use of these methods, descriptions of experimental design incorporating these methods and ethical treatment of data will be considered in all aspects of the course.

IDSP 230 Advances in Gene Therapy (1 credit, letter grade)

Faculty member in charge: Ronald Klein, Ph.D.

(Department of Pharmacology, Toxicology & Neuroscience)

When course is offered: As needed

Prerequisites for course: IDSP 211-214, 216-219

Description of course: An overview of gene therapy emphasizing the clinical history, the types of diseases that could benefit the most and ethical issues. Some of the major gene transfer vector systems will be covered in detail, highlighting advances in this rapidly developing field. Student's grades will be based on participation in discussion of current research and review articles, as well as exams.

IDSP 235 A and B Grant Writing (A offered for 1 letter grade credit, B offered for S/U)

Faculty members in charge: Andrew Yurochko, Ph.D.

(Department of Microbiology and Immunology)

When course is offered: Annually, fall semester

Prerequisites for course: None

Description of Course: This IDSP235 Grant Writing course will provide a broad overview of the principles of grantsmanship, and the multiple steps involved in grant writing and submission and review of a grant application. Elements of the class will include how to write a competitive grant, grant submission, the role of the Office of Sponsored Programs in grant submissions, the review process, and the submission of revised applications. The overall goal of the course is to provide the student with a basic understanding of the entire grant process, along with an education about the specifics of grant writing and how to try to secure funding as an academic scientist.

The ability to successfully compete in academic science (and other scientific arenas) is largely dependent on one's communication and grant writing skills. Thus, it is important that recent graduates have the critical skills to present significant, innovative, and testable research problems in a competitive grant format. This course will attempt to improve a student's grant writing skills by educating the student about the grant process and then providing them with a chance to complete each grant element in the submission of a scientific research grant. Twelve lectures over successive Fridays are designed to cover the various points of a successful grant application. The students will receive both an understanding of the grant process in a lecture format and a hands-on format that will allow the student to understand the importance of each element within a grant. Students will also watch a grant review take place and participate themselves in a mock grant review with the goal of gaining an appreciation for how a grant is reviewed and the significance of each element of a grant to the final outcome of that submission.

This IDSP235 Grant Writing class can either be taken for a letter grade (IDSP235A) or for a pass/fail (IDSP235B) option. For students participating in the graded format, attendance at all of the lectures is required and they will be expected to turn in for a grade, mock aspects of a grant, as well as a written review critique of a grant that is presented during the mock study section, which together will

be graded in a letter grade format (A, B, C, D, and F). For those students taking the pass/fail (S/U) option, attendance at all of the lectures is required and they will be expected to turn in for a grade, mock aspects of a grant, as well as a written review critique of a grant that is presented during the mock study section, which together will be graded in P/F or S/U format (A, B, and C = S (P); and D and F = U (F)).

IDSP 240 Philosophical and Ethical Issues in Science (1 credit, S/U)

Faculty member in charge: Sandra C. Roerig, Ph.D.

(Department of Pharmacology, Toxicology and Neuroscience)

When course is offered: Summer, annually

Prerequisites for course: None

Textbook: *Scientific Integrity*, Francis L. Macrina, 4th edition

Description of course: The objective of this course is to provide an understanding of the underlying philosophy in scientific endeavors and the ethical issues that face scientists. The course will involve detailed discussions about the history of scientific thought, the scientific method, experimentation and data collection, mentoring and current ethical issues. Sessions will include lectures and discussions by faculty, students and postdoctoral fellows.

IDSP 250 A & B Current Trends in Toxicology (1 credit, S/U)

Faculty member in charge: Kenneth McMartin, Ph.D.

(Department of Pharmacology, Toxicology & Neuroscience)

When course is offered: Every semester

Prerequisites for course: None

Description of course: A discussion format in which students, postdoctoral fellows, research personnel and faculty from the Health Sciences Center with a common interest in Toxicology and Environmental Health meet to present emerging concepts, research data and hypothesis-driven research proposals in all toxicological sub-specialties. Topics will be selected from peer-reviewed Toxicology-based literature, from research findings from the participant's own laboratories, or from proposals in preparation for external funding. Class sessions will include occasional, scheduled meetings with Toxicologists from nearby institutions in the tri-state area. Students will be taught oral presentation skills, methods of evaluating current trends in Toxicology literature and research, and fundamentals of the grant-writing and review process. Grading will be based on student presentations and participation in class discussion. Section A is offered in the fall semester for 0.5 credit and Section B is offered in the spring semester for 0.5 credit.

BIOCHEMISTRY AND MOLECULAR BIOLOGY COURSES

BIOCH 207. Introduction to Special Methods of Research (1-6 credits, S/U). This course provides first-year students credit for their efforts in laboratory rotation. Each new student is expected to participate in three separate rotations, each of two to three months duration. Course director: Dr. Brent Reed

BIOCH 223. Physical Biochemistry. (2 credits, letter grade) A lecture course taught in the spring semester of odd numbered years. Discussions of physical and chemical techniques used in biochemistry to study macromolecular architecture and interactions. Course Director: Dr. Eric First.

BIOCH 271. Topics in Biochemistry and Molecular Biology: Cell Signaling. (1 credit, letter grade)

A seminar/discussion course based on current literature that is offered in the spring semester. The theme (signaling pathway) covered by the course changes for each offering. The introduction of a topic by the instructor is followed by literature discussions led by students. Past examples of course themes include MAPK signaling in yeast, *Drosophila* and vertebrates, and two-component regulatory systems in prokaryotes and eukaryotes. Course Director: Dr. Lucy Robinson.

BIOCH 281. Topics in Biochemistry and Molecular Biology: Molecular Mechanisms of Post-transcriptional Control. (1 credit, letter grade) A literature-based course dealing with post-transcriptional control of gene expression in eukaryotic cells and their viruses. Topics will include mRNA splicing, mRNA stability, translational control, and protein targeting. Offered in the fall semester of even-numbered years. Course Director: Dr. Ricky De Benedetti.

BIOCH 282. Topics in Biochemistry and Molecular Biology: Protein Structure/Function. (1 credit, letter grade) A series of lectures focused on the use of state-of-the-art approaches to study protein structure, protein folding and protein-ligand interactions. Taught in the fall semester of even-numbered years. Course Director: Dr. Eric First

BIOCH 283. Topics in Biochemistry and Molecular Biology: Molecular Mechanisms of Transcriptional Control. (1 credit, letter grade) A literature-based course covering the role of promoter-specific activators and repressors, the nature and role of the general transcriptional machinery, and the role of nucleosomes and higher-order chromatin structures in regulating transcription. Offered in the fall semester of even-numbered years. Course Director: Dr. David S. Gross.

BIOCH 286. Topics in Biochemistry and Molecular Biology: Classical and Molecular Genetics. (1 credit, letter grade) This course will emphasize classical genetic methods as they apply to modern molecular biology. The course content will rely on yeast as an experimental organism, although the intent is to teach genetic principles as they apply to eukaryotic organisms in general. Offered in the fall semester of odd-numbered years. Course Director: Dr. Kelly Tatchell.

BIOCH 287. Topics in Biochemistry and Molecular Biology: Applications of Spectroscopic Techniques to Biochemical Problems. (1 credit, letter grade) This course emphasizes the principles of well-established methods, such as fluorescence spectroscopy, and new methods, such as surface plasmon resonance spectroscopy, and their applications to biochemical problems. Offered in the spring semester of odd-numbered years. Course Director: Dr. Stephan Witt.

BIOCH 288. Scientific Writing. (1 credit, letter grade) A course designed to teach fundamentals of writing a scientific paper, writing a grant proposal, and identifying topics and approaches suitable for grant proposals. Course offered spring semester of every year. Course Director: Dr. Hari Koul

BIOCH 290. Introduction to Bioinformatics. (3 credits, letter grade) This course introduces the computational and biological concepts and skills required for the field of bioinformatics. It is intended to provide an overview of the field of bioinformatics and train both life and computer science students to use commonly used bioinformatics programs. Offered in the spring semester of even-numbered years. Course Directors: Drs. Eric First and Marjan Trutschl.

BIOCH 298. Journal Club (0.5 credit, S/U). Each student is expected to present and discuss the content of a research article taken from the current literature and to participate in all journal club meetings scheduled in the fall and spring semesters. First and second year students should choose a faculty advisor who is not their dissertation or rotation director to advise in choice of topic and to critique the journal club both prior to and after the presentation. Course director: Dr. Nancy Leidenheimer.

BIOCH 299. Research Seminar (0.5 credit, S/U). This course offers credit for participation in the departmental seminar program and student seminar program. Each student is expected to present a formal research seminar on their research project at least once during his/her degree candidacy and to participate in all departmental seminars scheduled in the fall and spring semesters. Course director: Dr. Kelly Tatchell

BIOCH 300. Thesis Research. (1-6 credits, S/U) This course offers credit for research work applied to the Masters thesis. Course director: Dr. Brent Reed

BIOCH 400. Dissertation Research. (1-9 credits S/U) This course provides students credit for their research work applied to their Ph.D. dissertation. Course director: Dr. Brent Reed

CELLULAR BIOLOGY AND ANATOMY COURSES

CEBIO 200C *Integrative Structural Biology* (Histology, 3 credits, letter grade). An introduction to the microscopic anatomy and function of human tissues. Course director: Dr. David DeSha

CEBIO 216 *Human Developmental Biology* (3 credits, letter grade). Lectures on human development correlated with films and laboratory demonstrations. Participation of students is required in the form of discussions and presentations. Course director: Dr. David DeSha

CEBIO 223 *Molecular Basis of Disease* (2 credits, letter grade). This course integrates basic science knowledge obtained by students in the first year of graduate school with mechanisms of disease progression. The course consists of five modules taught by the basic science faculty in the Division of Research of the Department of Pathology. Lectures cover 1) what is known about the disease from a clinical perspective; 2) unanswered clinical questions that need to be addressed from a basic science perspective; 3) what is known about the basic mechanisms of disease initiation and progression. Course director: Dr. Kevin McCarthy.

CEBIO 224 *Molecular Basis of Disease Journal Club* (1 credit, S/U). The journal club serves to integrate basic science knowledge with mechanisms of disease progression. Dr. Kevin McCarthy

CEBIO 250 *Research Methods* (1-9 credits, S/U). A laboratory course in which students either rotate through faculty laboratories and become acquainted with the research area and laboratory routines in each; or perform research in their selected dissertation lab prior to the proposal defense. Course Director: Dr. Edward Glasscock

CEBIO 260 *Comprehensive Human Structural Biology* (5 credits, letter grade). A lecture- and human dissection-based course that provides comprehensive information on the structure and function of the human body cavities, their organs, blood, supply and innervation, and on the entire

musculoskeletal system. Course director: Dr. Leslie Hammer

CEBIO 261 *Human Structural Biology (Body Cavities)* (3 credits, letter grade). A lecture- and human dissection-based course that provides comprehensive information on the organs within the thoracic, abdominal, and pelvic cavities and on the topographic relationships between the organs, blood supply and innervating nerves. Course director: Dr. Sumitra Miriyala

CEBIO 262 *Human Structural Biology (Musculoskeletal and Head & Neck)* (3 credits, letter grade). A lecture- and laboratory dissection-based course that provides comprehensive information on the musculoskeletal system and topographic relationships the blood and nerve supply. Course director: Dr. Sumitra Miriyala

CEBIO 265 *Human Neuroanatomy* (2 credits, letter grade). A lecture- and laboratory-based course providing comprehensive information on 1) histology of the nervous system; 2) sensory systems; 3) motor systems; 4) cerebral cortex. Course director: Dr. Kathryn Hamilton

CEBIO 266 *Essential Neuroanatomy for Basic scientists* (2 credits, letter grade). A lecture- and laboratory-based neuroanatomy course tailored for graduate students, which provides comprehensive information on 1) histology of the nervous system; 2) sensory systems; 3) motor systems; 4) cerebral cortex. The course also includes labs in which rodent and human systems are compared. Course Director: Dr. Kathryn Hamilton

CEBIO 289 *Current Topics in Cell Biology* (1 credit, S/U). A Fall and Spring semester journal club, in which students keep abreast of recent contributions to the research literature, learn how to critically evaluate experimental data and hone public speaking skills. Course director: Dr. David Krzywanski

CEBIO 290A/B *Seminar* (0.5 credits, S/U). Students attend and participate in seminars conducted by the Department of Cellular Biology & Anatomy. Emphasis is placed upon current research findings. Periodically, students also present a seminar on their current research or on a subject under discussion. 290A is the Fall course; 290B is the Spring course. Course director: Dr. Manikandan Panchatcharam

CEBIO 299 *Research Proposal in Cell Biology* (3 credits, S/U). A required course in which Ph.D. candidates prepare a National Institutes of Health grant application on the questions to be addressed in the proposed doctoral research. The proposal contains sections on 1) background leading to the questions; 2) specific aims; 3) preliminary results; 4) rationale for the experimental design and methods, potential pitfalls, and alternative approaches. After the proposal has been approved, the student can proceed with dissertation research. Any deviation from the program outlined in the proposal must be approved by the student's Research Advisory Committee. Course director: Dr. Edward Glasscock

CEBIO 300 *Thesis Research* (1-9 credits, S/U). Students in the Clinical Anatomy track within the Master in Biomedical Sciences complete a research project commensurate with completion of an M.S. thesis, under the direction of an approved graduate faculty mentor and Research Advisory Committee approved by the Graduate Advisory Committee and Chair of the Department. Course director: Dr. Edward Glasscock

CEBIO 400 *Dissertation Research* (1-9 credits, S/U). Students in the doctoral program gain in-depth experience in research development, design, methodology and complete a research project commensurate with generating a dissertation, under the direction of an approved graduate faculty

mentor and Research Advisory Committee approved by the Graduate Advisory Committee and Chair of the Department. Course director: Dr. Edward Glasscock

MICROBIOLOGY AND IMMUNOLOGY COURSES

MICRO #276: GENERAL AND MOLECULAR VIROLOGY (3 credits)

Description: An introduction to the structure, replication, biology, and molecular biology of animal viruses. Emphasis is also given to virus-cell interactions at the molecular level, including the immune response to viral infections, and current research on mechanisms of viral replication and its effect on regulatory mechanisms of host cells. This course consists of lectures, discussions, and seminars. Course director: Dr. Rona Scott

MICRO #289: MOLECULAR PATHOGENESIS OF INFECTIOUS DISEASES II (3 credits)

Description: An advanced study of the mechanisms whereby parasites, viruses, and bacteria cause infectious disease. The interactions between these pathogens and the host will be examined in detail utilizing various animal and human models. Pathogenesis will be presented ecologically following the events of the pathogen's entry into the host, its encounters with the host, its encounters with the host's defense mechanisms, strategies employed by the parasite and virus to counteract host defenses, to spread throughout the host, mechanisms of cell and tissue damage, etc. Emphasis will be placed on the molecular aspects of virulence factors and host defenses. Course director: Dr. Kenneth Peterson

MICRO #291: BACTERIOLOGY AND MOLECULAR PATHOGENESIS OF INFECTIOUS DISEASE I (3 credits)

Description: An advanced course of lectures, discussions, and student presentations in the areas of structure, function, and physiology of bacteria. In the first portion of the course, emphasis will be placed on bacterial structure and the functions of these structures, bacterial physiology, and the nature of antibiotics and their mechanisms of action. In the second portion, the mechanisms employed by bacteria to cause disease will be stressed, and lectures will cover the major types of bacterial infectious diseases. Lastly, basic information on the properties of fungi will be covered, and lectures will address topics in medical mycology. Course director: Dr. David McGee

MICRO #292: DISCUSSIONS IN ADVANCED VIROLOGY

Description: A journal club format is used for students to present and discuss developing concepts and new information about techniques and research findings from the disciplines of molecular virology and cellular-molecular biology. Emphasis is given to teaching the student to develop the skills required for a critical assessment of the scientific literature and for understanding how new information can be applied to research problems. Course director: Dr. Dennis O'Callaghan

MICRO #293: DISCUSSIONS IN ADVANCED IMMUNOLOGY

Description: A journal club/research in progress format is used for the discussion of published and unpublished findings in advanced immunology. Emphasis is on critical evaluation of experimental design and interpretation. Students will present and also participate in overall discussions. Grading will be based on participation and attendance. The class will meet every other week for 1 hr. This course will be offered over two semesters with the Fall being MICRO 293A, and the Spring being MICRO 293B. Each semester will be worth 0.5 credits, and the student must complete both semesters to successfully complete the course. Course director: Dr. Robert Chervenak

MICRO #295: DISCUSSIONS IN BACTERIOLOGY

Description: A journal club/research-in-progress format is used for discussion of recently published and unpublished research in the field of bacteriology. Emphasis is placed on critical evaluation of experimental design, data and conclusions as well as on the development of communication skills and knowledge of new developments in prokaryotic biology. Course director: Dr. David McGee

MICRO #297: IMMUNOLOGY (3 credits)

Description: An advanced course, employing both lecture and discussion formats, that is designed to cover many of the important aspects of modern cellular and molecular immunology. Strong emphasis is placed on understanding the myriad of molecular interactions involved in the development, function, and regulation of the cells responsible for immune phenomena. By the supplemental reading of crucial journal and review articles, students are encouraged to examine and interpret recent experimental findings. Course director: Dr. Matthew Woolard

MICRO #298: SEMINAR IN MICROBIOLOGY

Description: The student prepares and presents selected findings from either the current literature or his/her research in a 45-minute public seminar. The seminar consists of a brief and informative introduction, explanation of the experimental procedures and strategies employed, presentation and critical assessment of the findings, and a questions/discussion period. Prior to the seminar, the student must prepare and circulate a written abstract announcing the seminar and summarizing the key findings to be presented. One seminar each year must concern the research in progress by the student. The student is provided a written critique of the seminar by each faculty member and discusses these critiques with the faculty member responsible for the course. Course directors: Fall course, Dr. Stanimir Ivanov; Spring course, Dr. David McGee

MICRO #400: DISSERTATION RESEARCH

Description: Research for the doctoral degree is conducted under the supervision of the student's Advisor in concert with the members of the student's Advisory Committee. Registration is by consent of the Head of the Department. The amount of credit is to be stated at the time of registration.

MOLECULAR AND CELLULAR PHYSIOLOGY COURSES

PHYSIO 201 Human Physiology. This is a foundation course in Physiology and does not replace any required Foundation or Physiology course. Students will be required to take this course in the summer prior to entry into the Ph.D. program if the student is accepted into the Physiology graduate program under the terms stated above for "Probationary Admission". Course director: Dr. Christopher Pattillo

PHYSIO 202. Laboratory Rotations (3 credits, S/U). Hours and credits by arrangement.

PHYSIO 203. Physiology Research (1-9 credits, S/U). Hours and credits by arrangement.

PHYSIO 210. Pathophysiology. (3 credits, letter grade) To teach Physiology graduate students the general paradigms and fundamental concepts related to changes in physiological processes that underlie different disease states. Course director: Dr. Steven Alexander

PHYSIO 211. Skills in Investigative Research. (2 credits, letter grade) This course will provide a practical introduction to first year graduate students to the basic oral and written skills that are fundamental in investigative research. Students will be instructed in the theory and practice of how to

write a scientific paper, to present a scientific talk, to critique and present research papers, and grantsmanship. Student participation is a major emphasis. Course director: Dr. Lynn Harrison

PHYSIO 270. Special Topics - Journal Club. (1 credit, S/U) Course covers journal reviews and articles on diverse topics in molecular physiology, including inflammation, microcirculation, imaging, genomics and therapeutics approaches. Course directors: Faculty rotation

PHYSIO 278. Advanced Cardiovascular Physiology. (5 credits, letter grade) A comprehensive summary of physiology of the microcirculation, peripheral circulation, and heart. The major emphasis is on the functions of various components of the microcirculation including a consideration of the biophysics of vascular smooth muscle contraction and its relation to the regulation of blood flow distribution within and among organs, substrate transport across the microcirculation, the endothelial cell as a metabolic barrier to substrate transport, regulation of blood flow in the various organs, and angiogenesis. Course director: Dr. Norman Harris

PHYSIO 300. Thesis Research. (1-6 credits, S/U) Amount of credit to be stated at time of registration.

PHYSIO 400. Dissertation Research. (1-9 credits, S/U) Amount of credit to be stated at time of registration.

PHARMACOLOGY, TOXICOLOGY AND NEUROSCIENCE COURSES

PHARM 203 *Methods in Pharmacology* (3 Credits, letter grade)

Faculty Member in charge: Kenneth McMartin, Ph.D.

When course is offered: Every semester

Prerequisites for course: None

Description of course: Hours and credit by arrangement. Consists of rotations through laboratories of department faculty. In general, the course should be taken for each rotation.

PHARM 204 *Brain Research through Advanced and Innovative Neurotechnologies* (1 Credit, letter grade)

Faculty Member in charge: Xiaohong Lu, Ph.D.

When course is offered: Every semester

Prerequisites for course: Neuropharmacology (PHARM 233)

Description of course: The objective of the course is to enhance the students' depth of knowledge of the cutting edge genetic, molecular, and pharmacologic approaches used for the anatomic and functional interrogation of neural circuitry, brain development and disease.

PHARM 209 *Introduction to Research in Pharmacology* (1 Credit, S/U) (

Faculty Member in charge: Ronald L. Klein, Ph.D.

When course is offered: Summer, Annually

Prerequisites for course: None

Description of Course: An introduction to research in Department of Pharmacology labs for incoming graduate students. This course will aid students in choosing their research rotations.

PHARM 220 *Clinical Toxicology* (1 Credit, letter grade)

Faculty Member in charge: Kenneth E. McMartin, Ph.D.

When course is offered: Summer, Annually

Prerequisites for course: None

Description of course: Three day, all day course of lectures and panel discussion. This course deals with clinical and laboratory methods for the diagnosis and treatment of intoxication from drug over dosage and poisons. Special problems associated with drug abuse and industrial and environmental toxicology are also discussed. Independent topical paper is required.

PHARM 221 *Advanced Topics in Pharmacology: Biochemistry* (2 Credits, letter grade)

Faculty Member in charge: Yunfeng Zhao, Ph.D.

When course is offered: Fall, Annually

Prerequisites for course: None

Description of course: Biochemistry portion of Medical School Module 1, Course 1 (**Physiological Chemistry, Medical Genetics, and Developmental Biology**). An overview of the basic biochemical properties of amino acids and proteins, lipids, and carbohydrates. The class also includes the basic principles of enzyme kinetics, membrane transport, and important biochemical processes and enzymes that cells utilize to generate metabolic energy.

PHARM 222 *Advanced Topics in Pharmacology: Molecular Biology* (2 Credits, letter grade)

Faculty Member in charge: Yunfeng Zhao, Ph.D.

When course is offered: Fall, Annually

Prerequisites for course: None

Description of course: Molecular biology portion of Medical School Module 1, Course 1 (**Physiological Chemistry, Medical Genetics, and Developmental Biology**). The course is a basic introduction to nucleic acids structure and function including replication, transcription, RNA processing, and protein synthesis.

PHARM 225 *Advanced Topics in Pharmacology* (1-5 Credits, letter grade)

Faculty Member in charge: Staff

When course is offered: As required

Prerequisites for course: Foundations in Biomedical Sciences

Description of course: Hours and credits as well as lecture and laboratory to be arranged depending upon the special topic. This course is designed for advanced studies of special groups of drugs such as steroids, antibiotics, antihistamines, analgesics, etc.

PHARM 233 *Neuropharmacology* (2 Credits, letter credit)

Faculty Member in charge: Ronald L. Klein, Ph.D.

When course is offered: Fall, Annually

Prerequisite for course: Foundations in Biomedical Sciences: Nervous System (IDSP 218)

Description of course: A study of the structure and properties of membranes, axoplasmic transport, and the fundamental principles of neurotransmission and neuroendocrinology. Detailed study of the chemical transmitters in the central nervous system with special emphasis on drug-modifications of transmitter action and neuronal function, drug-modification of physiological function and behavioral pharmacology.

PHARM 238 *Cardiovascular Pharmacology* (2 Credits, letter grade)

Faculty Member in charge: James H. Zavec, Ph.D.

When course is offered: As required

Prerequisites for course: Foundations in Biomedical Sciences: Cardiovascular System (IDSP 212)

Description of course: Two hours of lecture. The study of drugs used to treat cardiovascular disorders with primary emphasis on their fundamental mechanisms of action.

PHARM 240 *Behavioral Pharmacology I* (1 Credit, letter grade)

Faculty Member in charge: Chris Schmoutz, Ph.D.

When course is offered: As required

Prerequisites for course: Neuropharmacology (PHARM 233)

Description of course: Basic principles of the experimental analysis of behavior, including operant and classical conditioning, and schedules of reinforcement. Definition and scope of behavioral pharmacology. Behavioral mechanisms of drug actions. Drug-environment interaction.

PHARM 242 *Pharmacology of Drugs of Abuse* (1 Credits, letter grade)

Faculty Member in charge: Nicholas Goeders, Ph.D.

When course is offered: As required

Prerequisites for course: Foundations in Biomedical Sciences: Nervous System (IDSP 218)

Description of course: This course will discuss the behavioral and physiological effects of drugs of abuse and the mechanisms of action of these substances. This is a writing intensive course.

PHARM 243 *Environmental Toxicology* (2 Credits, letter grade)

Faculty Member in charge: Kenneth E. McMartin, Ph.D.

When course is offered: Summer, or as required

Prerequisites for course: None

Description of course: Two hours of lecture and classroom discussion. A study of the effects of industrial, agricultural and other human-produced pollutants on the deterioration of the environment. The control of environmental problems will be illustrated in case histories.

PHARM 245 *Toxicology* (2 Credits, letter grade)

Faculty Member in charge: Yunfeng Zhao, Ph.D.

When course is offered: Fall, Annually

Prerequisites for course: Permission of instructor

Description of course: Three hours of lecture and classroom discussion. A study of the general principles of toxicology, including the biochemical and physiological mechanisms involved in injury. Specific organ systems and toxic compounds will be discussed for illustration.

PHARM 251 *Research in Pharmacology* (1-8 Credits, S/U)

Faculty Member in charge: Kenneth McMartin, Ph.D.

When course is offered: As required

Prerequisites for course: None

Description of course: This course offers an in-depth experience in research development, design, methodology and implementation. Students will undertake specific projects of limited scope and develop their findings under the guidance and direction of faculty preceptors.

PHARM 258 *Pharmacokinetics and Pharmacodynamics* (1 Credit, letter grade)

Faculty Member in charge: James H. Zavec, Ph.D.

When course is offered: Spring, Annually

Prerequisites for course: Basic Biochemistry and Molecular and Cell Biology (IDSP 111-113 or PHARM 221-223) and Foundations in Biomedical Sciences: General Principles (IDSP 211)

Description of course: Two hours of lecture, twice a week. In depth presentation of receptor quantification and drug pharmacokinetics. Material is covered in lecture and through the completion of problem sets. Student's progress is judged based on examination performance and take home problems.

PHARM 260 *Molecular Pharmacology* (2 Credits, letter grade)

Faculty Member in charge: James H. Zavec, Ph.D.

When course is offered: Spring, Annually

Prerequisites for course: Basic Biochemistry and Molecular and Cell Biology (IDSP 111-113 or PHARM 221-223), Foundations in Biomedical Sciences: General Principles (IDSP 211) and Pharmacokinetics and Pharmacodynamics (PHARM 258)

Description of course: Two hours of lecture, twice a week and student presentations. This course provides a detailed examination of molecular events that occur during and after drugs bind to receptors. Intracellular signal transduction events and cross-talk among different systems are emphasized.

PHARM 270 *Discussions in Neurochemistry & Neuropharmacology* (1 Credit, S/U)

PHARM 271 *Discussions in Toxicology* (1 Credit, S/U)

PHARM 272 *Discussions in Pharmacology* (1 Credit, S/U)

Faculty Member in charge: Ronald Klein, Ph.D.

When course is offered: Biannually, Fall and Spring

Prerequisites for course: None

Description of course: A journal club/research presentation format in which students present and discuss new concepts and research findings in topics relating to pharmacology (PHARM 272), neurochemistry and neuropharmacology (PHARM 270), or toxicology, including biochemical, clinical and environmental (PHARM 272). Students will be taught critical assessment of research data and how new techniques can be applied to research problems. Grading will be by faculty on the basis of student presentations and participation in class discussions.

PHARM 298 *Seminar* (1 Credit, S/U)

Faculty Member in charge: Yunfeng Zhao, Ph.D.

When course is offered: Biannually, Fall and Spring

Prerequisites for course: None

Description of course: Students are required to attend and participate in oral presentations of research data. The student should register for seminar each year semester they are taking classes. Grades will be assigned based on seminar presentation, but students must participate in seminar each semester regardless of whether they are registered for the course.

PHARM 299 *Research Proposal in Pharmacology* (3 Credits, S/U)

Faculty Member in charge: Kenneth McMartin, Ph.D.

When course is offered: Every semester

Prerequisites for course: Successful completion of Qualifying Examination

Description of course: A required course for all doctoral candidates. The student will write a proposal for his/her dissertation research in National Institutes of Health grant-application format. The proposal should contain sections on a) Specific Aims, b) Research Strategy (Significance, Innovation, and Approach), as well as a detailed budget and justification, and rationale for the use of animals or humans, if applicable. The proposal will be reviewed by the student's Research Advisory Committee,

and presented by the student before this Committee. The grade will be assigned by the Advisory Committee based on the scientific quality of the written proposal and its verbal defense.

PHARM 300 *Thesis Research* (1-9 credits, S/U)

Faculty Member in charge: Staff
When course is offered: Every semester
Prerequisites for course: Registration by permission of advisor
Description of course: Amount of credit must be stated at time of registration

PHARM 400 *Dissertation Research* (1-9 Credits, S/U)

Faculty Member in charge: Staff
When course is offered: Every semester
Prerequisites for course: Registration by permission of advisor
Description of course: Amount of credit must be stated at time of registration