

Physiology

College of Medicine

Graduate study in physiology is designed to prepare candidates for careers as independent scientists in academics, industry, and government positions. Admission to the graduate program is competitive and is based upon academic background, professional recommendations, performance on the Graduate Record Examination (GRE), experience, and when possible, personal interviews. Applicants should complete an undergraduate degree in biological sciences, chemical sciences, physical sciences, mathematics, psychology, or engineering. It is recommended that applicants complete courses in organic chemistry, physical chemistry, calculus, physics, and the biological sciences, as well as have some research experience.

Students will have the opportunity to join faculty research programs across a spectrum of topics such as neural, endocrine, cardiovascular, renal, respiratory, sensory, and muscle physiology. Research activities employ systems, cellular, and molecular approaches. The program of study is tailored to the individual background and career goals of the student and stresses an interdepartmental approach both in the selection of courses and in the pursuit of research. Students are expected to participate in graduate seminars, journal clubs, research seminars; to interact with visiting scholars; and to present the results of their research at local and national meetings. Teaching opportunities leading to a graduate certificate in teaching is also available. Financial aid is available to the students accepted to the program.

Admission Requirements

Admission to the Ph.D. program in Physiology is through the Integrated Biomedical Sciences (IBS) Curriculum. Inquiries regarding admission should be directed to Director, Integrated Biomedical Sciences Curriculum, University of Kentucky, College of Medicine <http://graduate.med.uky.edu/integrated-biomedical-sciences>. For information about the Ph.D. program in Physiology, please contact the Director of Graduate Studies, Department of Physiology. Information may also be obtained from the department Web site: <http://physiology.med.uky.edu/>.

Course Descriptions

*PGY 502 SYSTEMS, CELLULAR AND MOLECULAR PHYSIOLOGY. (5)

PGY/BIO 502 is a team-taught, lecture-based course that provides an integrated in-depth understanding of the physiology and pathophysiology of the human cardiovascular, digestive, endocrine, neural, renal and respiratory organ systems. Lectures are supplemented with assigned readings, hands-on demonstrations, and problem-oriented study sessions. Prereq: An introductory physiology course (for example PGY 206), and an understanding of fundamental undergraduate-level chemical and physical concepts is recommended but not required. (Same as BIO 502.)

PGY 504 INDEPENDENT WORK IN PHYSIOLOGY. (2-4)

A study of some advanced problems in physiology under the direct supervision of the instructor. Discussion period, one hour; laboratory, four hours. May be repeated to a maximum of eight credits. Prereq: Consent of instructor.

PGY 512 EVOLUTIONARY MEDICINE. (3)

This online course surveys the consequences of evolution on human function and disease. Lecture materials, online discussions, and reading and writing assignments will expand on examples of the repercussions of evolutionary processes on health. Prereq: BIO 150-153 or equivalent introductory biology sequence, BIO 315 or equivalent, and an introductory physiology course (PGY 206, BIO 350, or PGY 412G).

PGY 535 COMPARATIVE NEUROBIOLOGY AND BEHAVIOR. (3)

The course consists of an introduction to neurophysiology and study of the neural basis of sensory processing and motor patterns. A comparative analysis of the neurobiological basis of behavioral responses will be made, utilizing a broad range of vertebrates and invertebrates. Prereq: BIO 350 or consent of instructor. (Same as BIO 535.)

PGY 560 PATHOPHYSIOLOGY: INTEGRATIVE STUDY IN PHYSIOLOGY AND MEDICINE. (1)

This course aims at the development of an integrative conception of the human organism, and involves the study of medical case histories. The complex network of physiologic interactions which underlie disease states is investigated. The physiologic bases of health, illness, dying, and death are explored. May be repeated to a maximum of three credits. Prereq: PGY 412G, PGY 502 or consent of instructor.

PGY 601 MAMMALIAN ENDOCRINOLOGY. (3)

An introduction to the basic anatomy, physiology and biochemistry of endocrine systems with emphasis on mechanisms of hormone synthesis, secretion and action. Lectures and reading assignments will focus on endocrine function in mammalian species, including laboratory animals, humans and livestock. Prereq: BCH 401G and BIO 350 or equivalents. (Same as ASC 601.)

PGY 602 READINGS IN SYSTEMS, CELLULAR AND MOLECULAR PHYSIOLOGY.(3)

A critical evaluation at the advanced level of the literature of the major mammalian physiological systems at the organ, cellular and molecular level. The course is intended to be taken with and to complement PGY 502. It includes a critical reading of the primary literature. Prereq: One year each of physics, general chemistry; PGY 206 or equivalent.

PGY 603 DESIGN AND ANALYSIS. (3)

This is a course for students in the biomedical sciences interested in understanding the principles and pitfalls of experimental design and data analysis. The course focuses on why specific experimental design and analysis strategies are applied. Prereq: Consent of instructor. An introductory statistics course is recommended, e.g., STA 570 or STA 580.

PGY 604 ADVANCED CARDIOVASCULAR PHYSIOLOGY. (3)

The objective of this course is to examine in-depth the various functions of the cardiovascular system and their proposed mechanisms. Prereq: PGY 502 or consent of instructor.

PGY 605 NEUROBIOLOGY OF CNS INJURY AND REPAIR.

The objective of the course will be to provide a general overview of the current state of knowledge concerning the pathophysiology and therapeutic approaches to central nervous system injury. The course will provide a strong working background concerning the issues, techniques and frontiers of neurotrauma therapeutic discovery research aimed at reducing acute post-traumatic neurodegeneration in the injured brain or spinal cord or enabling regeneration and repair. This course is a graduate level course intended for students who are in their second or subsequent years of graduate study and who are pursuing focused research training in neurotrauma research. No special prerequisites, other than graduate standing, are necessary. However, a background in neuroanatomy and neurophysiology is highly recommended. Prereq: Permission of instructor. (Same as ANA 605.)

PGY 608 ADVANCED RENAL PHYSIOLOGY. (3)

This course will examine in-depth the physiology and pathophysiology of the renal system, as well as provide an understanding of advanced renal physiological techniques. Prereq: PGY 412G, PGY 502 or consent of instructor.

PGY 609 ADVANCED RESPIRATORY PHYSIOLOGY. (3)

This course will examine in-depth the physiology and pathophysiology of the respiratory system. Prereq: PGY 412G, PGY 502 or consent of instructor.

PGY 612 BIOLOGY OF AGING. (3)

A multidisciplinary discussion of how the process of aging affects biological systems. Coverage will be quite broad and includes topics such as subcellular and cellular aging, genetics, immunology, anatomy and physiology, animal model of aging, etc. Prereq: Enrollment in the doctoral program in Gerontology or a biomedical science department or consent of instructor. (Same as ANA/BIO/GRN 612.)

PGY 615 SEMINAR IN TEACHING MEDICAL SCIENCE (MED SCIENCE TEACHING I). (2)

A two (2) credit seminar course in which issues related to the theory and practice of life science education are discussed in a Socratic manner. May be repeated to a maximum of three credits. Prereq: Current enrollment in a life science graduate program. (Same as GRN 615.)

PGY 616 PRACTICUM IN TEACHING MEDICAL SCIENCE (MED SCIENCE TEACHING II). (2)

A two (2) credit experimental course in which students will directly participate in the teaching of Physiology under supervised conditions. May be repeated to a maximum of six credits. Prereq: PGY 615 may be taken concurrently.

PGY 617 PHYSIOLOGICAL GENOMICS. (2)

RNA-seq, ChIP-seq and microarray techniques are powerful tools for global analyses of transcriptomes and gene expression. They are widely used in biological and medical research. Lectures on fundamental concepts, experimental design, and the impact of understanding gene expression patterns are combined with computer labs where students analyze RNA-seq, ChIP-seq and microarray data. Prereq: IBS 603 or an equivalent course in Cell Biology or Molecular Biology. (Same as PHA 617.)

PGY 625 MUSCLE FORUM.(1)

Muscle Forum is a course that will allow students to develop critical evaluatory skills for seminars and grant writing in the field of Muscle Biology. Prereq: Students need to be enrolled in the Rehabilitation Sciences doctoral program, one of the graduate programs of the Integrative Biomedical Sciences, or with permission of the course director. (Same as RHB 625.)

PGY 627 PROSEMINAR IN PHYSIOLOGICAL PSYCHOLOGY. (3)

An intensive examination of theories, methods of investigation, and current developments in the field of physiological psychology. Prereq: Graduate standing or consent of instructor. (Same as PSY 627.)

PGY 630 ADVANCED TOPICS IN PHYSIOLOGY. (1-3)

Contemporary topics in physiology. Course designed to utilize the special research interests of resident and visiting faculty. May be repeated to a maximum of six credits. Prereq: PGY 502 or consent of instructor.

PGY 638 DEVELOPMENTAL NEUROBIOLOGY. (3)

An explanation of the processes which contribute to the development of the nervous system. Neurophysiological, cell biological and molecular approaches to cell differentiation, neuronal pathfinding and synapse formation and stabilization will be explored and discussed. Examples will be drawn from both vertebrate and invertebrate preparations. Prereq: BIO 535 or consent of instructor. (Same as ANA/ BIO/ PSY 638.)

PGY 650 ANIMAL PHYSIOLOGY LABORATORY.

Hands-on laboratory exercises in animal physiology. Prereq: Previous or concurrent enrollment in BIO 550. (Same as BIO 650.)

PGY 660 BIOLOGY OF REPRODUCTION. (3)

Advanced study of current topics in reproductive biology. The course is comprised equally of student-led discussions and lectures given by faculty with research expertise in selected topics. Readings will be taken from current and classic literature. Topics covered include (but are not limited to) molecular and cellular endocrinology, hormone receptors and mechanism of action, reproductive neuroendocrinology, reproductive behavior, gametogenesis, fertilization, sexual differentiation, puberty, menopause and environmental effects on reproduction. Emphasis will be placed on the analysis and understanding of the experimental basis for current concepts in reproductive biology. Prereq: ASC/PGY 601 and ASC 364 or BIO/PGY 502 or consent of instructor. (Same as ANA 660 and ASC 660).

PGY 710 AGING OF THE NERVOUS SYSTEM. (3)

This course will examine the alterations in the brain that occur with aging and in neurodegenerative disorders such as Alzheimer's disease. The emphasis will be on human aging although the relevance of animal models to studies of human aging will be a recurrent theme. The course will examine aging at several levels, including molecular, cellular, organismic, and behavioral. A strong background in the basic sciences is encouraged. (Same as ANA/GRN/PHA 710.)

PGY 748 MASTER'S THESIS RESEARCH. (0)

Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prereq: All course work toward the degree must be completed.

PGY 749 DISSERTATION RESEARCH. (0)

Half-time to full-time work on dissertation. May be repeated to a maximum of six semesters. Prereq: Registration for two full-time semesters of 769 residence credit following the successful completion of the qualifying exams.

PGY 766 TOPICAL SEMINAR BEHAVIORAL NEUROSCIENCE. (3)

A study of selected topics in behavioral neuroscience with emphasis on recent research and theory. May be repeated to a maximum of nine credits. Prereq: Consent of instructor. This course may be elected to fulfill requirements in the Psychology and Physiology graduate programs. (Same as PSY 766.)

PGY 767 TOPICAL SEMINAR IN BEHAVIORAL NEUROSCIENCE. (3)

A study of selected topics in behavioral neuroscience with emphasis on recent research and theory. May be repeated to a maximum of nine credits. Prereq: Consent of instructor. This course may be elected to fulfill requirements in the psychology and physiology graduate programs. (Same as PSY 767.)

PGY 774 GRADUATE SEMINAR IN PHYSIOLOGY. (1)

A discussion-based course for physiology graduate students and other advanced students interested in physiology. The students learn how to understand and critique research papers and how to review a research manuscript. The full potential of the course is realized in conjunction with the Physiology Seminar Series, because the material of the course prepares the students for these Seminars. Students are encouraged to participate until they are heavily involved in their research project.

PGY 791 RESEARCH IN PHYSIOLOGY. (1-15)

May be repeated to a maximum of 15 credits. Prereq: Consent of instructor.

PGY 813 NEUROPHYSIOLOGY. (1)

The brain uses electrical signals to process all information it receives and analyzes. Individual neurons encode complex information into simple electrical signals; the meaning behind these signals is derived from the specific interconnections of neurons. The purpose of neurophysiology is to describe how the neuron produces electrical and chemical signals and illustrate how these signals are involved in the functional organization of neural circuits. This course also describes how the central nervous system analyzes and integrates the various inputs, elicits command decisions that determine the motor and/or endocrine responses. Lecture: three hours per week for five weeks. Prereq: Admission to the College of Dentistry, or consent of the Course Director. (Same as OBI 813.)

PGY 814 PRINCIPLES OF HUMAN PHYSIOLOGY FOR DENTAL STUDENTS. (4)

This course enables student dentists to understand the basic principles of human physiology, especially as it relates to the practice of dentistry. The introduction of the course presents the basic physiology of cells, conducting and contracting tissues, lining and secretory tissues, and other special tissues. The course focuses on the major physiological systems and presents them at the system, cellular, and molecular levels; and emphasizes those aspects particularly relevant to dentistry - dentin sensitivity, dental and pulpal pain, muscle dysfunction, ischemic and, hypertensive heart disease, oral manifestations of endocrine abnormalities, temperature regulation, calciumphosphate homeostasis, and the dental mineralized tissues. Upon successful completion of the course, student dentists will be able to rationally and scientifically apply basic cell, tissue, organ, and organ system function to clinical decision-making. Lectures with assigned reading: 68 hours. Prereq: OBI 812 or consent of the course director. (Same as OBI 814.)

PGY 815 FIRST-YEAR ELECTIVE, PHYSIOLOGY. (1-3)

With the advice and approval of his or her faculty adviser, the first-year student may choose approved electives offered by the Department of Physiology and Biophysics. The intent is to provide the student an opportunity for exploration and study in an area which supplements and/or complements required course work in the first-year curriculum. Pass-fail only. Prereq: Admission to first year, College of Medicine.

PGY 818 HUMAN FUNCTION. (8)

This course provides in-depth instruction on the physiological mechanisms of body function from the single cell to the organism level. The course is team taught by medical scientists and clinicians. Teaching methodologies include didactic and Socratic lectures, small group discussions, demonstrations and live model and computer simulated laboratories. Lecture, 20 hours per week. Prereq: Admission to medical school (first year). (Same as OBI 814.)

PGY 825 SECOND-YEAR ELECTIVE, PHYSIOLOGY. (1-4)

With the advice and approval of his or her faculty adviser, the second-year student may choose approved electives offered by the Department of Physiology and Biophysics. The intent is to provide the student an opportunity for exploration and study in an area which supplements and/or complements required course work in the second-year curriculum. Pass-fail only. Prereq: Admission to second-year medical curriculum and approval of adviser.

PGY 850-899 FOURTH-YEAR ELECTIVE FOR MEDICAL STUDENTS. (1-6)

With the advice and approval of the faculty adviser and the Student Progress and Promotions Committee, the fourth-year student may choose approved electives offered by the various departments in the College of Medicine. The intent is to provide the student an opportunity to develop his fund of knowledge and clinical competence. Prereq: Admission to the fourth year, College of Medicine and/or permission of the Student Progress and Promotions Committee.

Approved elective: PGY 850 RESEARCH IN PHYSIOLOGY