

Cellular and Integrative Physiology

School of Medicine Indianapolis

Chairperson

Professor Michael Sturek

Departmental E-mailcellphys@iupui.edu**Departmental URL**www.medicine.iu.edu/physiology

Graduate Faculty

(An asterisk [*] denotes membership in the University Graduate School faculty with the endorsement to direct doctoral dissertations.)

Professors

Robert Bigsby* (Obstetrics), H. Glenn Bohlen*, Richard Day, Loren Field* (Medicine, Pediatrics), Janice Froehlich* (Medicine), Patricia J. Gallagher*, Lawrence Garetto* (Dentistry), Susan J. Gunst*, Maureen Harrington* (Biochemistry), Brian Paul Herring*, Chiu Shuen Hui* (Emeritus), Gary Hutchins* (Radiology), Stephen A. Kempson, Richard Meiss* (Emeritus), Sidney Ochs* (Emeritus), Kenneth R. Olson*, Fredrick M. Pavalko*, Ora Pescovitz* (Pediatrics), Rodney Rhoades* (Emeritus), Simon J. Rhodes*, W. Eugene Roberts* (Emeritus), Carl Rothe* (Emeritus), Rex D. Stith, Michael S. Sturek, George A. Tanner*, Joseph Unthank* (Medicine), Frank A. Witzmann*

Associate Professors

David P. Basile, David R. Bell, Robert Considine (Medicine), Stephen F. Echtenkamp*, Jeffrey S. Elmendorf, Brian G. Kennedy*, James A. Marrs (Medicine), C. Subah Packer*, Jonathan D. Tune, Gabi Nindl Waite

Assistant Professor

Alexander Obukhov

Adjunct Professors

Navin Bansal (Radiology), Bonnie Blazer-Yost* (Biology), Ghassan Kassab (Engineering & Technology), Keith L. March* (Medicine)

Graduate Office
Union Building 207
Indiana University–Purdue University Indianapolis
Indianapolis, IN 46202
(317) 274-1577
Contact: gradoff@iupui.edu

Adjunct Associate Professors

Daniel Meldrum (Pediatrics), Deborah Thurmond* (Biochemistry & Molecular Biology), Lei Wei (Pediatrics)

Adjunct Assistant Professors

Christopher Burlak* (Surgery), Patrick T. Fueger* (Pediatrics), Steven Miller (Surgery), Michael Murphy (Surgery)

Director of Graduate Studies

Professor Patricia J Gallagher*, Medical Science Building 350D, (317) 278-2146, pgallag@iupui.edu

Master's Degree Graduate Advisor

Professor Patricia J Gallagher*, Medical Science Building 350D, (317) 278-2146, pgallag@iupui.edu

Degrees Offered

Master of Science and Doctor of Philosophy

Graduate training in the department reflects the modern view of physiology as an integrative science, utilizing information obtained from several different levels to gain a better understanding of organ system functions. State-of-the-art techniques are used to study physiological responses at the molecular, cellular, and whole-organ levels. The research interests of the faculty span cardiovascular physiology, cell growth and development, respiratory biology, cancer biology, and signal transduction mechanisms.

Special Departmental Requirements

(See also general University Graduate School requirements.)

Admission Requirements

Students should have a background in biology, chemistry, physics, and mathematics. Graduate Record Examination (GRE) or Medical College Admission Test (MCAT) scores are required as a part of the application and are used as guidelines for admission together with GPA and letters of recommendation.

Master of Science Degree

Course Requirements

A total of 30 credit hours is required; two options are offered, non-thesis and thesis.

The non-thesis option consists of 30 credit hours of didactic course work. Required courses include: F702 (1 cr.), G715 (3 cr.), G716 (3 cr.), G717 (3 cr.), F613 (5 cr.), G655 (1 cr.), G651 (3 cr.), and G504 (2 cr.). In addition, 9 credits of elective course-work will complete the degree requirements.

The thesis MS option consists of 30 credit hours of both didactic courses and laboratory research. Required courses include: F702 (1 cr.), G715 (3 cr.), G716 (3 cr.), G717 (3 cr.), G735 (1 cr.). The student must also take either G736 (1 cr.) and 6 credits of electives; or F613 (5 cr.), G655 (1 cr.), and either G505 (1 cr.) or G504 (2 cr.). In addition, 12 credits of research (F701) are required.

Thesis

Optional

Final Examination

Oral defense of dissertation with MS thesis option

Doctor of Philosophy Degree

Course Requirements

A total of 90 credit hours, including 30 credit hours of formal course work, (of which 12 are in the minor field). Required courses include: G717 (3 cr.), G735 (1 cr.), G736 (1 cr.), G718 (6 cr.), F702 (1 cr.), G855 (1 cr.), G655 (1 cr.), G505 (1 cr.). Three credits of Physiology electives complete the 18 credit hours of course work for the major.

Minor

Comprised of 12 credit hours in one of the following fields: anatomy, biochemistry, microbiology and immunology, pharmacology, medical genetics, neurobiology, life sciences, aging diabetes, imaging, bioinformatics, or cancer biology.

Qualifying Examination

Written and oral.

Final Examination

Oral defense of dissertation.

Other Provision

Participation in Preparing Future Faculty (PFF) program or departmental teaching is required.

Ph.D. Minor in Cellular and Integrative Physiology

Students outside the department desiring to obtain a doctoral minor in physiology must complete a minimum of 12 credit hours in physiology courses other than research (F701) and seminar (F702).

Courses

F503 Human Physiology (4 cr.) P: Introductory biology (K101, K103), and organic chemistry (C341, C342), and physics (P201, P202), or equivalent. Advanced course in human physiology designed for students with no prior exposure to the discipline.

Emphasis on basic physiological mechanisms of control with regard to membrane, neural, endocrine, reproductive, muscle, cardiovascular, respiratory, gastrointestinal, renal, and multisystems physiology.

F613 Mammalian Physiology Lecture (5 cr.) Neurophysiology, physiology of muscular activity, respiration, circulation, gastrointestinal physiology, excretion, metabolism, and endocrinology. Emphasis on basic physiological mechanisms and control systems.

F650 Membrane Biophysics (3 cr.) Structure and function of special membranes; mitochondria, RBC, nerve, and muscle.

F701 Research in Physiology (cr. arr.)

F702 Seminar in Physiology (1 cr.) Literature reports and group discussion by students and staff.

F705 Molecular and Cellular Physiology (4 cr.) Emphasis is on the principles of cellular structure and function that underlie the physiological functions of many organ systems. Three fundamental topics will be discussed: cell structure, the organization of the cells to form tissues, and cell physiology. Modern techniques in cellular physiology will be covered through critical analysis of the primary research literature.

F708 Cardiac and Coronary Physiology of Exercise (1 cr.)

P: Graduate integrative physiology. Exercise stimulus, quantification of work, and in vivo responses and adaptations involved in cellular and molecular mechanisms of myocardial and coronary artery responses and adaptations to exercise.

F709 In Vivo Microcirculatory Physiology (1 cr.) P: Graduate physiology. Fundamental roles of the microcirculation are to provide oxygen and nutrients to the living cells, remove wastes, and maintain hydration of the tissues. These functions are best understood from their cellular and biophysical regulation in the in vivo setting.

F710 Physiology of Membranes (2 cr.) P: Consent of instructor. Structure and function of cell membranes. Kinetics and energetics of membrane transport. Regulation of intracellular ionic concentrations. Hormonal and pathophysiological modification of membrane function.

F711 Integrative Physiology: Cells to Systems (4 cr.) P: No formal prerequisites; background in basic biochemistry and cell biology or cell physiology is recommended. Introductory physiology course for graduate students covering fundamental concepts of cellular and integrative physiology of tissues and organ systems. Basic physiology of the neural, musculoskeletal, cardiovascular, respiratory, renal, endocrine, and gastrointestinal systems are covered. At the end of the course, students should have a basic understanding of the physiologic functions of cells, tissues, and organ systems and should understand modern approaches for the measurement and interpretation of physiologic functions.

F713 Angiogenesis (1 cr.) P: Graduate cell biology. Advanced study of angiogenesis. Focus will be on concepts and mechanisms of angiogenic processes. Methods of assessment of sprouting angiogenesis will be introduced including demonstrations and readings.

F714 Development of the Vascular System (1 cr.) P: F710 and Graduate Cell Biology, or consent of instructor. Advanced study of the development of the vascular system. Concepts of vascular development will be explored with an emphasis on the experimental technique used to unravel organ development. This course may be taken for credit only once.

F715 Physiology of the Coronary Circulation (1 cr.) P: Graduate physiology. Advanced study of the physiology, pharmacology, and pathophysiology of the coronary circulation using contemporary methods. Overall goal is to provide a rational basis for functional genomics and modern therapy.

F716 Epithelial Cell Biology (1 cr.) P: Graduate cell biology. An integrated approach to epithelial structure/function, and role of subcellular organization in physiology and pathophysiology. Emphasis is on reading original reviews, research papers, and demonstration of techniques to study epithelia function in cultured cells, tissues, and model organisms such as zebrafish.

F720 Physiological Proteomics (1 cr.) P: Graduate biochemistry. This is a fundamental-based course on theory and practice of contemporary proteomics techniques. Graduate students will learn to select and apply appropriate proteomic technologies in their research through exposure to protein and analytical, quantitative, and informatic approaches to physiologically relevant biomedical problems.

F721 Designer Mice: Transgenes and Knockout Animals (1 cr.) P: Graduate cell and molecular biology. An advanced course emphasizing strategies for designing genetically modified mouse models.

F725 Muscle Macromolecules and Contraction (2 cr.) Structure and function of various macromolecules involved in muscle contraction. The aspects covered include excitation-contraction coupling, regulation of myoplasmic free calcium level, the contractile machinery, and force generation. Comparison in skeletal, cardiac, and smooth muscles. Lectures and guided discussion of papers.

F726 Physiology of Smooth Muscle (1 cr.) P: Graduate-level physiology course. Advanced study of the physiology of the smooth muscle tissues with focus on the normal physiology and pathophysiology of airway smooth muscle and the airways. Biochemical and physiologic mechanisms in the regulation of contraction, growth, and phenotypic expression in smooth muscle tissues will be explored.

F761 Molecular and Cellular Physiology of Ion Transport (1 cr.) P: Graduate cellular physiology. Advanced ion transport topics selected from current research on channels, pumps, and exchangers. Topics include transporter biophysical characteris-

tics, long-term regulation, and electrophysiological and optical methods for study.

F762 Renal Physiology (1 cr.) P: Graduate physiology. Reading and discussion of classical papers in renal physiology. Laboratory experiences will include measurement of renal functions using clearance methods and demonstrations of micropuncture and in vivo techniques.

F780 Special Topics in Physiology (cr. arr.) Tutorial instruction in physiology.

F782 Physiology and Pathophysiology of Lipid Rafts (1 cr.)

P: Graduate cell biology. To acquire a core of essential principles about lipid raft structure and comprehensive insight into the functional process of these membrane domains by means of introductory lectures, review of current literature, and group discussions with an emphasis on experimental techniques used to examine membrane physiology.

GRAD G735 Cardiovascular, Renal, and Respiratory Function in Health & Disease (1 cr.) P: G715 and G717. This course will

advance fundamental elements of cardiovascular function including basic hemodynamics, cardiac function, respiratory function, ventilator mechanics, gas exchange and kidney function, including control of excretion and regulation of body fluid dynamics. An emphasis will be placed on integrative function of different organ systems.

GRAD G736 Endocrine and Gastrointestinal Function in Health and Disease (1 cr.) P: G715 and G717. The course emphasizes

the use of modern experimental techniques to study mechanisms underlying the physiological function of the gastrointestinal tract and endocrine system. Lectures highlight the molecular and cellular basis for diseases of the gastrointestinal and endocrine systems and how they impact whole animal function.

GRAD G818 Integrative Cell Biology (3 cr.) This course provides broad understanding of ways in which cells are organized and integrated into tissues. Emphasis is on the function of cells in neural/ neuroendocrine system, cardiopulmonary, renal, and immune systems and in cytomechanics. Modern approaches to the study of tissue function by analysis of cellular regulation will be emphasized.