DEPARTMENT OF PHYSIOLOGY AND BIOPHYSICS

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Professor and chair

physiology.vcu.edu (http://www.physiology.vcu.edu)

The Department of Physiology and Biophysics brings a long tradition to the study of physiology that spans the entire spectrum from molecules to man. Strong research programs exist in molecular biophysics, cardiovascular and gastrointestinal physiology as well as in chemical senses. Faculty recruitments are ongoing in two areas: structural biology, which aims to understand function in terms of structure, and systems physiology, which aims to elucidate fundamental ways of communication within and between physiological systems. Biophysical approaches serve as the common language used at all levels of scientific inquiry. The department offers a strong collegial atmosphere where faculty, students, postdoctoral fellows and administrators work together to promote and share in the discovery of fundamental principles governing life processes.

- Physiology and Biophysics, Doctor of Philosophy (Ph.D.) (http://bulletin.vcu.edu/graduate/school-medicine/physiology-biophysics-phd)
- Physiology and Biophysics, Doctor of Philosophy (Ph.D.) with a concentration in molecular biology and genetics (http://bulletin.vcu.edu/graduate/school-medicine/physiology-biophysics-phd-concentration-molecular-biology-genetics)
- Physiology and Biophysics, Master of Science (M.S.) (http://bulletin.vcu.edu/graduate/school-medicine/physiology-biophysics-ms)
- Physiology and Biophysics, Master of Science (M.S.) with a concentration in molecular biology and genetics (http://bulletin.vcu.edu/graduate/school-medicine/physiology-biophysics-ms-concentration-molecular-biology-genetics)

PHIS 501. Mammalian Physiology. 5 Hours.
Semester course; 5 lecture hours. 5 credits. A comprehensive study of the function of mammalian organ systems at the organ, cell and molecular level, designed for graduate and professional students. Successful students typically have high achievement in intermediate-level undergraduate biology, chemistry and physics.

PHIS 502. Physiology and Pathophysiology (Dentistry). 5 Hours.
Semester course; 5 lecture hours. 5 credits. Prerequisites: biology, chemistry and physics. A comprehensive study of the function of mammalian organ systems, designed primarily for dental students.

PHIS 512. Cardiac Function in Health and Disease. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501 or permission of instructor. A comprehensive study of cell and system cardiovascular physiology with pathophysiological implications, primarily designed for professional students.

PHIS 514. Cardiovascular Hemodynamics. 2 Hours.
Semester course; 30 lecture/lab hours. 2 credits. Prerequisite: PHIS 501. Emphasizes the pathophysiological implications of cardiovascular hemodynamics. The rationale and principles of a variety of clinical and paraclinical examination methods used in cardiology will be studied and demonstrated. The pathophysiology of some of the major cardiovascular diseases will be explained by specialists.

PHIS 604. Cell Physiology: Cardiovascular and Respiratory. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501. Enrollment restricted to Ph.D. and M.S. students. This research-oriented course covers topics such as the cellular, molecular and structural bases for cardiovascular and pulmonary function, including detailed analyses of the behavior and regulation of diverse types of transmembrane ion channels at the molecular and cellular level; detailed studies of oxygen delivery by microcirculation; mechanisms of ischemia-reperfusion injury, novel cardio-protection strategies and heart failures; cholesterol homeostasis by macrophages in coronary artery disease; and airway inflammation and mucus secretion as a model for drug development.

PHIS 606. Molecular Basis for Disease. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Topics covered include an introduction to structure of macromolecules and biophysical methods of protein determination. The second part of the course includes research topics such as gene regulation, protein folding and ribosome biogenesis. The third section includes ion channel structure and function. Each section includes problem sets that students are required to complete, three exams and a written mini-grant chosen from the topics discussed in class.

PHIS 607. Cell Physiology: GI and Endocrine. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501. This course focuses on physiology at the levels of individual molecules, cells, organs and entire organisms. Molecular mechanisms, regulatory processes and diseases processes are considered. The course is designed for research-oriented students and focuses on taste, gut, intestines, endocrine and reproductive systems and is structured around the ongoing research activity of the participating faculty.

PHIS 612. Cardiovascular Physiology. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501. An in-depth study of the original literature in selected areas of cardiovascular physiology.

PHIS 615. Signal Detection in Sensory Systems. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Prerequisite: PHIS 501 or permission of instructor. An in-depth study of cells and cell systems that serve as either internal or external environmental sensors. Topics will emphasize the physiology, anatomy and the biochemistry of mature sensing systems, the systems in normal development and their plasticity toward stresses during development or in maturity.

PHIS 619. Mitochondrial Pathophysiology and Human Diseases. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Mitochondria are essential for eukaryotic life energy production in an oxygen environment, extensively modulate intracellular calcium signaling, are the major source of damaging oxygen free radicals, control activation of cell death pathways and are now known to be impaired in many human diseases of aging. For all these reasons, understanding mitochondrial physiology is essential for graduates of biomedical research programs in medical schools.

PHIS 620. Ion Channels in Membranes. 3 Hours.
Semester course; 3 lecture hours. 3 credits. Previous course work including basic concepts in electrophysiology, such as those covered in PHIS 501 or PHTX/PHIS/ANAT 509, is highly recommended. Detailed presentation of the fundamental biophysical properties of ionic channels in membranes including the elementary properties of pores, molecular mechanisms of ionic selectivity, mechanisms of drug block, structure-function relationships, and basis for channel gating. Discussion will encompass modern techniques for studying ion channel function. Crosslisted as: PHTX 620.
PHIS 630. Methods in Molecular Biophysics: A Practical Approach. 2 Hours.
Semester course; 2 lecture hours. 2 credits. The course will cover the theoretical and practical aspects of several techniques that are used to study the structure and function of biological macromolecules. In each section the theoretical background and practical application will be covered. The design of the course is to provide a basic familiarity of biophysical techniques used in structural biology and biochemistry laboratories to understand biological phenomena. Graded S/U/F.

PHIS 631. Electrophysiology and Photonic Methods. 2 Hours.
Semester course; 2 lecture hours. 2 credits. This course elaborates on the fundamentals of bioelectrical activity (resting and action potentials, electrical propagation and synaptic transmission) guiding the student to the use of equivalent circuits to model the electrical properties of cells design and the use of basic operational amplifiers for electrophysiological studies. The course develops a similar approach to understand the basis for fluorescence and phosphorescence techniques and how they can be applied to biophysical research.

PHIS 650. Critical Thinking in Physiology. 1 Hour.
Semester course; 1 lecture hour. 1 credit. Journal club format. Pre- or corequisite: PHIS 501. Enrollment restricted to students with graduate standing or by permission of instructor. This course introduces classical research papers and incorporates problem sets in areas that lend themselves to an analytical approach. Students read and present papers, contributing answers to questions about them.

PHIS 651. MD/PhD Journal Club. 1 Hour.
Semester course; 1 lecture hour. 1 credit. May be repeated for credit. Enrollment restricted to students in the MD/PhD program. This course is intended for first-year MD/PhD students as a complement to the ongoing medical curriculum and is designed to expose MD/PhD students to research literature related to their ongoing course work. The objectives are to introduce students to original research papers from the current and classical literature and to provide practice and training in effectively identifying and discussing key hypotheses, methods, results and conclusions, as well as in evaluating the strengths and weaknesses of papers. Graded as Satisfactory/Unsatisfactory.

PHIS 652. MD/PhD Science and Disease. 1 Hour.
Semester course; 1 lecture hour. 1 credit. Enrollment restricted to students in the MD/PhD program. This course is intended for second-year MD/PhD students as a complement to the ongoing medical curriculum. Clinical faculty or physician-scientists present a patient and then either the physician-scientist or a basic science faculty member discusses the basic science underpinnings of the disease in question. The sessions are coordinated with the MS2B curriculum. Active student participation in the discussion of the case and scientific basis is expected and required. Faculty members are encouraged to present informal sessions designed to encourage student participation and engaged learning. Graded as Satisfactory/Unsatisfactory.

PHIS 689. Physiology Preseminar Highlights. 1 Hour.
Semester course; 1 lecture hour. 1 credit. May be repeated for credit. Designed to review research to be presented in the department's upcoming weekly seminar. Students present and discuss papers by that week's seminar speaker. Graded as Satisfactory/Unsatisfactory/Fail.

PHIS 690. Physiology Research Seminar. 1 Hour.
Semester course; 1 lecture hour. 1 credit. Presentation and discussion of research reports and topics of current interest to the departmental seminar or special group seminar.

PHIS 691. Special Topics in Physiology. 1-4 Hours.
Semester course; 1-4 credits. Prerequisite: PHIS 501 (or taken concurrently). Special Topics in Physiology (Section 1) 1-4 credits. Lectures, tutorial studies and/or library assignments in selected areas of advanced study not available in other courses or as part of the research training. Special Topics: Student Seminar (Section 3) 1 credit. Pre- or corequisite: PHIS 501. Designed to develop skills in preparing and delivering lectures and other oral presentations. Students present talks on topics in which they are particularly interested, and provide mutual constructive criticism.

PHIS 692. Special Topics. 1-4 Hours.
Semester course; 1-4 variable hours. 1-4 credits. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other courses or as part of the research training. Graded S/U/F.

PHIS 693. Methods in Molecular Biophysics: A Practical Approach. 2 Hours.
Semester course; 1 lecture and 2 laboratory hours. 2 credits. Covers the theoretical and practical aspects of several techniques that are used to study the structure and function of biological macromolecules. In each section, theoretical background and practical applications will be covered. The course will provide a basic familiarity of biophysical techniques used in structural biology and biochemistry laboratories to understand biological phenomena. Graded S/U/F.

PHIS 695. Research in Progress. 0.5 Hours.
Semester course; 0.5 lecture hour. 0.5 credit. Restricted to Ph.D. students or, with permission of instructor, master's students. Student presentations and discussion of research results and contemplated research projects based on research rotations, thesis proposals and ongoing thesis research. Graded S/U/F.

PHIS 697. Directed Research in Physiology. 1-15 Hours.
Semester course; 1-15 credits. Research Leading to the M.S. or Ph.D. degree and elective research projects for other students.