

Cellular and Integrative Physiology, Ph.D.

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Degrees Offered

- Doctor of Philosophy
- Joint Doctor of Medicine and Doctor of Philosophy

Nature of the Program

Physiology is a dynamic life science that focuses on the study of biological systems at many levels of complexity, ranging from genes and molecules to cells and organisms. Thus, training in physiology has the ultimate goal of linking molecular and cellular information to functional outcomes. Currently, groundbreaking research and discovery in the life sciences are more interdisciplinary than ever, and students studying within the realm of physiology can expect to work with a wide range of scientists, including pharmacologists who are focused in a complementary field: namely, the study of how drugs affect biological systems and how biological systems affect drugs.

The goal of the doctoral program in **Cellular and Integrative Physiology** is to engage students in creating a new approach to the life sciences, with the aim of explaining how the higher-level properties of complex systems appear from the interactions amongst their parts and environmental inputs. Our program provides a multidisciplinary approach to modern life sciences, drawing on faculty expertise from several departments and centers in the Schools of Medicine and Pharmacy.

Completion of the Ph.D. degree is realized when the student publishes at least one original, peer-reviewed manuscript in the biomedical research literature and successfully presents this original research to faculty of the graduate dissertation committee and the program/department. Typically, approximately five years are required to realize this goal.

The program's participating research faculty consists of scientists from the Department of Physiology & Pharmacology, NIOSH/CDC, and the Rockefeller Neurosciences Institute. As a result, this multidimensional program includes activities in the following:

- Inhalation Toxicology
- Integrative and Systems Physiology
- Oxidative Stress Biology
- Pathophysiology
- Translational Research
- Pharmacology

It also integrates information from genetics, functional genomics, and proteomics into whole animal and human physiology.

This interactive and cross-disciplinary environment, together with an atmosphere filled with enthusiasm and passion for scientific discovery, makes our program a uniquely exciting place for doing research and the training of students. Specific topics of research emphasis include the following:

- Protein Regulators of Hormone and Neurotransmitter Signal Transduction
- Free Radical Biology in Diabetes and Obesity
- Impact of Inhaled Toxicants on Cardiovascular Function and Health
- Respiratory Function and Control in Health and Disease
- Neuroendocrine Control of Reproduction
- Regulation of Cardiac Function and Inflammation
- Influence of Small Molecules on Cardiac Function and Health

Students will leave our program better able to identify important unsolved scientific problems and with an appreciation of how to select problems for which quantitative and theoretical approaches will be most productive.

ADMINISTRATION

CHAIR

- Tim Nurkiewicz - Ph.D.

ADMINISTRATOR

- Tammy McPherson -
(Sr. Administrative Official)

ASSOC. CHAIR FOR RESEARCH

- Eric Kelley - Ph.D.

ASSOC. CHAIR FOR EDUCATION

- Mark Paternostro - Ph.D.

FACULTY

GRADUATE PROGRAM DIRECTOR

- Stan Hileman - Ph.D.
(Director)
- Scott Levick - Ph.D.
Co-Director
- Robert Brock - Ph.D.
(Assistant Director)

CHAIR

- Tim Nurkiewicz - Ph.D.

REGULAR MENTORS

- Lizzie Bowdridge - Ph.D.
Assistant Professor
- Paul Chantler - Ph.D.
(Cardiovascular)
- Robert Goodman - Ph.D.
(Endocrine & Neuroscience)
- Stanley Hileman - Ph.D.
(Endocrine & Neuroscience)
- Salik Hussain - Ph.D.
(Respiratory Toxicology)
- Eric Kelley - Ph.D.
(Redox Physiology)
- Timothy Nurkiewicz - Ph.D.
(Cardiovascular)
- Scott Levick - Ph.D.
Associate Professor
- Mark Olfert - Ph.D.
(Cardiovascular & Respiratory)
- Vazhaikurichi Rajendran - Ph.D.
(Gastrointestinal Electrophysiology)

RESEARCH ASSISTANT PROFESSOR

- Evan DeVallance - Ph.D.
Research Assistant Professor
- Alexander Widiapradja - Ph.D.
Research Assistant Professor

NIOSH MENTORS

- Patti Erdely - Ph.D.
- Aaron Erdely - Ph.D.
- Jeffrey Fedan - Ph.D.
- Richard Johnson - Ph.D.
- Dale Porter - Ph.D.
- Anna Shvedova - Ph.D.
- Todd Stueckle - Ph.D.

Doctor of Philosophy

MAJOR REQUIREMENTS

Code	Title	Hours
BMS 700	Scientific Integrity	1
BMS 701	Scientific Rigor and Ethics	1
BMS 706	Biomedical Research Methods	1
BMS 707	Experiential Learning for Biomedical Trainees	2
BMS 720	Scientific Writing	2
Graduate Seminar		4
PSIO 744	Graduate Seminar	
Journal Club		9
PSIO 745	Physiology Journal Club	
PSIO 750	Graduate Physiology and Pharmacology 1	3
PSIO 751	Graduate Physiology and Pharmacology 2	3
BMS 702	Biomedical Lab Experience	2
BMS 747	Foundations for Contemporary Biomedical Research I	4
BMS 777	Foundations for Contemporary Biomedical Research 2	4
Research		40
PSIO 797	Research	
Electives:		6
BMM 715	Molecular Genetics	
CCB 730	Cancer Cell Biology	
PHAR 779	Drug Discovery	
MICB 784B	Special Problems in Microbiology	
MICB 784C	Special Problems in Microbiology	
PSIO 790	Teaching Practicum	
PSIO 793	Special Topics (Physiology Issues)	
PSIO 793	Special Topics	
PSIO 793	Special Topics	
PSIO 795	Independent Study	
Qualifying Exam		
Candidacy Exam		
Dissertation Defense		
Total Hours		82

Seminars and Research Forum

Students are required to present one departmental seminar per academic year. Students will register for one credit hour in the semester when the seminar is presented.

Journal Club

Students are required to enroll in Journal Club each semester. The course involves the presentation and discussion of current research papers and will help acquaint students with the variety of methods used in scientific research.

Doctoral Research

Students will conduct research with a dissertation mentor during time in the program. Students register for research credits each semester, and their performance is graded by their dissertation mentor.

Qualifying and Dissertation Proposal/Ph.D. Candidacy

The oral qualifying exam is given in the spring or summer of the second year of study. The candidacy exam consists of either presenting and defending a research dissertation proposal to the student's dissertation committee or the submission of a predoctoral fellowship application to a recognized funding agency. The student is admitted to candidacy when both requirements are met.

Dissertation Defense and First-Author Paper Requirement

Students are allowed to defend their dissertation when a minimum of one manuscript with student as the first author, based on dissertation research, is accepted in a peer-reviewed journal. The final examination for the Ph.D. degree consists of orally defending a written dissertation in a public seminar and then in private to the dissertation committee. Participation of an external examiner, a distinguished scientist external to WVU, is optional at the dissertation defense. Satisfactory performance in the oral defense will result in recommendation for granting of the Ph.D. degree.

Suggested Plan of Study***First Year**

Fall	Hours	Spring	Hours	Summer	Hours	
BMS 700		1 Electives		3 PSIO 797		3
BMS 706		1 BMS 701		1		
BMS 702		2 PSIO 745		1		
BMS 747		4 PSIO 751		3		
BMS 777		4 PSIO 797		1		
		12		9		3

Second Year

Fall	Hours	Spring	Hours	Summer	Hours	
PSIO 745		1 PSIO 744		1 BMS 720		2
PSIO 750		3 PSIO 745		1 PSIO 797		1
PSIO 797		2 PSIO 797		7		
Electives		3				
		9		9		3

Third Year

Fall	Hours	Spring	Hours	Summer	Hours	
Elective (as needed)		3 PSIO 744		1 PSIO 797		1
PSIO 745		1 PSIO 745		1 BMS 707		2
PSIO 797		5 PSIO 797		7		
		9		9		3

Fourth Year

Fall	Hours	Spring	Hours	Summer	Hours	
PSIO 745		1 PSIO 744		1 PSIO 797		3
PSIO 797		8 PSIO 745		1		
		PSIO 797		7		
		9		9		3

Total credit hours: 87

NOTE: The graduate curriculum is finalized with a plan of study once the mentor and laboratory have been selected in the first year. The plan of study is developed by the graduate committee in consultation with the student. The courses listed above include the required and elective coursework necessary for the student to finalize his/her plan of study. When the student enters the laboratory of his/her doctoral dissertation mentor, repetitive enrollments in research, seminars, and journal club are typical and will determine total hours necessary for degree completion.

*This is a suggested plan of study. Course sequences and length of time in program may vary depending on student and altered total credit hours.

Major Learning Outcomes**CELLULAR AND INTEGRATIVE PHYSIOLOGY**

The student learning and programmatic outcomes of the Cellular and Integrative Physiology Graduate Program are similar to those put forth by the Human Anatomy & Physiology Society (HAPS) and the American Physiological Society (APS). They are as follows:

Fundamental Content & Process Goals

1. Recognize the anatomy and explain physiological functions of body systems.
2. Recognize and explain the principle of homeostasis and the use of feedback loops to control physiological systems.
3. Use anatomical knowledge to predict physiological consequences, and use knowledge of function to predict the features of anatomical structures.

4. Recognize and explain the interrelationships within and between anatomical and physiological systems of the body.
5. Synthesize ideas to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.

Broader Process Goals

1. Demonstrate information literacy skills to access, evaluate, and use resources to stay current in the field of physiology.
2. Examine issues related to physiology from an evidence-based perspective.
3. Communicate clearly and in a way that reflects knowledge and understanding of physiology and demonstrates the ability to adapt information to different audiences and applications.