

Cellular and Integrative Physiology

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Degrees Offered

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

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, four to 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:

- Pharmacology
- Integrative and systems physiology
- Pathophysiology
- Translational research
- Small animal physiology
- Biophysics

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
- Hemodynamics and Cardiovascular Control in Health and Disease
- Microcirculation and Cellular Biophysics
- Respiratory Function and Control in Health and Disease
- Neuroendocrine Control of Reproduction
- Neural Control of Sensory Physiology

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

- David Siderovski - Ph.D.
(E.J. Van Liere Endowed Medicine Professor)

ADMINISTRATOR

- Tammy McPherson -
(Sr. Administrative Official)
-

FACULTY

GRADUATE PROGRAM DIRECTOR

- David Siderovski - Ph.D.
(Interim Director)
- Robert Brock - Ph.D.
(Extended Leave)

CHAIR

- David Siderovski - Ph.D.
(Hormone & Neurotransmitter Signaling)

REGULAR MENTORS

- 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)
- S. Jamal Mustafa - Ph.D.
(Cardiovascular)
- Timothy Nurkiewicz - Ph.D.
(Cardiovascular)
- Mark Olfert - Ph.D.
(Cardiovascular & Respiratory)
- Vazhaikurichi Rajendran - Ph.D.
(Gastrointestinal Electrophysiology)
- Bernard Schreurs - Ph.D.
(Neuroscience)
- Vincent Setola - Ph.D.
(Neuroscience & Signaling)
- James Simpkins - Ph.D.
(Cardiovascular)
- Han-Gang Yu - Ph.D.
(Cardiovascular)

NIOSH MENTORS

- Patti Erdely - Ph.D.
- Aaron Erdely - Ph.D.
- Jeffrey Fedan - Ph.D.
- Dale Porter - Ph.D.
- Anna Shvedova - Ph.D.

Doctor of Philosophy

MAJOR REQUIREMENTS

| | | |
|----------------------|---|---|
| Scientific Integrity | | 2 |
| BMS 700 | Scientific Integrity | |
| BMS 706 | Cellular Methods | 1 |
| BMS 707 | Experiential Learning for Biomedical Trainees | 2 |
| BMS 720 | Scientific Writing | 2 |
| Graduate Seminar | | 4 |

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|----------------------|--|----|
| PSIO 744 | Graduate Seminar | |
| 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 | |
| Graduate Colloquium | | 7 |
| PSIO 799 | Graduate Colloquium | |
| Electives: | | 15 |
| BMS 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 791 | ADTP:Physiology Issues | |
| PSIO 792 | Directed Study | |
| PSIO 793 | Special Topics | |
| PSIO 795 | Independent Study | |
| Qualifying Exam | | |
| Candidacy Exam | | |
| Dissertation Defense | | |
| Total Hours | | 89 |

Seminars and Research Forum

Students register for one credit of seminar each academic year while in residence.

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 at the end of the second year of study. The candidacy exam is completed in the third year of study. Admission to Ph.D. candidacy occurs following the successful defense of the dissertation proposal.

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. An external examiner, a distinguished scientist external to WVU, is required to participate 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 700 | 1 | |
| BMS 702 | 2 PSIO 744 | 1 | |

| | | | |
|----------------------|---------------------|---------------------|--------------|
| BMS 747 | 4 PSIO 750 or 751 | 3 | |
| BMS 777 | 4 PSIO 797 | 2 | |
| | PSIO 799 | 1 | |
| | 12 | 11 | 3 |
| Second Year | | | |
| Fall | Hours Spring | Hours Summer | Hours |
| PSIO 750 or 751 | 3 Electives | 6 BMS 720 | 2 |
| PSIO 797 | 2 PSIO 744 | 1 PSIO 797 | 1 |
| Electives | 3 PSIO 797 | 1 | |
| PSIO 799 | 1 PSIO 799 | 1 | |
| | 9 | 9 | 3 |
| Third Year | | | |
| Fall | Hours Spring | Hours Summer | Hours |
| Elective (as needed) | 3 PSIO 797 | 8 PSIO 797 | 1 |
| PSIO 744 | 1 PSIO 799 | 1 BMS 707 | 2 |
| PSIO 797 | 4 | | |
| PSIO 799 | 1 | | |
| | 9 | 9 | 3 |
| Fourth Year | | | |
| Fall | Hours Spring | Hours Summer | Hours |
| PSIO 744 | 1 PSIO 797 | 8 PSIO 797 | 3 |
| PSIO 797 | 7 PSIO 799 | 1 | |
| PSIO 799 | 1 | | |
| | 9 | 9 | 3 |

Total credit hours: 89

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 colloquia 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

6. Demonstrate information literacy skills to access, evaluate, and use resources to stay current in the field of physiology.
7. Examine issues related to physiology from an evidence-based perspective.

8. 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.