Pathophysiology, Rehabilitation & Performance, Ph.D

Degrees Offered

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

Director of PhD Studies

John M. Hollander, PhD, Professor, jhollander@hsc.wvu.edu (johollander@hsc.wvu.edu)
https://medicine.wvu.edu/exercise-physiology/pathophysiology-rehabilitation-and-performance-phd/

Nature of the Program

Exercise physiology is the comprehensive study of the biophysical, biomechanical and biochemical processes that contribute to movement production and disease progression. Advances in exercise physiology research have provided the foundation for human enhancement and medical treatment. The focus of the program is to promote student innovation and foster the development of independent thought. Students and faculty interact in a collegial fashion facilitating open inquiry and collaborative science.

Students entering the Pathophysiology, Rehabilitation, and Performance doctoral program have the ability to select a specialization in one of three research tracks: 1) Cardiovascular and Metabolic Diseases (CMD); 2) Muscle Pathophysiology (MPP); and 3) Rehabilitation Science and Engineering (RSE).

- ***Cardiovascular and Metabolic Diseases (CMD):*** Cardiovascular and respiratory function/dysfunction are studied at cellular, molecular, genetic and whole organ level in human and animal models that mimic chronic diseases, such as obesity, diabetes mellitus, stroke, and environmental exposure. Mitochondrial dysfunction, vascular remodeling, blood flow disruption, exercise and metabolic dysfunction are specific interests.
- ***Muscle Pathophysiology (MPP):*** Muscle function and dysfunction are studied under conditions of aging, cancer, disuse and obesity at the cellular, molecular, genetic and whole organ levels. Mechanisms contributing to dysfunction and therapeutic interventions are tested utilizing appropriate pre-clinical and clinical experimental models.
- ***Rehabilitation Science and Engineering (RSE):*** The research focus is on enhancing the understanding of the basic processes associated with sensorimotor control of reaching movements, balance, and locomotion after central or peripheral damage using tissue engineering, neurophysiology, biomechanics and computational neuroscience methodologies.

The philosophy of the program is to provide flexibility in coursework to support the student's research interest in accordance with the selected track. The student and faculty mentor will define an individualized curriculum to address specific requirements for accomplishing the dissertation research. The program fosters a high degree of collaboration among faculty with interests in clinical medicine and basic research. Completion of the doctoral degree is realized when the student successfully disseminates the research results in peer-reviewed journals, national/international conferences, and to the dissertation committee. Typically, five years are required to realize this goal.

Current areas of scientific inquiry among the faculty in exercise physiology include the following:

- Aging and repetitive use injury in skeletal muscle
- Cancer cachexia and muscle wasting diseases
- Mitochondria dysfunction in pathophysiological states
- Metabolic syndrome and diabetes mellitus
- Control of movement in health and disease
- Development of assisted technologies and wearable devices
- Assessment and enhancement of human performance
- Microvascular dysfunction in disease states
- Stem cell biology and mechanical signal and tissue regeneration
- Mechanisms of stoke and post-stroke recovery

Upon completion of the doctoral degree, the student will be capable of undertaking a career in a traditional research setting (academic, industrial, government, etc.). The acquired training will also prepare students for careers outside of a traditional research setting. Students will be periodically exposed to diverse opportunities for career development.

Degree Requirements

Code	Title	Hours
Minimum overall GPA of 3.0 required.		
Minimum GPA of 3.0 in all EXPH courses required.		
A grade of B- must be earned in all required courses.		
BMS 700	Scientific Integrity	1
BMS 701	Scientific Rigor and Ethics	1
BMS 702	Biomedical Lab Experience	2
BMS 706	Biomedical Research Methods	1
BMS 707	Experiential Learning for Biomedical Trainees	2
BMS 720	Scientific Writing	2
BMS 747	Foundations for Contemporary Biomedical Research I	4
BMS 777	Foundations for Contemporary Biomedical Research 2	4
EXPH 787	Cardiopulmonary Physiology	3
EXPH 793	Special Topics (Human Performance and Rehabilitation Engineering)	3
Graduate Seminar		3
EXPH 796	Graduate Seminar	
Research		55
EXPH 797	Research	
Electives		6
BMS 715	Molecular Genetics (recommended)	
PSIO 750	Graduate Physiology and Pharmacology 1	
PSIO 751	Graduate Physiology and Pharmacology 2	
Candidacy Exam		
Dissertation Defense		
Total Hours		87

Students will complete the BMS course sequence including the laboratory rotations before beginning to work with a dissertation research mentor and starting the specialized doctoral courses in the Exercise Physiology program.

Seminars and Research Forum

Students will present three seminars during their graduate study. The first seminar is on a topic outside of the student's research area. The second seminar is the public presentation of the dissertation proposal, which is the background and proposed research for the dissertation project. The third seminar is the public presentation of the dissertation defense.

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.

Dissertation Proposal/Ph.D. Candidacy

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 the student as 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. Satisfactory performance in the oral defense will result in recommendation for granting of the PhD.

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.

Major Learning Outcomes

DOCTOR OF PHILOSOPHY (PHD) IN PATHOPHYSIOLOGY, REHABILITATION & PERFORMANCE

Students will:

- Attain a comprehensive understanding of the biophysical, biomechanical and biochemical processes that contribute to movement production and disease progression
- Learn to apply theories and methodologies to address fundamental questions in health-specific issues related to exercise physiology
- Obtain independent and critical thinking skills requisite for designing, conducting, and interpreting research data in an effort to advance knowledge related to health and disease through creative and innovative research
- Effectively communicate knowledge through oral and written means by disseminating research findings that have the potential to improve health and quality of life
- Demonstrate principles of ethics associated with appropriate research conduct
- Acquire technical skills requisite for conducting experimental procedures