Exercise Physiology

DEGREES OFFERED

- Doctor of Philosophy
- Joint Doctor of Medicine and Doctor of Philosophy
- Master of Science

Interim Chair and Director of Undergraduate Education

Randall W. Bryner, Ed.D., Associate Professor, rbryner@hsc.wvu.edu; (rbryner@hsc.wvu.edu) https://medicine.hsc.wvu.edu/ep/students/bachelor-of-science/

Vice Chair and Director of Graduate Studies

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https://medicine.hsc.wvu.edu/ep/students/phd-program/

Director of M.S. Studies and Director of Human Performance Lab

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https://medicine.hsc.wvu.edu/ep/students/master-of-science/

DOCTORAL 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 Exercise Physiology 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
- Physiologic basis of angiogenesis in pulmonary and skeletal muscle tissue

- 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.

MASTER OF SCIENCE

The master's of science is a two-year program, with two track emphases, clinical and thesis.

- Clinical track students engage in an intensive curriculum consisting of 39 required credits and a minimum of 6 elective credits. Didactic coursework in biological sciences comprise a significant portion of the first-year curriculum.Students gain experience working with individuals with cardiovascular, metabolic, neuromuscular etc. in which exercise has been shown to be an effective treatment. Clinical Master Students also assist clinical faculty in the WVU Human Performance Laboratory with functional assessment, risk factor modification, exercise prescription, and monitoring hemodynamic responses in populations with various medical conditions .Another aspect of the clinical track is the clinical internships which are performed in Phase I (inpatient), Phase II (outpatient), and Phase III (maintenance) cardiac rehabilitation programs as well as observation opportunities within in the WVU Heart and Vascular Institute, and Bariatric Surgery. Students are also encouraged to become involved with any of the various clinically related research projects being performed within the Division of Exercise Physiology.

  Thesis track is also a two-year program and it is designed for students who wish to engage in an intensive research training experience, in preparation for further training in a Ph.D., or MD or similar postgraduate program. The thesis track student selects a research mentor and committee from faculty within the division of exercise physiology (or an afflicted group) based on their research interests. The first year consists of didactic coursework, while learning the necessary research skills and tools to conduct research. In the second year, the thesis track student can focus heavily on all aspects of research, the production and oral defense of a research thesis.

  The faculty who will act as primary mentors in exercise physiology have research and/or clinical expertise in:

- Heart disease
- Stroke
- Diabetes
- Motor unit recruitment in stroke and disability
- Biomechanical and motor control for gait in stroke or spinal cord injury
- Muscle injury and repair
- Cancer cachexia and muscle wasting diseases
- Aging and sarcopenia in skeletal muscle
- Cardiac and skeletal muscle growth and function
- Vascular dysfunction with the metabolic diseases
- Physiologic basis of lung disease
- Exercise-induced angiogenesis
- Stem cell biology and mechanical signal and tissue regeneration
- Arthritis control and exercise
- Aquatic Therapy applications to health and disease

MS students are expected to:

- Take an array of courses in exercise physiology, physiology, biochemistry, and molecular biology (both non-thesis and thesis tracks)
- Some students will take courses specializing in clinical science approaches (clinical track MS and clinical thesis tracks)
- Conduct independent research, analyze and interpret the data, and defend the finding's conclusions (thesis track)
- Demonstrate clinical care competency (clinical non-thesis track)
- Learn the process of writing and submitting grants (both non-thesis and thesis tracks)
- Present and discuss their research findings at national and international scientific meetings (both non-thesis and thesis tracks)
- Develop and improve teaching skills; communication with scientific and lay populations (both non-thesis and thesis tracks)
- Submit their thesis research for publication prior to graduation (MS thesis)

FACULTY

PROFESSOR

- John M. Hollander - Ph.D. (University of Wisconsin-Madison)
  Diabetes, Mitochondria Dysfunction, Molecular Regulation of Heart Disease

ASSOCIATE PROFESSORS

- Daniel E. Bonner - MS (West Virginia University)
  Clinical Exercise Physiology
- Randall W. Bryner - Ed.D. (West Virginia University)
  Diabetes, Exercise, and Cancer
- Paul D. Chantler - Ph.D. (Liverpool John Moores University)
  Metabolic Syndrom, Vascular Biology, Effects of Aging and CV Dieases on Arterial and Venticular Structure and Function
- David Donley - MS (West Virginia University)
  Exercise and Metabolic Syndrome
- Diana Gilleland - MS (West Virginia University)
  Clinical Exercise Physiology
- Guyton W. Hornsby Jr. - Ph.D. (Louisiana State University)
  Diabetes and Depression
- Jean McCrory - Ph.D. (Penn State University)
  Biomechanics, gait, foot injuries
- Beth Nardella - M.A. (West Virginia University)
  Writing Instructor, Global Engagement Coordinator
- I Mark Olfert - Ph.D. (Loma Linda)
  Angiogenesis, respiratory physiology, toxicology
- Emidio E. Pistilli - Ph.D (West Virginia University)
  Muscular Dystrophy, Muscle Injury, Cytokines, Cancer Biology
- Lori Sherlock - Ed.D. (West Virginia University)
  Aquatic Therapy in Obesity
- Sergiy Yakovenko - Ph.D. (University of Alberta)
  Neuromuscular Integration of Movement

ASSISTANT PROFESSORS

- Juniath S. Mohamed - Ph.D. (Tamil Nadu, India)
  Muscle fatigue, genetics of aging, muscle regeneration
- James Thomas - M.S. (West Virginia University)
  Exercise, Children, Strength Training
- Emily Ryan - Ph.D. (Kent State University)
  Obesity Exercise

ADJUNCT ASSOCIATE PROFESSOR

- Ming Pei - Ph.D. (Beijing University, China)
  Stem Cells, Cartilage Repair

ADJUNCT ASSISTANT PROFESSOR

- Brent Baker - Ph.D. (West Virginia University)
  Muscle injury, rehabilitation, genomics

Master of Science

Degree Requirements

A minimum GPA of 3.0 is required in all courses

A grade of B or higher must be earned in all required courses		
PSIO 743	Fundamentals of Physiology	5
EXPH 567	Exercise Physiology 2	4
EXPH 682	Research Design and Methods	4
STAT 511	Statistical Methods 1	3

Electives		3
Complete 1 of the following Tracks		26
Thesis Track		
AGBI 514	Animal Biotechnology	
EXPH 697	Research (18 hours)	
EXPH 698	Thesis or Dissertation (2 hours)	
EXPH 799	Graduate Colloquium (2 hours)	
Clinical Track		
EXPH 670	Lab Techniques and Methods 2	
PCOL 549	Applied Pharmacology	
EXPH 680	Advanced Clinical Exercise Physiology	
EXPH 681	Clinical Exercise Prescription	
EXPH 696	Graduate Seminar	
EXPH 672	Professional Field Placement (4 hours)	
EXPH 673	Exercise Prescription	
Electives (4 hours)		
Total Hours		45

Doctor of Philosophy

Degree Requirements

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.		
Scientific Integrity		2
BMS 700	Scientific Integrity	
BMS 702	Biomedical Lab Experience	2
BMS 706	Cellular 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 786	Musculoskeletal Biology	3
EXPH 787	Cardiopulmonary Physiology	3
Graduate Seminar		3
EXPH 796	Graduate Seminar	
Research		48
EXPH 797	Research	
Graduate Colloquium		7
EXPH 799	Graduate Colloquium	
Electives		6
BMS 715	Molecular Genetics (recommended)	
PSIO 750	Graduate Physiology and Pharmacology 1	
PSIO 751	Graduate Physiology and Pharmacology 2	
Qualifying Exam		
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.

Qualifying and Dissertation Proposal/Ph.D. Candidacy

The written 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 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.

First Year			
Fall	**Hours Spring**	**Hours Summer**	**Hours**
BMS 700	1 BMS 700	1 EXPH 797	3
BMS 702	2 BMS 715	3	
BMS 706	1 EXPH 797	4	
BMS 747	4 EXPH 799	1	
BMS 777	4		
	12	9	3
Second Year			
Fall	**Hours Spring**	**Hours Summer**	**Hours**
EXPH 787	3 EXPH 786	3 BMS 720	2
EXPH 797	5 EXPH 796	1 EXPH 797	1
EXPH 799	1 EXPH 797	1	
	EXPH 799	1	
	Elective	3	
	9	9	3
Third Year			
Fall	**Hours Spring**	**Hours Summer**	**Hours**
EXPH 797	8 EXPH 796	1 BMS 707	2
EXPH 799	1 EXPH 797	7 EXPH 797	1
	EXPH 799	1	
	9	9	3
Fourth Year			
Fall	**Hours Spring**	**Hours Summer**	**Hours**
EXPH 797	8 EXPH 796	1 EXPH 797	3
EXPH 799	1 EXPH 797	7	
	EXPH 799	1	
	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 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

DOCTOR OF PHILOSOPHY (PHD) IN EXERCISE PHYSIOLOGY

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

MASTER OF SCIENCE (MS) IN EXERCISE PHYSIOLOGY

This program is designed with a clinical and a thesis track. The clinical track specializes in working with persons with diseases such as obesity, cardiovascular disease, and diabetes and aging. The thesis track provides opportunities for students to study mechanisms leading to and contributing to health diseases and disparities and to understand the impact of exercise on these health issues. The graduates of the masters program clinical track will become leaders who will supervise Exercise Physiologists in hospitals, rehabilitation, aquatic therapy programs, fitness, or academic settings. Some will use the clinical training in this degree to strengthen their application to medical school or another professional program. The MS clinical track will provide students the research basis from which to launch additional training in a research intensitve doctoral or professional program.

Students will:

- Critically apply theories, methodologies, and knowledge to address fundamental questions in health specific issues related to exercise physiology
- Demonstrate skills in written and oral communication and critical thinking by critically analyzing research that is significant and novel in exercise physiology and within the sub-discipline associated with it
- Plan and conduct this research or implement this project under the guidance and approval of their research mentors while developing the intellectual independence that typifies true scholarship (thesis track students)
- Critically evaluate published research data and demonstrate clinical skills in working with patients and evaluating health and exercise-stress test data for appropriate exercise treatment (clinical track students)
- Follow the principles of ethics associated with appropriate research conduct (thesis track students) or clinical treatment of patients (clinical track students)
- Interact productively with people from diverse backgrounds including mentors and team members/peers with integrity and professionalism