Exercise Physiology

DEGREES OFFERED

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

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INTRODUCTION

The overall goal of the M.S., and Ph.D. training programs is to provide students the skills that will allow them to promote health and quality of life of the citizens of West Virginia and the nation through the use of appropriate research, physical activity and lifestyle behavioral tools. The two-year program leading to a masters of science (clinical or thesis track), and a doctoral program leading to a Ph.D. in exercise physiology is offered through the Division of Exercise Physiology.

WHAT IS AN EXERCISE PHYSIOLOGIST?

Exercise physiology is the study of the biological and biochemical processes associated with exercise and overload that affects the underlying function of cells and organ systems in the human body. Exercise physiology is a rapidly evolving field that is becoming increasingly important in the delivery of healthcare. Exercise physiologists work to prevent or delay the onset of chronic disease in healthy participants or to provide therapeutic or functional benefits to patients with known disease. Services may be offered in a variety of medical settings such as hospitals, rehabilitation centers, and out-patient clinics; in community, corporate, commercial, and university fitness and wellness centers; in nursing homes and senior citizens centers; as well as in research and academic settings.

Research by scientists trained in exercise physiology have greatly expanded our understanding of the ways in which exercise affects cell function. Advances in research in exercise physiology have provided a foundation for many types of medical treatment in areas that include but are not limited to cardiovascular diseases, diabetes, aging, obesity, and disuse atrophy. Employment opportunities are expanding and increase with experience and level of education.

Exercise physiologists are trained to evaluate people in the areas of cardiovascular fitness, muscular strength and endurance, flexibility, neuromuscular integration, and body composition. They are also trained to provide exercise programs based on the results of these evaluations that are designed to increase the functional capacity of the participants.

Exercise physiologists work with athletes, patients, and healthy participants in the areas of disease prevention in wellness programs or rehabilitation in hospital settings. The bachelor of science program is a preparatory program for graduate school. Graduates of this program continue their studies in exercise physiology, physical therapy, medicine, or other health-related careers. Graduates of the master of science or doctoral program find employment in corporate wellness, hospital rehabilitation, higher education, or other research settings. Graduates of our Ph.D. program have obtained postdoctoral positions in prestigious universities and medical schools. Additionally, they may be employed in a wide variety of private, community, state, and national agencies. Exercise physiology is an evolving field that is becoming increasingly important with the integration of preventive medicine into the healthcare system. Employment opportunities are expanding and increasing with experience and level of education.

Master of Science Program

This is a two-year program. We have a clinical track and thesis track. Clinical track students take course work, obtain experience in various medical settings (e.g., heart cath lab etc.), and work with populations with varied health problems (heart disease, diabetes, metabolic syndrome, arthritis etc.). The 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 faculty who will act as primary mentors in exercise physiology have research and/or clinical expertise in:

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

**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)

**Doctoral Program**

The graduate program in exercise physiology fosters a high degree of collaboration among faculty with interests in clinical medicine and basic research.

The faculty in exercise physiology have research expertise in exercise-induced adaptations and pathological tissue remodeling associated with aging, diabetes, and cardiovascular disease. Current areas of inquiry include the following:

• Aging and sarcopenia in skeletal muscle
• Cancer cachexia and muscle wasting diseases
• Muscle stem cells
• Mitochondria dysfunction and pathophysiological mechanisms of diabetic cardiomyopathy
• The Metabolic Syndrome and right-left heart function
• Immunology/cytokine/myokine responses of muscle to exercise and disease
• Reactive oxygen species development in cardiac and skeletal muscles with aging and diabetes
• Biomechanical and motor control for gait in stroke or spinal cord injury
• Microvascular dysfunction with the metabolic syndrome
• Cardiac and skeletal muscle growth and function
• Physiologic basis of lung disease
• Exercise-induced angiogenesis
• Extracellular matrix regulation and gene expression
• Stem cell biology and mechanical signal and tissue regeneration
• Motor unit recruitment in stroke and disability

Our Ph.D. program is intended to give exceptional students knowledge in basic medical and scientific areas to prepare them for careers as effective and knowledgeable researchers and teachers in the broad field of exercise physiology/kinesiology. In the Division of Exercise Physiology, these goals are achieved by several means. Formal coursework in the sub-disciplines of exercise physiology, physiology, biochemistry, molecular biology, pharmacology and neuroscience provides the student with the opportunity to develop a solid foundation in basic subject matter of medical sciences that can be applied to aspects of exercise and disease. The student's knowledge base will be further strengthened by participation in elective courses offered within the division, selected courses offered by other departments within the School of Medicine, and by departments in other colleges of West Virginia University.

**PH.D. STUDENTS ARE EXPECTED TO:**

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

The Division of Exercise Physiology actively engages in both basic science and clinically-based research, with an emphasis on cardiovascular disease, aging, obesity, and diabetes.

**Required Research Participation**

Because the thesis track masters degree has an intensive research training experience, and the doctorate is a research degree, students will be expected to be involved in research from the beginning of their programs. Doctoral students will participate in three research rotations with faculty in exercise physiology during the first two semesters of enrollment. Students are expected to choose a dissertation chair and a dissertation committee by the end of the first year of enrollment. Students should work with their dissertation advisor to design appropriate pilot studies and with that data identify a dissertation project and appropriate research questions/hypothesis to be tested by the proposed research. All approved research projects must be hypothesis-based, and whenever possible, the research questions should address mechanistic questions that explain biological phenomenon relevant to exercise physiology.

Research is conducted throughout the doctoral and masters thesis program with a goal of having at least three manuscripts published or submitted to a journal for peer review before graduation. Students should strive to present their research findings at a minimum of one national/international meeting annually beginning no later than the second year of enrollment in the doctoral program. A minimum of one peer-reviewed manuscript that is derived from the student’s dissertation research must be published before graduation.

**FACULTY**

**PROFESSOR**

- Stephen E. Alway - Ph.D. (McMaster University)
  Sarcopenia, Muscle Wasting, Molecular regulation of Muscle Regeneration, Diabetes and Muscle Injury

**ASSOCIATE PROFESSORS**

- Daniel E. Bonner - MS (West Virginia University)
  Clinical Exercise Physiology

- Randall W. Bryner - Ed.D. (West Virginia University)
  Diabetes, Exercise, and Cancer

- David Donley - MS (West Virginia University)
  Exercise and Metabolic Syndrome

- Diana Gilleland - MS (West Virginia University)
  Clinical Exercise Physiology

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

- Guyton W. Hornsby Jr. - Ph.D. (Louisiana State University)
  Diabetes and Depression

- Jean McCrory - Ph.D. (Penn State University)
  Biomechanics, gait, foot injuries

- I Mark Olfert - Ph.D. (Loma Linda)
  Angiogenesis, respiratory physiology, toxicology

- Lori Sherlock - Ed.D. (West Virginia University)
  Aquatic Therapy in Obesity

**ASSISTANT PROFESSORS**

- Paul D. Chantler - Ph.D. (Liverpool John Moores University)
  Metabolic Syndrome, Vascular Biology, the Effects of Aging and CV Diseases on Arterial and Ventricular Structure and Function, Stroke and Vascular Dysfunction

- Juniath S. Mohamed - Ph.D. (Tamil Nadu, India)
  Muscle fatigue, genetics of aging, muscle regeneration

- Emidio Pistilli - Ph.D. (West Virginia University)
  Muscular Dystrophy, Muscle Injury, Cytokines

- Sergiy Yakovenko - Ph.D. (University of Alberta)
  Neuromuscular Integration of Movement
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.

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Complete 1 of the following Tracks

**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
- BMS 700 Scientific Integrity
- BMS 702 Biomedical Lab Experience
- BMS 706 Cellular Methods
- BMS 707 Experiential Learning for Biomedical Trainees
- BMS 720 Scientific Writing
- BMS 747 Foundations for Contemporary Biomedical Research I
- BMS 777 Foundations for Contemporary Biomedical Research 2
- EXPH 786 Musculoskeletal Biology
- EXPH 787 Cardiopulmonary Physiology
- Graduate Seminar
- EXPH 796 Graduate Seminar

Research 48
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

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Second Year

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Fourth Year

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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 Goals

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 intensive 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

DOCTOR OF PHILOSOPHY (PHD) IN EXERCISE PHYSIOLOGY

Students will:

- Attain a comprehensive understanding of the important cellular and system processes that are regulated by exercise, lack of exercise, and clinically relevant diseases
- Develop a vocabulary of appropriate terminology to effectively communicate information related to exercise physiology
- Acquire a foundation for critically applying theories, methodologies, and knowledge 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 the health and livelihood of citizens of the state, nation, and world
- Demonstrate principles of ethics associated with appropriate research conduct