Exercise Physiology

DEGREES OFFERED

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

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Stephen E. Alway, Ph.D., Professor and Chair and Director of Graduate Studies Master's Program, salway@hsc.wvu.edu; http://medicine.hsc.wvu.edu/ep/Education/Master-of-Science

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INTRODUCTION

The WVU Exercise Physiology Program was established in the Health Sciences Center’s School of Medicine in July 1993. The program offers a four-year curriculum leading to a bachelor of science degree in exercise physiology, a 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.

The Bachelor of Science program meets the knowledge, skill, and aptitude (KSA) requirements for students to be eligible to take the American College of Sports Medicine Health and Fitness National Examination and the National Strength and Conditioning Association Certified Strength and Conditioning Specialist Examination.

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.

FACULTY

PROFESSOR

• Stephen E. Alway - Ph.D. (McMaster University)
  Sarcopenia, Muscle Wasting, Diabetes and Muscle Injury
ASSOCIATE PROFESSORS

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

• John M. Hollander - Ph.D. (University of Wisconsin)  
  Cardiovascular Research in Diabetes

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

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

• Gregory Dick - Ph.D. (University of Missouri School of Medicine)  
  Regulation of Ion Channels in Vascular Smooth Muscle

• David A. Donley - M.S. (West Virginia University)  
  Obesity, Vascular Function

• Jean L. McCrory - Ph.D. (Pennsylvania State University)  
  Biomechanics in Obesity and Pregnancy

• I. Mark Olfert - Ph.D. (Loma Linda University)  
  COPD, Vascular Function, Angiogenesis

• 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 PROFESSORS

• Robert W. Brock - Ph.D. (University of Western Ontario)  
  Renal Function in Diabetes

• Jefferson C. Frisbee - Ph.D. (University of Guelph, Canada)  
  Alterations to Microvascular Structure and Function During Metabolic Syndrome Development

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

Doctor of Philosophy

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
• 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
• Regulation of ion channels in vascular smooth muscle in cardiovascular disease
• 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

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, molecular biology, and pharmacology
- 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
- Submit their dissertation 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 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 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.

**Sample Curriculum**

Students will follow the first year integrated curriculum that is common to all Ph.D. students in basic biomedical sciences. Students will begin the curriculum program in year two. Students should complete the requirements for the comprehensive examination by the end of the year. Students should take one of (or both) EXPH 786 and EXPH 787. Students should sign up for EXPH 799 every fall and spring semester that they are enrolled in the program. The majority of the hours should be spent on research after year two.

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EXPH 786</td>
<td>Musculoskeletal Biology</td>
<td>3</td>
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<tr>
<td>EXPH 787</td>
<td>Cardiopulmonary Physiology</td>
<td>3</td>
</tr>
<tr>
<td>EXPH 797</td>
<td>Research</td>
<td>1-15</td>
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<tr>
<td>EXPH 798</td>
<td>Dissertation</td>
<td>1-3</td>
</tr>
<tr>
<td>Electives</td>
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<td>3-6</td>
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<tr>
<td>EXPH 799</td>
<td>Graduate Colloquium</td>
<td>1-6</td>
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**Master of Science**

The master of science program in exercise physiology prepares students for careers in adult fitness, hospital or corporate-based wellness programs, or cardiac rehabilitation. This is a two-year program. We have a clinical track and thesis track. Clinical track students take coursework, obtain experience in various medical settings (e.g., cath lab, bariatric surgery 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., M.D., or similar postgraduate program. Students specialize by completing a clinical internship or a research thesis.

**CLINICAL TRACK COURSES**

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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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>EXPH 670</td>
<td>Lab Techniques &amp; Methods 2</td>
<td>3</td>
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<tr>
<td>EXPH 671</td>
<td>Stress Testing</td>
<td>3</td>
</tr>
<tr>
<td>EXPH 672</td>
<td>Professional Field Placement</td>
<td>1-18</td>
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<tr>
<td>EXPH 673</td>
<td>Exercise Prescription</td>
<td>3</td>
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### Courses

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<tr>
<th>Course Code</th>
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<th>Credit Hours</th>
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<tr>
<td>EXPH 567</td>
<td>Exercise Physiology 2. 4 Hours.</td>
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<td></td>
<td>PR: Consent. Comprehensive knowledge of the functioning of body systems during exercise, the acute and chronic adaptations that occur, and the practical application of this to health and disease.</td>
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<tr>
<td>EXPH 668</td>
<td>Diabetes and Exercise. 3 Hours.</td>
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<td></td>
<td>PR: Graduate standing, consent. In-depth study of topics related to the comprehensive management of patients with diabetes mellitus, with special emphasis on the use of exercise in diabetes care.</td>
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<tr>
<td>EXPH 670</td>
<td>Lab Techniques &amp; Methods 2. 3 Hours.</td>
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<td>PR: Graduate standing, consent. This course teaches the techniques and methods used to monitor physiologic systems in humans during rest and exercise. It includes methods used to assess the health status of individuals desirous of exercise testing or prescription.</td>
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<tr>
<td>EXPH 671</td>
<td>Stress Testing. 3 Hours.</td>
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<td></td>
<td>PR: EXPH 670, consent. In-depth study of graded exercise testing in laboratory or field situations. The course includes protocols for athletes, asymptomatic individuals, and special populations.</td>
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<tr>
<td>EXPH 672</td>
<td>Professional Field Placement. 1-18 Hours.</td>
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<td>PR: EXPH 370, and EXPH 371, consent. Prearranged program to be planned, supervised, and evaluated for credit by faculty and field supervisors. Involves temporary placement with public or private enterprise for professional competence development. (Internship.).</td>
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<tr>
<td>EXPH 673</td>
<td>Exercise Prescription. 3 Hours.</td>
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<td>This course will provide graduate students an understanding of the exercise prescription process and the exercise management of patients with chronic diseases.</td>
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<td>EXPH 680</td>
<td>Adv Clinl Exercise Physiology. 3 Hours.</td>
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<td>PR: Graduate Standing. Presentation of scientific techniques utilized by clinical exercise physiologists to assess fitness in healthy and disease populations. This course will refine clinical competencies needed to safely administering various fitness assessments in clinical populations in which the risk of untoward events increases.</td>
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<td>EXPH 681</td>
<td>Clinical Exercise Prescription. 4 Hours.</td>
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<td></td>
<td>PR: EXPH 670 and EXPH 680. This course will present current established exercise guidelines for the safe evaluation of functional capacities and the establishment of safe, effective exercise prescriptions for individuals with cardiovascular and/or metabolic diseases.</td>
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EXPH 682. Research Design and Methods. 4 Hours.
An advanced level of important concepts involved in the design of experimental studies in Exercise Physiology. The main focus will be on understanding the essential techniques for study design, data collection, its critical evaluation, and research reporting.

EXPH 691A-Z. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

EXPH 693A-Z. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

EXPH 695. Independent Study. 1-6 Hours.
Faculty supervised study of topics not available through regular course offerings.

EXPH 696. Graduate Seminar. 1 Hour.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

EXPH 697. Research. 1-15 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or dissertation. (Grading may be S/U).

EXPH 698. Thesis. 1-6 Hours.
PR: Consent. This is an optional course for programs that wish to provide formal supervision during the writing of student reports (698), or dissertations (798). Grading is normal.

EXPH 699. Graduate Colloquium. 1-6 Hours.
PR: Consent. For graduate students not seeking coursework credit but who wish to meet residency requirements, use the University’s facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department’s 699/799 Graduate Colloquium to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights and privileges of duly enrolled students. Grading is P/F; colloquium credit may not be counted against credit requirements for masters programs. Registration for one credit of 699/799 graduate colloquium satisfies the University requirement of registration in the semester in which graduation occurs.

EXPH 786. Musculoskeletal Biology. 3 Hours.
Introduction to current research approaches in musculoskeletal biology of exercise physiology. This course will stress critical thinking, and refine skills related to research design and evaluation of research methods used in exercise physiology.

EXPH 787. Cardiopulmonary Physiology. 3 Hours.
An advanced survey of important concepts involved in cardiovascular/ cardiopulmonary physiology and pathophysiology. The main focus will be on understanding the changes to cardiovascular/pulmonary system brought about by physiological stimuli such as exercise, aging, and disease states.

EXPH 790. Teaching Practicum. 1-3 Hours.
PR: Consent. Supervised practice in teaching exercise physiology. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It also provides a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U).

EXPH 791A-Z. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation in advanced subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.

EXPH 792A-Z. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

EXPH 794A-Z. Seminar. 1-6 Hours.
Special seminars arranged for advanced graduate students.

EXPH 795. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

EXPH 796. Graduate Seminar. 1 Hour.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

EXPH 797. Research. 1-15 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U).

EXPH 798. Dissertation. 1-6 Hours.
PR: Consent. This is an optional course for programs that wish to provide formal supervision during the writing of student reports (698), or dissertations (798). Grading is normal.
EXPH 799. Graduate Colloquium. 1-6 Hours.
PR: Consent. For graduate students not seeking coursework but who wish to meet residency requirements, use the University’s facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department’s 699/799 graduate colloquium to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights of duly enrolled students. Grading is P/F; colloquium credit may not be counted against credit requirements for masters programs. Registration for one credit of 699/799 graduate colloquium satisfies the University requirement of registration in the semester in which graduation occurs.