

Research Training Program in Prosthetics and Orthotics

FAQs:

- Application to the program can be done on line, similar to the general GT application to graduate school: <http://www.gradadmiss.gatech.edu/>
- You will be required to take the GRE exam; there is no minimum score required.
- Minimum requirement for a GPA for entrance to this training program is the same as the general minimum requirement for Georgia Tech, i.e. 3.0.
- A pre-doctoral training program leads to the PhD degree from Georgia Tech in Applied Physiology: Emphasis in Prosthetics and Orthotics.
- Mrs. Joy Daniell should be contacted with all questions related to the application procedure: joy.daniell@ap.gatech.edu.
- The length of the program depends on the student's background and progress in the program but usually will last about 4-5 years.

1. Rationale and Need

The profession of Prosthetics and Orthotics (P&O) is entering its adolescence— endeavoring to grow taller upon a diminutive body of knowledge. The paucity of existing rigorous research providing the “evidence” for evidence-based practice in P&O dictates that decision making is relegated to anecdotal and individual clinical experience by the practitioners who treat individuals in need of care. Research scientists possessing knowledge and skills cultivated in a clinically sensitive research environment have been consistently absent in P&O. The majority of the research conducted in P&O stems from affiliated and more mature professions of engineering, allied health and medicine. These investigations have not sufficiently linked the prosthetic or orthotic device's physical performance to the physiological performance and adaptation of the person utilizing it as part of a comprehensive rehabilitation treatment plan. While this by no means invalidates the existing knowledge gained, absence of a clinical perspective driving P&O research has resulted in a dearth of basic science and clinical research in P&O. It is this need for research in the basic and clinical sciences that provides the motivation for this training grant.

In 2002, a curriculum in P&O was developed at Georgia Tech creating an advanced education program distinct from existing P&O education models. As the world's first CAAHEP (Commission on Accreditation of Allied Health Education Programs) accredited entry level graduate degree program in P&O, the Master of Science in Prosthetics and Orthotics (MSPO, <http://www.ap.gatech.edu/mspo/>) program in the School of Applied Physiology integrates research as a teaching tool in an applied clinical practitioner education model. The MSPO graduate however, is neither the terminal academic degree research scientist nor the researcher groomed to fill the void in clinically based outcomes in P&O. The individuals that will fill these gaps are the future graduates of this PhD training program in Prosthetics and Orthotics.

2. Relationship to Current Training Program

The School of Applied Physiology has several laboratories involved in movement control engaging in multidisciplinary research in biomechanics, neuromechanics, systems physiology, modeling of human movement and a keen interest in behavioral outcomes as related to clinical research. The pre-doctoral training program in movement science applied to prosthetics and orthotics research will be accomplished by completing a series of eight (8) required major courses (24 semester hours) and a minimum of three courses (9 semester hours) in a “minor” area of study. While all but one of the major courses already exist in the graduate program in Applied Physiology the enriched minor area of study may be completed by selecting from a menu of courses on diverse subject matter already offered in Applied Physiology, in other units at Georgia Tech and/or in courses at Emory University and Georgia State University.

While the two existing programs, MSPO and the PhD in Applied Physiology, are relatively new, certain relevant facts should be highlighted here for clarity and focus. The MSPO program is unique and is embraced by the P&O community as their “standard bearer” for future growth; the prosthetics and orthotics profession has requested/recommended the development of such a federally funded

training program; the School of Applied Physiology is one of eight units in the College of Sciences whose faculty already conduct interdisciplinary research in the biomechanics and neural control of movement; current graduate programs embrace the physiological basis of movement control; faculty in the School already interact with scientists in rehabilitation medicine and the prosthetics and orthotics profession and clinically related fields as well as hold adjunct and joint appointments in the College of Engineering and Departments of Physiology and Rehabilitation Medicine in the Emory University Medical School. All programs rely on both existing and future collaborative interactions as well as the interdisciplinary approach to research. These philosophies and scientific capabilities can be harnessed to directly address the challenges posed by the American Academy of Orthotists and Prosthetists and will directly serve to enhance the impact of an already successful MSPO program in the development of a “research culture” requisite to the successful emergence of the field of P&O and in the larger context the field of rehabilitation.

B. PROGRAM PLAN

1. Program Administration

Drs. Steve Wolf, Richard Nichols and Robert Gregor will serve as co-project directors (Dr. Gregor will serve as the PI) urging feedback and advice regarding the function and progress of the training program. The interface between the MSPO Program and the PhD training program as supported by the various units in three separate universities is enhanced by the representation on administrative committees outlined below:

- a. **Oversight Committee** (Short and Long-term Program Objectives)
 - Dr. Robert Gregor
 - Dr. T. Richard Nichols
 - Dr. Steve Wolf
 - Mr. Christopher Hovorka, Director of MSPO Program
 - Representative from CETL: <http://www.cetl.gatech.edu/>
- b. **External Advisory Committee** (External Review)
 - Dr. Ronald F Zernicke
 - Dr. Doug Smith
 - Dr. Jams H Campbell
- c. **Operations Committee** (Specific Program Operations, e.g. admissions)
 - Dr. Millard-Stafford, Associate Chair of AP, Committee Chair
 - Dr. Robert Gregor, School Chair, Liaison to the School
 - Dr. Steve Sprigle, Director of CATEA, Joint Appointment in AP
 - Dr. Young-Hui Chang, Director of Comparative Neuromechanics Lab
 - Dr. Mark Geil, Director, Biomechanics Lab, Georgia State University
 - Mr. Chris Hovorka, CPO, Director of MSPO Program
 - Mr. Robert Kistenberg, CP, Coordinator of Prosthetics, MSPO Program
 - Dr. Geza Kogler, CO, Coordinator of Orthotics, MSPO Program

The Training Program will be offered through the School of Applied Physiology but the overall program requires the integration of faculty and programs outside the College of Sciences at Georgia Tech as well as prosthetic and orthotic clinical training sites in the greater Atlanta area. The existing formal links between program faculty and institutions are intended to facilitate the necessary administrative relationships/partnerships requisite to the success of this program. In addition, Research Directors from laboratories at Georgia State University, the Center for Assistive Technology and Environmental Access (CATEA) at Georgia Tech, Shepherd Spinal Center and other clinical P&O, allied health care and medical facilities around Atlanta involved in this program will provide the necessary infrastructure for curriculum development and research mentorship.

2. Current Training Program

a. Objectives

The purpose of the current program is to prepare independent scientists through predoctoral, multidisciplinary research training in the rehabilitation priority, specifically

rehabilitation related to prosthetics and orthotics, as part of a treatment plan in the movement sciences. The objective of this training is to provide an advanced theoretical basis in the biomechanics and neural control of movement for the skills required in rehabilitation research in the field of prosthetics and orthotics.

b. Number and Level of Trainees (Institutional Support)

Three pre-doctoral trainees will be admitted each year during the period of the grant. Georgia Tech will support one trainee beginning the second grant year and two trainees in years 3-5. Support during years 4 and 5 of the training program, and any subsequent years, will be the responsibility of the research advisor of the trainee for their dissertation work. A summary of this plan is presented as follows:

	Number of Trainees				
	Predoctoral Grant Years				
	YR1	YR2	YR3	YR4	YR5
A. Training Grant Support	3	5	7	7	7
B. University Support	0	1	2	2	2
C. Advisor Support				3	6
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D. Total Number	3	6	9	12	15

c. Program of Study

The pre-doctoral training program exposes the trainee to basic and applied sciences in neuroscience, the neural control of movement, mechanical engineering and movement dynamics, electrical engineering and signal processing, biomedical engineering, general systems physiology, experimental design and statistics, rehabilitation medicine, a wide range of topics in prosthetics and orthotics and advanced theory in neuromechanical and biomechanical modeling. The program is a flexible interdisciplinary program of study focused specifically on prosthetics and orthotics research.

Courses required for this program include three courses in biomechanics and neural control (9 hrs), two courses in integrated systems physiology (6 hrs), one course in statistics (3 hrs) and two research seminars (6 hrs), one in the Responsible Conduct of Research (RCR) and the other a general research seminar for a total of 24 required hours. All instructors are experienced teachers and all are philosophically aligned with the theme of vertical integration and a multidisciplinary approach to research and education.

In addition to the required hours, per Georgia Tech guidelines, there is a minimum of nine elective hours in related courses, chosen by the student in consultation with his/her Advisory Committee, that are required of each student. The purpose of the minor is to encourage a wider interest on the part of the student and to provide a broader basis for the evaluation of the student's capabilities on the written comprehensive exam and in their total doctoral program. An extensive breadth of courses, including all MSPO clinical classes, dissection anatomy, classes at Emory and Georgia State and classes in several units on the Georgia Tech provide a menu of choices to serve as elective classes for this flexible, interdisciplinary program.

Each student is expected to participate in a Rehabilitation Research Issues Seminar each semester (one hour) for the period of their training. This seminar will be broadly applied to current issues in Rehabilitation Medicine. All students are also required by Georgia Tech to complete a minimum of 12 hours of dissertation topics (they usually sign up for many more dissertation hours) to fill in their schedule. The total number of hours including the 24 required hours, the 9 elective hours and the 12 dissertation hours for the program is 45. The Operations Committee (Dr. Gregor, Chair) will review any petitions to exempt these requirements. Students may begin taking elective courses approved by their faculty advisor prior to completion of the required classes. However, all students must satisfactorily complete all required classes before they are eligible to take the written comprehensive examination.

APPH 6201 Biomechanics/Kinesiology in Prosthetics and Orthotics (1 semester) (3 hrs)

Specific to prosthetics and orthotics information related to the use of skeletal muscle as a resource to the nervous system are presented. Muscle synergies, limb-based dynamics, total body mechanics and local and central neural control systems and logic are discussed.

APPH 6202 Clinical Gait Analysis (1 semester) (3 hrs)

Techniques in gait analysis are studied in extensive laboratory experiences in motion capture, musculoskeletal modeling, segmental inertial parameters as related to the properties of various prosthetic and orthotic devices and/or prosthetic devices are emphasized.

APPH 6212, 6213 Systems Physiology II & III (2 semesters) (6 hrs)

Several faculty members team- teach this course from the School of Applied Physiology as well as selected Adjunct Faculty, e.g. Patricia Nichols. The course will cover advanced principles in physiology from the level of function of individual physiological systems (6212) to system integration, adaptation and homeostasis (6213).

APPH 6225 Biostatistics (1 semester) (3 hrs)

This course covers basic statistics and experimental design used in physiological research, for example, ANOVA, Repeated Measures Analysis and Linear Regression.

APPH 6231 Biomechanical Aspects of Human Movement Control (1 semester) (3 hrs)

Advanced techniques in the neuromechanical analysis of movement and theories of movement control are explored. Correlations between output of elements in the central nervous system, i.e. the motor cortex, and selected biomechanical parameters in 3D are studied.

APPH 8000 General Research Seminar (1 semester) (3 hrs)

This course will be taught by multiple faculty: critiquing published manuscripts, research hypotheses in the different labs in the School, research ethics (IRB, IACUC) and presentation of scientific results.

APPH 8001 Responsible Conduct of Research Seminar (New) (3 hrs)

The written comprehensive exam assesses both general knowledge of the degree area (primarily in the coursework listed above) and specialized knowledge of the student's chosen research field. (GT General Catalog, <http://www.catalog.gatech.edu/>). The content of the exam will be set by the student's academic advisor and members of the student's Advisory Committee with input from course instructors from both the required and elective classes and clinical faculty from prosthetics and orthotics. While certain fundamental material will be tested, e.g. systems physiology and biomechanics and neural control, the exam can be flexible in content and format according to each student's specific program area. However, while there is the appropriate flexibility in exam content related to the specific interests of each student, there are certain fundamental materials required of all students and a written comprehensive exam administered by the Operations Committee is required for all students.

Students will typically take the written comprehensive exam some time after the spring semester of their second year following completion of the required coursework and some electives but no later than by the end of their 5th semester during the fall of their third year. Actual timing of the exam however, will be the responsibility of the student's Advisory Committee considering the individual progress of each student. A passing grade of 75% is required on all parts of the exam. If a student fails any part of the comprehensive exam, the Operations Committee in consultation with the Student's Advisory Committee will determine whether the candidate may sit for the exam a second time. This second exam can be either oral or written and would cover areas of the comprehensive exam that the student failed previously. At the end of this process the student is still expected to pass with a grade of 75% all areas of the exam or be terminated from the program. A permanent record of all exams will be maintained in the office of the School of Applied Physiology.

Research training will begin at the start of the first semester and continue each semester until the dissertation is completed. Training in the first semester will include the first formal laboratory rotation, a required graduate seminar (AP 8000) designed to organize their thoughts into a research focus area, and a Rehabilitation Research Issues Seminar focused on the multidisciplinary nature of rehabilitation research. Research training will continue in the second semester with a required class in Biostatistics (APPH 6225), another formal lab rotation, another seminar in Issues in Rehabilitation Research and the Seminar in the Responsible Conduct of Research required in this training program. Formal laboratory rotations will continue through the third semester (and possibly the fourth semester depending on the student's progress) allowing each trainee the opportunity to develop skills in basic and applied research techniques in a range of fields relevant to prosthetics and orthotics.

1. General Program Requirements

○ Teaching Requirement

Ph.D. students shall participate in at least one teaching practicum to expose them to the elements involved in organizing and teaching a class. Students who have passed the written Comprehensive Exam will be required to work closely with a faculty member for one semester in all aspects of teaching a course, including planning the course, preparing and delivering lectures or leading discussion sessions, holding office hours, preparing and grading homework and exams. The faculty member is expected to attend the selected number of lectures delivered by the student and provide in-depth feedback. The faculty member of record will maintain full responsibility for the course.

○ Oral Qualifying Examination

Within six months following the written comprehensive exam, the student will make a public oral presentation of the dissertation proposal to their Dissertation Committee and other interested students and faculty. This presentation is technically intended for the student's committee; however, other faculty input is encouraged to assist the student in recognizing possible difficulties in his/her research plan prior to conducting the research. A copy of the final proposal should be submitted to each committee member and to the School office two weeks prior to the scheduled proposal presentation.

After approval of the final dissertation research by the faculty advisor, the written dissertation will be distributed to other members of the Dissertation Committee in preparation for the final oral defense of the completed research project. The dissertation must be in final form with respect to content, format, and accuracy. One copy should be submitted to each committee member and the School office two weeks prior to the date of the final oral defense. Once the final oral defense has been successfully completed, the candidate will then follow standard Georgia Tech procedures as set by the Office of Graduate Studies and Research to formally be awarded the Ph.D. degree.

○ Program of Study

By design there is flexibility built into the program to allow trainees from different backgrounds to enter and to be successful in the training program. This flexibility concept is discussed below.

Each student entering the Training Program will be required to attend the Orientation Week for the MSPO Program which is held the week prior to the beginning of fall semester. This will be required because students will be seeing patients some time during their training program and the sessions during Orientation Week cover important information such as CPR, patient monitoring, appropriate behavior in working with certain patient populations, etc.

All students will follow the academic plan outlined below with individualized minor areas and other needs established by the student's Advisory Committee.

YEAR 1:	Fall Semester		
	General Research Seminar	APPH 8000	3 hours
	Biomechanics/Kinesiology in P&O	APPH 6201	3 hours
	Clinical Gait Analysis	APPH 6202	3 hours
	Lab Rotation/Ind. Research	(New)	2 hours

	Rehabilitation Research Issues Seminar in P&O	(New)	1 hour
	Spring Semester		
	Systems Physiology II	APPH 6212	3 hours
	BioStatistics	APPH 6225	3 hours
	Seminar in RCR	(New)	3 hours
	Lab Rotation/Ind. Research	(New)	2 hours
	Rehabilitation Research Issues Seminar in P&O	(New)	1 hour
YEAR 2:	Fall Semester		
	Systems Physiology III	APPH 6213	3 hours
	Elective/Dissertation		6 hours
	Lab Rotation/Ind. Research	(New)	2 hours
	Rehabilitation Research Issues Seminar	(New)	1 hour
	Spring Semester		
	Biomech. of Mvt. Control	APPH 6231	3 hours
	Elective/Dissertation		6 hours
	Lab Rotation/Ind. Research (if needed, possibly in advisor's lab)		2 hours
	Rehabilitation Research Issues Seminar	(New)	1 hour

The written comprehensive exam will be completed by the student prior to the start of fall semester of the student's third year. Extenuating circumstances will be handled on an individualized basis.

YEARS:	Fall Semester		
3 - 5	Elective/Dissertation		11 hours
	Rehabilitation Research Issues Seminar	(New)	1 hour
	Spring Semester		
	Elective/Dissertation		11 hours
	Rehabilitation Research Issues Seminar	(New)	1 hours

(Submission of an individual NRSA grant application during the Spring Semester of Year 3 after consultation with their major advisor and members of the dissertation committee is expected.)
