

# Neuromotor Science, Ph.D.

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COLLEGE OF PUBLIC HEALTH (<https://cph.temple.edu>)

Learn more about the Doctor of Philosophy in Neuromotor Science.

## About the Program

The study of human movement, both as an outcome of health and functioning and as a means to understand the mechanisms underlying neuromotor system integration and behavior, is foundational to many health professions. The skills needed to be successful in fields of related study require fluency across the disciplines of engineering, movement science, neuroscience, and rehabilitation. The need exists for rigorously trained scientists with interdisciplinary training in neuromechanics, neurobiology, and biomechanics of the sensorimotor system, and the impact of health conditions, disease, and disability on human movement. Our Neuromotor Science (NMS) program trains scientists to advance the science of neuromotor control and biomechanics of human posture and movement in individuals across the lifespan and spectrum of health and disability levels. The Ph.D. in Neuromotor Science (PhD NMS) program is designed for individuals in the fields of Engineering, Exercise Science, Kinesiology, Occupational Therapy, Physical Therapy, Rehabilitation Science, and the like, preparing them to:

- advance the science and understanding of neuromotor processes, including assessment and evaluation of movement, neuromotor function and integration, and its impact on movement on health, functioning, and disability, and
- contribute to the development of interventions to improve human movement, particularly posture and locomotor control and function across the lifespan.

**Time Limit for Degree Completion:** 7 years

**Campus Location:** Main, Health Sciences Center

**Full-Time/Part-Time Status:** Full-time study is expected. This research-focused doctoral degree program requires 4 to 7 years of full-time study post-baccalaureate or 2 to 3 years of full-time study after completion of the M.S. in Neuromotor Science degree.

PhD NMS students are initially advised by the Program Director during admission and in the first term if an academic advisor has not been identified. Within two terms of matriculation, students are assigned an academic advisor from the core program faculty — or an available Graduate Faculty member with expertise in the student's cognate area, as approved by the Program Director. Students develop an "Individualized Development Plan of Graduate Studies," which is reviewed with their advisor every term, and by the NMS Program Director and/or the Program Advisory Committee on an annual basis.

**Interdisciplinary Study:** Students may use their elective coursework to pursue interdisciplinary study throughout the University. The PhD NMS program participates in the interdisciplinary program in Neuroscience at Temple University.

**Areas of Specialization:** All students complete the same core course requirements, but may focus their elective coursework and research experiences on preparing them for future work in areas related to their specific interests.

**Job Prospects:** Graduates of the PhD NMS degree program are prepared for research or teaching/research positions at Carnegie Research I institutions. They are also prepared for employment as faculty members in other academic settings, in clinical research settings, or in industry positions.

**Non-Matriculated Student Policy:** Non-matriculated students may enroll in up to three graduate courses with permission from the NMS Program Director.

**Financing Opportunities:** Assistantship packages consisting of a stipend, tuition remission, and subsidized health benefits are available. Admission to the PhD NMS program does not, however, guarantee financial support. Research and Teaching Assistantships are highly competitive, with awards varying based on faculty-funded areas of research and the teaching needs of the College. Please contact the NMS Program Director for additional information.

## Admission Requirements and Deadlines

### Application Deadline:

*Fall:* January 5

*Spring:* November 1

All applicants to the Ph.D. in Neuromotor Science program must apply via the Centralized Application Service for Public Health (SOPHAS). The system can be accessed at <https://sophas.liaisoncas.com/>. Applications received after the stated deadlines will be reviewed as space and funding allow.

### Letters of Reference:

*Number Required:* 3

*From Whom:* Letters of recommendation should be obtained from individuals who can speak to the applicant's potential for graduate study. At least one should be from a faculty member who is familiar with the applicant's academic abilities.

**Master's Degree in Discipline/Related Discipline:** A master's degree is not required.

**Bachelor's Degree in Discipline/Related Discipline:** All applicants must present credentials that are the equivalent of a baccalaureate degree at Temple University.

For applicants who completed their degree outside of the United States, a World Education Services (WES) (<https://www.wes.org>) course-by-course transcript evaluation is required. This can be requested and submitted through SOPHAS (<https://sophas.liaisoncas.com/applicant-ux>).

**Statement of Goals:** A one-page statement articulates why you want to enroll in the PhD NMS program at Temple. State your career goals and research interests.

**Standardized Test Scores:**

GRE: Required. Scores from a test taken within the last 5 years must be at or above the 50th percentile in the verbal and quantitative components, with a score of 4 or higher on the writing component. Official scores should be sent directly to SOPHAS (<https://sophas.liaisoncas.com/applicant-ux>) using code 0151.

Applicants who earned their baccalaureate degree from an institution where the language of instruction was other than English, with the exception of those who subsequently earned a master's degree at a U.S. institution, must report scores for a standardized test of English that meet these minimums:

- TOEFL iBT: 79 (send officially to SOPHAS (<https://sophas.liaisoncas.com/applicant-ux>) using the SOPHAS-specific TOEFL code of 5688)
- IELTS Academic: 6.5
- PTE Academic: 53

**Interview:** Students may be invited to interview with the program faculty. An interview may take place in person or through technology if costs prohibit travel to Temple.

**Resume:** Current resume or CV required.

## Program Requirements

**General Program Requirements:**

*Number of Credits Required to Earn the Degree: 45*

*Required Courses:*

Code	Title	Credit Hours
<b>College Core Course</b>		
HRPR 5001	Current and Emerging Issues in Public Health and Health Professions	0
<b>Core Courses</b>		
HRPR 5999	Research Experience in Health Professions (work on publishable paper for two terms)	0
NMS 9621	Neuromotor Science 1: Neural Factors	3
NMS 9622	Neuromotor Science: Instrumentation	3
NMS 9623	Neuromotor Science: Programming	3
NMS 9624	Neuromotor Science 2: Mechanics and Models	3
NMS 9627	Neuromotor Science 3: Cognition and Learning	3
NMS 9653	Grantsmanship	3
Statistics and Research Design courses		9
Teaching Practicum <sup>1</sup>		0
<b>Electives</b> <sup>2</sup>		12
<b>Research Courses</b>		
NMS 9994	Doctoral Preliminary Exams	1
NMS 9998	Dissertation Proposal	2
NMS 9999	Dissertation Research	3
Total Credit Hours		45

- 1 Each student serves as a Teaching Assistant for one academic term during the degree program. If the student selects the Teaching in Higher Education Seminar as one of the required electives, s/he can then use the Teaching Practicum to complete the Teaching in Higher Education certificate (<https://tlc.temple.edu/teaching-certificates/teaching-higher-education-certificate-graduate-students>).
- 2 Electives are chosen from existing 5000, 8000, or higher level courses to provide a cognate area based on the student's interest in, for example, engineering, kinesiology, neuroscience, psychology, public health, rehabilitation science, or teaching in higher education. The Program Director and faculty advise on and approve the selection of electives.

### **Culminating Events:**

In addition to completing the required coursework, students are expected to complete an area paper, a preliminary written and oral examination, and a dissertation research proposal prepared in the form of a grant proposal. Students are also expected to write and submit an abstract for their research and present that research at a scientific or professional meeting. The dissertation must include a publishable article.

#### *Area Paper:*

Prior to the preliminary examination, students must write a paper of publishable quality in their chosen area. Students could enroll in an elective course, a laboratory rotation, or independent study to complete this paper. The paper can be a report of research completed with a faculty member, a systematic review of literature related to the projected area of dissertation work, or a representation of theoretical work. In each instance, the student is expected to be the lead or sole author. Students are encouraged to select and submit the paper for peer review to an appropriate journal, but the publishable quality of the paper will be determined by faculty members with sufficient background in the area to judge the quality of the work. Students who have published a peer-reviewed paper in a journal as lead author prior to entry into the doctoral program can request a waiver of this requirement.

#### *Preliminary Examination (NMS 9994):*

All students must pass a preliminary examination prior to defending their dissertation research proposal. This qualifying examination consists of assessment of both didactic knowledge and research skills in neuromotor science. The didactic knowledge portion of the exam consists of a written examination followed by an oral examination of core concepts taught within the core neuromotor science courses. The research skill portion of the exam consists of skills acquired in a research lab presented in a lab practicum format.

#### *Dissertation Proposal and Defense (NMS 9998):*

In conjunction with the academic advisor and with the approval of the Program Director, each student is expected to identify a Doctoral Advisory Committee. The committee shall be comprised of at least three members. Two of the members shall be from within the Department of Health and Rehabilitation Sciences, and at least one shall be from outside the department. At least two of the three members must hold full Graduate Faculty status.

Students are required to prepare and submit a dissertation proposal and successfully defend it orally in front of their committee. As appropriate, they must obtain IRB approval for their proposed research and submit a copy of the dissertation proposal to the Graduate School. Students are expected to have developed and defended their dissertation proposal within one year of successfully completing their preliminary examination.

Any student who does not adhere to this timeline must petition the Program Advisory Committee for an exception to this requirement. Extensions are not guaranteed. If a student does not receive an extension, her/his case will be considered at the time of the Annual Review of Progress toward the degree. Failure to pass NMS 9998 within one year can result in dismissal from the program.

#### *Dissertation Research (NMS 9999):*

Students are required to complete and orally defend their dissertation research. Students must be enrolled continuously in NMS 9999 until their dissertation is successfully defended. The Graduate School requires at least 6 credit hours of dissertation coursework. Students must be enrolled in the term that they graduate.

The dissertation must be successfully defended in a public oral defense as determined by the student's Dissertation Examining Committee. This committee evaluates the student's ability to express verbally her/his research question, methodological approach, primary findings, and implications. The Dissertation Examining Committee votes to pass or fail the dissertation and the defense at the conclusion of the public presentation.

Students who are preparing to defend their dissertation must confirm a time and date for the oral defense with their Dissertation Examining Committee at least 15 days before the desired defense date. After the student and department have arranged the time, date, and room for the defense, the student must provide the official announcement to the Graduate School at least two weeks before the defense.

## **Contacts**

### **Program Web Address:**

<https://www.temple.edu/academics/degree-programs/neuromotor-science-phd-hp-nms-phd>

### **Department Information:**

Dept. of Health and Rehabilitation Sciences  
Ritter Hall Annex, 6th Floor  
1301 Cecil B. Moore Avenue  
Philadelphia, PA 19122-6091  
deptpt@temple.edu

215-204-9066

## Submission Address for Application Materials:

<https://sophas.liaisoncas.com/>

## Department Contacts:

*Program Director:*

W. Geoffrey Wright, Ph.D.

wrightw@temple.edu

215-204-9008

*Interim Chairperson:*

Scott Burns, PT, D.P.T., OCS, FAAOMPT

scott.burns@temple.edu

215-204-9016

## Courses

### **NMS 9621. Neuromotor Science 1: Neural Factors. 3 Credit Hours.**

Current theories and research pertaining to the neural mechanisms underlying motor control, sensorimotor integration and motor learning will be introduced as a foundation for understanding functional movement and motor deficits. The roles of selected brain regions as they relate to different aspects of motor behavior will be discussed. Lesions studies will be presented to further demonstrate the impact of neural impairments on movement performance and motor learning. Application of neurophysiologic methods that evaluate the relationship between neural circuitry and human movement (e.g., EMG, MRI, PET, EEG, TMS) will be discussed.

**Level Registration Restrictions:** Must be enrolled in one of the following Levels: Graduate.

**Repeatability:** This course may not be repeated for additional credits.

### **NMS 9622. Neuromotor Science: Instrumentation. 3 Credit Hours.**

Instrumentation is an introduction to electrical components and circuits, and their role in the function of laboratory instrumentation. The main goal of this class is to develop the student's competence in managing the instrumentation and the quality of resultant data for motion analyses through an understanding of data acquisition equipment that is appropriate to their chosen research area. The student will be exposed to basic electronic design of filters, amplifiers, and A/D sampling as well as selected pieces of laboratory instrumentation. The class is organized in a lecture/lab structure.

**Level Registration Restrictions:** Must be enrolled in one of the following Levels: Graduate.

**Repeatability:** This course may not be repeated for additional credits.

### **NMS 9623. Neuromotor Science: Programming. 3 Credit Hours.**

This course is designed for students with little to no programming skills to help them with a general understanding of computer hardware, software, and the interaction between the two. Factors that make the use of the computer useful to neuromotor research will be presented. Basic computer architecture and operating systems will be discussed in this class. The student will gain a basic understanding of software programming logic and structures as well as signal processing techniques for analysis of human movement data. The goal of this course is for students to gain skills in basic programming for scientific data analysis of time series data with Matlab. In addition, students will also be exposed to software packages commonly used for movement analysis such as LabView, C, Visual-3D, and OpenSIM. The class is organized in a lecture/lab structure.

**Level Registration Restrictions:** Must be enrolled in one of the following Levels: Graduate.

**Repeatability:** This course may not be repeated for additional credits.

### **NMS 9624. Neuromotor Science 2: Mechanics and Models. 3 Credit Hours.**

Application of mechanical principles to static and dynamic models of human posture and movement and of the mechanical properties of the link-segment systems and biological tissue are introduced in this course. Theoretical frameworks, computational, and statistical models (e.g., dynamical systems, equilibrium point, control theory, and Bayesian) are introduced as a basis for understanding the organization of complex movement patterns. Interpretation of the model predictions is based on both healthy individuals and those with movement deficits. The first half of the course will focus on the development of the tools necessary to conduct biomechanics research, process the data, and perform biomechanical data analysis. The second half of the course will work through common biomechanics questions related to human movement in three dimensions.

**Level Registration Restrictions:** Must be enrolled in one of the following Levels: Graduate.

**Repeatability:** This course may not be repeated for additional credits.

**NMS 9627. Neuromotor Science 3: Cognition and Learning. 3 Credit Hours.**

This course focuses on current theories and research related to cognitive and learning processes that influence motor behavior. Objectives include examination of lifespan motor development and learning, attentional mechanisms, perceptual effects on motor output, implicit and procedural memory effects on motor control, automatic compensatory responses and/or strategies following injury or disease, and the factors that influence adaptation and learning to long- and short-term changes in the body or environment.

**Level Registration Restrictions:** Must be enrolled in one of the following Levels: Graduate.

**Repeatability:** This course may not be repeated for additional credits.

**NMS 9653. Grantsmanship. 3 Credit Hours.**

This course exposes the Ph.D. level student to the mechanisms and methods of acquiring funding for Behavioral and Somatic Science Research. Students will learn Grantsmanship - the skills required to write a grant proposal. Learning experiences consist of literature review, writing key sections of a grant application, and if applicable, subject recruitment. Class time will be divided into lectures and discussion of assignments.

**Level Registration Restrictions:** Must be enrolled in one of the following Levels: Graduate.

**Repeatability:** This course may not be repeated for additional credits.

**NMS 9654. Neuromotor Science: Laboratory Rotation and Seminar. 1 to 3 Credit Hour.**

This course provides the student with an in-depth exposure to the laboratory methods and focus of a faculty member. Students will learn the conceptual basis for the research as well as technical skills such as instrumentation and data analyses pertinent to the areas of research that are core to the NMS program or in a cognate area of interest to the student. Two rotations (6 credit hours) are required for the Ph.D. degree students and a single rotation (3 credit hours) for the MS degree students.

**Level Registration Restrictions:** Must be enrolled in one of the following Levels: Graduate.

**Repeatability:** This course may be repeated for additional credit.

**NMS 9682. Neuromotor Science: Independent Study. 1 to 3 Credit Hour.**

This course provides an opportunity for independent investigation and analysis of the intellectual, physical, social, psychological, and ethical bases of human movement. An independent study allows students to explore a well-defined area within Neuromotor Science and related fields in greater depth providing an opportunity for independent investigation and analyses of topics that enrich their academic and research training.

**Level Registration Restrictions:** Must be enrolled in one of the following Levels: Graduate.

**Repeatability:** This course may be repeated for additional credit.

**NMS 9994. Doctoral Preliminary Exams. 1 Credit Hour.**

This course supports preparation for taking the preliminary examinations in the Neuromotor Science program. To enroll, students must have completed all required coursework for the Ph.D. and obtain the approval of the Ph.D. Program Director. Students must be enrolled to take the required preliminary examinations.

**Level Registration Restrictions:** Must be enrolled in one of the following Levels: Graduate.

**Repeatability:** This course may be repeated for additional credit.

**NMS 9998. Dissertation Proposal. 2 Credit Hours.**

This course supports preparation of the dissertation proposal. The course is required for students who have passed the preliminary examinations for their programs and who have not yet defended the dissertation proposal.

**Level Registration Restrictions:** Must be enrolled in one of the following Levels: Graduate.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:**

NMS 9994|Minimum Grade of P|May not be taken concurrently.

**NMS 9999. Dissertation Research. 1 to 3 Credit Hour.**

This course is limited to Ph.D. candidates who have completed and defended a dissertation proposal that is filed with the Graduate School by the last day to add a course in the semester. Continuous registration in 9999 fall and spring is required until the dissertation is successfully defended.

**Level Registration Restrictions:** Must be enrolled in one of the following Levels: Graduate.

**Student Attribute Restrictions:** Must be enrolled in one of the following Student Attributes: Dissertation Writing Student.

**Repeatability:** This course may be repeated for additional credit.

**Pre-requisites:**

NMS 9994|Minimum Grade of P|May not be taken concurrently.