

# NEUROSCIENCE, PHD

The Department of Neuroscience offers an interdisciplinary program designed to train doctoral students for independent research and teaching in neuroscience. It is the goal of the program to ensure that candidates for the Ph.D. and M.D./Ph.D. degrees obtain a background covering molecular, cellular, systems, and cognitive approaches to neuroscience, as well as receive training that brings them to the forefront of research in their particular area of interest. A series of core courses in neuroscience, along with advanced electives, seminar series, laboratory rotations, and original independent dissertation research, form the Neuroscience Graduate Training Program.

Students enter the program from different backgrounds and the laboratories in which they elect to work cover different disciplines; therefore, the program is tailored to fit the needs of individual students. The academic year at the Johns Hopkins University School of Medicine is divided into four quarters plus a summer semester. Courses are designed so that students have ample time to become involved in laboratory rotations. These laboratory rotations expose the student to a variety of current research techniques in neuroscience and provide an opportunity for the student to select a laboratory in which to conduct dissertation research. Scheduling of the three rotations is adjusted to make the most convenient schedule for each student. The rotations are usually completed by the end of the first full year in the program. Most students begin their thesis research at the beginning of their second year.

For more information, please visit The Solomon H. Snyder Department of Neuroscience webpage: <http://neuroscience.jhu.edu>. (<http://neuroscience.jhu.edu>)

## Financial Aid

The program provides tuition remission plus a stipend at or above the National Institutes of Health Predoctoral level for all students. All entering and first-year students are encouraged to apply for individual fellowships such as those sponsored by the National Science Foundation and the Howard Hughes Medical Institute.

### Vivien Thomas PhD Scholars at JHU

The **Vivien Thomas Scholars Initiative (VTSI)** is a new endowed fellowship program at Johns Hopkins for PhD students in STEM fields. It provides full tuition, stipend, and benefits while also providing targeted mentoring, networking, community, and professional development opportunities. Students who have attended a historically black college and university (HBCU) or other minority serving institution (MSI) for undergraduate study are eligible to apply. More information about the VTSI program is available at this link: <https://provost.jhu.edu/about/vivien-thomas-scholars-initiative/>. To be considered for the VTSI, all application and supplementary materials must be received by **December 1st**.

## Admission Requirements

We use a holistic approach to evaluating applicants and look forward to reading your application. We are most enthusiastic about applicants who have taken full advantage of the opportunities available at their undergraduate institution and through other summer or postbac experiences. Our class size is typically ~18 students per year.

Applicants are expected to have received a B.S. or B.A. prior to enrolling in the graduate program. Laboratory research experience prior to enrollment is also desirable. If you have research experience, please

describe your research in your Statement of Interest and Career Objectives and indicate the number of months engaged in full-time and part-time research on your CV. Students who do well in our program typically have a strong academic foundation in areas of biological or physical sciences. Some of the courses that prepare students well include general biology, neuroscience, mathematics through calculus, general physics, general chemistry, organic chemistry, statistics, engineering, or computer science.

**NOTE: The Neuroscience Program DOES NOT require GRE scores.**

## Program Requirements Courses

A year-long core course provides an integrated overview of molecular and cellular neuroscience, neuroanatomy and systems, and cognitive neuroscience. This course is aimed at providing Neuroscience graduate students with a foundation for posing meaningful questions in their area of interest. During the first two years, students are required to take 6 graduate level core courses that provide rigorous training in principles of neuroscience research. In addition, students in the first year attend research symposia and complete lab rotations to introduce them to research. Students in the program are also required to participate in core program activities such as seminars, journal clubs, a quantitative analysis boot camp, career development courses and various program events. In addition, each student selects advanced electives offered by members of the Neuroscience Training Program or other departments at the Medical School.

## Seminar Program

The Neuroscience Training Program conducts several seminar series to ensure that students are exposed to recent work by researchers from across the country and the world as well as by Hopkins faculty and fellows. Graduate trainees participate actively in these series throughout their training, including inviting and hosting three speakers each year. A weekly lecture is given by an outstanding researcher in some field of neuroscience. Seminars are selected so that an overall balance of subject matter is covered yearly. Students are given an opportunity to meet with each speaker for questions and discussion. Weekly lunchtime talks are presented on current literature by graduate students and postdoctoral fellows. Since an ability to communicate scientific work clearly is essential, graduate students receive close guidance in preparing and evaluating their journal club presentations. Once a month, the faculty, postdoctoral fellows, and students from one laboratory present and discuss the ongoing research in that laboratory. This provides an informal setting to discuss research being conducted in the laboratories of the Neuroscience Training Program and gives advanced graduate students and postdoctoral fellows a forum for presenting their work.

## Requirements for the PhD Degree

A minimum residency of two academic years is required. During the course of graduate study, the student must successfully complete the required course requirements. An oral examination, conducted as prescribed by the Doctor of Philosophy Board, must be completed by the end of the second year. The student must then conduct original research and describe this research in a written thesis dissertation, which must be approved by the students Thesis Committee and the Doctor of Philosophy Board.

## Training Facilities

The Training Program is centered in the Department of Neuroscience. The Training Program utilizes laboratory facilities located in the Department

of Neuroscience plus several other basic and clinical departments closely associated with the Neuroscience Department. All of these laboratories are within a short distance of each other. Modern state of the art facilities for research in molecular biology, neurophysiology, pharmacology, biochemistry, cell biology, and morphology are available. The Mind/Brain Institute, located on the Homewood Campus of the University, is a group of laboratories devoted to the investigation of the neural mechanisms of higher mental function and particularly to the mechanisms of perception. All of the disciplines required to address these questions are represented in the Institute. These include neurophysiology, psychology, theoretical neurobiology, neuroanatomy, and cognitive science. All of the faculty in the Mind/Brain Institute are members of the Neuroscience Graduate Program.

## Combined M.D./PhD Program

A subset of the current predoctoral trainees in the Neuroscience Program are candidates for both Ph.D. and M.D. degrees. Applications for admission to the combined program are considered by the M.D./Ph.D. Committee of the School of Medicine. Application forms for the School of Medicine contain a section requesting information relevant to graduate study. Applicants interested in the combined M.D./Ph.D. program should complete this section also, and indicate specifically their interest in the "Neuroscience Training Program". If application to the combined M.D./Ph.D. program proves unsuccessful and the applicant wishes to be considered for graduate studies, they must notify the Admissions Office of the Neuroscience Training Program by separate letter.

Core competencies in Neuroscience

**1. Basic knowledge of neuroscience principles.** All graduates should be able to:

- Explain how neurons use passive and active membrane properties to receive, process, and transmit signals to post-synaptic cells.
- Explain how neurons are connected in circuits and refined by experience.
- Demonstrate a fundamental understanding of the cellular and molecular specializations that support nervous system function.
- Demonstrate sufficient understanding of neuroanatomy to describe neural circuits and how they contribute to nervous system function.
- Explain how the nervous system develops.
- Identify and discuss common disorders of the nervous system, their biological basis, & current therapies.
- Grasp the fundamental approaches used by theoretical neuroscience to understand how the brain solves computational problems.
- Demonstrate familiarity with common methodologies used in experimental neuroscience.
- Explain biochemical and cell biological processes important for brain function.

**2. Critical thinking.** All graduates should be able to:

- Analyze primary literature and identify strengths and shortcomings of the methods employed.
- Construct testable hypotheses and design experiments to challenge these hypotheses.

**3. Quantitative analysis.** All graduates should be able to:

- Appropriately process and apply analytical techniques and statistical tests to their data.
- Create figures that effectively communicate results.

- Critically evaluate and interpret quantitative data.
- Identify and use computational tools in their research.

**4. Effective written/oral communication skills.** All graduates should be able to:

- Organize their oral and written scientific communications to effectively transmit: 1. significance of topic, 2. relevant background material to place the topic in context, and 3. knowledge gap to be addressed.
- Orally present scientific material in a clear and effective manner.

**5. Career-specific skills:** All students should have the opportunity to develop additional skills required to translate their neuroscience Ph.D. into a successful career. For example: curriculum design for teachers or financial analysis for consulting. Students will develop a plan with their mentor and thesis advisory committee based on their IDP, Career Development Office programs, and other available resources.

**6. Self-motivated learning/scientific inquiry.** All graduates should:

- Independently explore and assimilate existing literature in their field of interest.
- Be able to identify and engage expert guidance when needed.

**7. Discipline-specific research skills.** All graduates should be able to:

- Develop hypothesis driven research questions founded on own their current studies.
- Conduct discipline-specific experimental techniques with appropriate controls and analysis.
- Troubleshoot and solve emergent problems.
- Explain how their studies may impact human health.

**8. Citizenship.** All graduates should demonstrate:

- A fundamental understanding of research ethics.
- The ability to work collaboratively with others.
- Leadership skills necessary to effectively train and supervise others.