

NEUROSCIENCE (PHD)

Overview

The Neuroscience Training Program at the CU School of Medicine provides multidisciplinary PhD training covering the breadth of neurobiology. Hands-on research training in state-of-the-art laboratories and formal coursework in cellular and molecular neurobiology, systems, neural development, neuropharmacology, and biochemistry, propels students to competitive careers in the sciences.

Admissions Requirements

The Neuroscience application deadline is December 1.

PRIORITY DEADLINE FOR INTERNATIONAL APPLICANTS IS NOVEMBER 1.

Applications received by December 1 will be given first consideration for admission to the Fall Semester of the following year, but applications received subsequently may also be considered.

An application for admission must include the following:

- Graduate School on-line application (Includes resume, statement of purpose and research statement)
- A \$50 (domestic) or \$75 (international) non-refundable application fee. An application will not be processed without payment. Fee waivers are available for qualified applicants.
- Three (3) letters of recommendation
- International Applicants should review the additional requirements on the International Admissions Website: <https://www.ucdenver.edu/international-admissions/apply-for-admission/graduate> (<https://www.ucdenver.edu/international-admissions/apply-for-admission/graduate/>)
- One (1) unofficial or official transcript of all academic work completed to date. An official transcript will be required following acceptance to matriculate into our program and must come from the issuing institution directly and sent either electronically or mailed to:

Electronic Transcript(s): graduate.school@cuanschutz.edu

Mailed Transcript(s):

University of Colorado Denver
Graduate School
Mail Stop C296
Fitzsimons Building, C5000
13001 E. 17th Place
Aurora, CO 80045

Exams | The GRE is not required. International students may be required to submit proof of English language proficiency.

Undergraduate Coursework | An undergraduate degree or its equivalent is required. A baccalaureate degree in a biological science, chemistry, physics or engineering is recommended.

GPA | There is no absolute requirement for grade point average above that required by the graduate school, but successful applicants will generally have GPAs above 3.2 (A=4.0).

Research Experience | Research experience is strongly recommended.

Degree Requirements

First Year

First Year		Hours
Fall		
BMSC 7806	Core I: Foundations in Biomedical Sciences	6
NRSC 7501	Introduction to Neuroscience	1
NRSC 7615	Developmental Neurobiology	3
NRSC 7650	Research in Neuroscience	2
NRSC 7662	Survey of Neuroscience	1
NRSC 7663	Neuroscience Journal Club	1
Hours		14

Spring		Hours
NRSC 7600	Cellular & Molecular Biology	3
NRSC 7610	Fundamentals of Neurobiology	3
NRSC 7650	Research in Neuroscience	1
NRSC 7662	Survey of Neuroscience	1
NRSC 7663	Neuroscience Journal Club	1
Hours		9
Total Hours		23

First Year		Hours
Summer		
NRSC 8990	Doctoral Thesis	1-10
Hours		1-10
Total Hours		1-10

Second Year ¹

Second Year		Hours
Fall		
BMSC 7811	Responsible Conduct of Research	1
BMSC 7820	Statistics and Data Analyses for the Biomedical Sciences	3
NRSC 7650	Research in Neuroscience	1-10
NRSC 7663	Neuroscience Journal Club	1
Hours		6-15

Spring		Hours
NRSC 7650	Research in Neuroscience	1-10
NRSC 7612	Nervous System Modeling with NEURON	1
ELEC 5375	Engineering Neuroscience	3
BIOE 5053	Optics & Microscopy in Biomedical Research	3
NRSC 7657	Workshop in Advanced Programming for Neuroscientists	1
MOLB 7950	Informatics and Statistics for Molecular Biology	3
NRSC 7661	Grant Proposal Writing Workshop	1
NRSC 7663	Neuroscience Journal Club	1
Hours		14-23
Total Hours		20-38

Second Year

Summer		Hours
NRSC 8990	Doctoral Thesis	1-10
Hours		1-10
Total Hours		1-10

Third Year & Beyond ¹

Code	Title	Hours
NRSC 8990	Doctoral Thesis	1-10

¹ Students in Year 2 or 3 are required to take a minimum one-credit elective course that provides training in quantitative methods in neuroscience. Some options include: MOLB 7950 Informatics and Statistics for Molecular Biology, NRSC 7612 Nervous System Modeling with NEURON, ELEC 5375 Engineering Neuroscience, BIOE 5054 Introduction to Regulatory Affairs, NRSC 7657 Workshop in Advanced Programming for Neuroscientists.

Learning Objectives

Graduate education in general | Doctoral education is the foundation of future scholarship and the “engine” of the research enterprise. It prepares future faculty and leaders in the academy and other areas of industry and society.

Program/Student Learning Outcomes | The PhD program in Neuroscience trains graduate students to become proficient and successful investigators who are able to:

- Demonstrate a basic knowledge of central concepts in the biomedical sciences.
- Understand the current concepts in Neuroscience.
- Read and critically evaluate the scientific literature.
- Formulate hypotheses based on current concepts in the field and design, conduct, and interpret their own research projects.
- Present research results in peer-reviewed publications and in a dissertation.
- Communicate research results effectively through oral presentations at scientific seminars, conferences, and other venues.
- Write a competitive application for research funding.
- Develop ancillary skills, where necessary, to obtain positions outside of scientific research.

Courses

BIOE 5053 - Optics & Microscopy in Biomedical Research (3 Credits)
Graduate overview of optical imaging, ranging from classical microscopy to advanced non-linear techniques and includes theory, technology and applications in biomedical sciences. This will prepare students for developing and applying state-of-the-art optical imaging in their research. Cross-listed with BIOE 4053. Prereq: Grad standing or permission from the instructor. Max Hours: 3 Credits.
Grading Basis: Letter Grade

BMSC 7806 - Core I: Foundations in Biomedical Sciences (6 Credits)
Course will focus on the fundamental principles of biomedical sciences. Lectures and recitations/discussions will primarily address the basics of molecular biology, biochemistry, genetics, cell biology and energetic principles. Course is typically limited to ORE biomedical science PhD. Previously offered as IDPT 7806

Grading Basis: Letter Grade
Repeatable. Max Credits: 6.
Typically Offered: Fall.

ELEC 5375 - Engineering Neuroscience (3 Credits)
In this course, mathematical models and data processing strategies will be introduced as well as other cutting-edge research techniques to help students understand how these techniques can be applied to solve modern neuroscience problems. Prereq: ELEC 3316 or graduate standing. Cross-listed with ELEC 4735 and NRSC 7674 (Anschutz Medical Campus course). Max Hours: 3 Credits.
Grading Basis: Letter Grade
Prereq: ELEC 3316 or Graduate Standing

MOLB 7950 - Informatics and Statistics for Molecular Biology (3 Credits)
This course covers the design and analysis of common molecular biology experiments with thorough coverage of statistical and informatic approaches to data analysis. The course begins with a “boot camp” that covers use of shell programming, R/R Studio, and Python scripting in bioinformatics. Pre-Req: MOLB-PhD or CSDV-PhD students only
Grading Basis: Letter Grade
A-GRAD Restricted to graduate students only.
Typically Offered: Fall.

NRSC 7501 - Introduction to Neuroscience (1 Credit)
Introduction to study of the nervous system from the level of the brain to an understanding of how neurons are specialized for communication and information processing. This course is a prerequisite for NRSC 7600 series courses.
Grading Basis: Letter Grade
A-GRAD Restricted to graduate students only.
Typically Offered: Fall.

NRSC 7600 - Cellular & Molecular Biology (3 Credits)
A comprehensive, in-depth, discussion-based course intended for candidates for the Ph.D. in Neuroscience. Topics include ion channel structure and function, ionic basis of the resting and action potential, and the biochemistry and physiology of direct and synaptic transmission.
Grading Basis: Letter Grade
A-GRAD Restricted to graduate students only.
Typically Offered: Spring.

NRSC 7650 - Research in Neuroscience (1-10 Credits)
Research work in neuroscience. Prereq: Consent of instructor.
Grading Basis: Letter Grade with IP
Repeatable. Max Credits: 99.
A-GRAD Restricted to graduate students only.
Typically Offered: Fall, Spring, Summer.

NRSC 7662 - Survey of Neuroscience (1 Credit)
Designed to expose first year graduate students to current topics in neuroscience.
Grading Basis: Letter Grade
A-GRAD Restricted to graduate students only.
Typically Offered: Fall, Spring.

NRSC 7610 - Fundamentals of Neurobiology (3 Credits)

This course will provide basic knowledge on the structure and function of the nervous system. The lectures will be supplemented by discussion of primary research literature in neurobiology. Prereq: NRSC 7600 or equivalent at the discretion of the instructors.

Grading Basis: Letter Grade

Repeatable. Max Credits: 3.

A-GRAD Restricted to graduate students only.

Typically Offered: Spring.

NRSC 7615 - Developmental Neurobiology (3 Credits)

This course will cover fundamental principles regarding development of the nervous system. The format of the course will consist of lecture plus reading of primary literature.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall.

NRSC 7661 - Grant Proposal Writing Workshop (1 Credit)

Course is practical workshop in grant-writing culminating in a mock review panel including course participants. Students will examine various proposal types/formats, then write their own proposal in the format of NRSA fellowship application. Restriction: Students with adequate neuroscience background. Prereq: NRSC 7610.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Spring.

NRSC 8990 - Doctoral Thesis (1-10 Credits)

Doctoral thesis work in neuroscience. Prereq: Consent of instructor.

Grading Basis: Letter Grade with IP

A-GRAD Restricted to graduate students only.

Additional Information: Report as Full Time.

Typically Offered: Fall, Spring, Summer.

NRSC 7612 - Nervous System Modeling with NEURON (1 Credit)

The objective of this course is to introduce students to biophysically accurate modeling of single neurons and neuronal networks with NEURON simulation environment. Students will implement NEURON in a project of their choice, possibly related to their primary 'wet' research.

Grading Basis: Letter Grade

Typically Offered: Spring.

NRSC 7657 - Workshop in Advanced Programming for Neuroscientists (1 Credit)

MATLAB is an accessible programming environment that is widely used by scientists and engineers and offers powerful tools for data acquisition and data analysis. Students will develop their own MATLAB programs that are relevant to their particular line of research.

Grading Basis: Letter Grade

Typically Offered: Summer.

PHCL 7605 - Responsible Conduct of Research (1 Credit)

The Department of Pharmacology in the University of Colorado School of Medicine organizes and offers an interactive course during the fall semester entitled "Responsible Conduct of Research". The course is designed to inform students, trainees and faculty to the NIH requirements for ethical and responsible research.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall.

Policies

Please refer to the Office of Research Education and the Graduate School policy pages.

- <https://graduateschool.cuanschutz.edu/forms-resources/resources> (<https://graduateschool.cuanschutz.edu/forms-resources/resources/>)
- <https://medschool.cuanschutz.edu/ore/forms-and-resources> (<https://medschool.cuanschutz.edu/ore/forms-and-resources/>)

The Neuroscience Program handbook is located on the curriculum page of our website: <https://www.cuanschutz.edu/graduate-programs/neuroscience/curriculum> (<https://www.cuanschutz.edu/graduate-programs/neuroscience/curriculum/>)

Contact Us

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