NEUROSCIENCES

Courses offered by the Neurosciences Program are listed under the subject code NEPR on the Stanford Bulletin's ExploreCourses web site.

Master of Science in Neurosciences

The Neurosciences IDP does not offer a terminal or coterminal M.S. degree. An M.S. degree may only be pursued in combination with a doctoral degree from another department within the University or one of the University's professional schools.

Students interested in pursuing the M.S. must meet with the Neurosciences IDP Program Director and provide an unofficial Stanford transcript as well as a statement of purpose for adding the M.S. degree.

Requirements

- Completion of a minimum of 45 unduplicated units of course work, including the Neuroscience courses listed below or approved substitutes. Courses used for the Neurosciences M.S. may not be double-counted to meet the requirements of a Ph.D. degree.
- Course requirements must be completed before the student applies for terminal graduate registration (TGR) Status.
- In addition to required course work, students pursuing the M.S. in Neurosciences must sit for a qualifying exam that includes a written proposal for a thesis project and oral examination.

		Units
Required Courses		
All courses used for the Neurosciences M.S. must be taken for a letter grade and passed with a 3.0 (B) or better.		
NEPR 202	Neurosciences Development Core	2
NEPR 203	Neuroscience Systems Core	2
NEPR 204	Neuroscience Molecular Core	2
NEPR 205	Neurosciences Anatomy Core	2
NEPR 207	Neurosciences Cognitive Core	2
NEPR 208	Neuroscience Computational Core	2
NEPR 213	Neurogenetics Core	2
NEPR/COMPMED 201	Neuro-Cellular Core	2
NEPR 212	Responsible Conduct of Neuroscience Research	1
NBIO 228	Mathematical Tools for Neuroscience	2
NEPR 280	Neuroscience Journal Club and Professional Development Series (A minimum of 3 quarters is required)	1-2
Stanford Intensive Neurosciences (SIN) Boot Camp		10
Graduate Statistics Course (STATS 216 Introduction to Statistical Learning or similar; pre-approval is required)		3
Four (4) Advanced Level Neuroscience Courses (pre-approval is required)		12

Doctor of Philosophy in Neurosciences

University requirements for the Ph.D. are described in the "Graduate Degrees (http://exploredegrees.stanford.edu/graduatedegrees)" section of this bulletin.

The interdepartmental Neurosciences Program offers instruction and research opportunities leading to a Ph.D. in Neurosciences. The requirements for a Ph.D. degree follow those of the University and in addition are tailored to fit the background and interests of the student. Qualified applicants should, where possible, apply for the predoctoral fellowships in open competition, especially those from the National Science Foundation.

Admissions

Applications are made through the Graduate Admissions (http://gradadmissions.stanford.edu) web site and are due on November 28, 2018. Applicants should familiarize themselves with the research interests of the faculty and indicate their preferences clearly on the application form. Admitted students are notified from early March through mid-April. Accepted students receive an award covering tuition, a basic health plan, and a living stipend.

Requirements

Since students enter with differing backgrounds, and the labs in which they may elect to work cover several different disciplines, the specific program for each student is developed individually with an advisory committee. Students rotate through at least three labs during the first year while taking core modules. Passing of a comprehensive qualifying examination given by the student's advisory committee is required for admission to Ph.D. candidacy; the qualifying exam must be taken by the end of the second year. Students are required to prepare a Ph.D. dissertation that is the result of independent investigation accomplished while enrolled in the program that contributes to knowledge in an area of neuroscience, and to defend the dissertation in a University Oral Examination that includes a public seminar. Students must also publish a first-author paper in a major scientific journal on the defended work and submit a written dissertation prior to completing the Ph.D. degree.

Medical students may participate in this program provided they meet the prerequisites and satisfy all the requirements of the graduate program as listed above. The timing of the program may be adjusted to fit their special circumstances.

		Units
Required Courses		
Required courses must be taken for a letter grade and passed with a 3.0 (B) or better		
NEPR 202	Neurosciences Development Core	2
NEPR 203	Neuroscience Systems Core	2
NEPR 204	Neuroscience Molecular Core	2
NEPR 205	Neurosciences Anatomy Core	2
NEPR 207	Neurosciences Cognitive Core	2
NEPR 208	Neuroscience Computational Core	2
NEPR 213	Neurogenetics Core	2
NEPR/COMPMED 201	Neuro-Cellular Core	2
NEPR 212	Responsible Conduct of Neuroscience Research	1
NBIO 228	Mathematical Tools for Neuroscience	2
NEPR 280	Neuroscience Journal Club and Professional Development Series (A total of 9 quarters is required)	1-2
Stanford Intensive Neurosciences (SIN) Boot Camp		10
Graduate Statistics Course (STATS 216 Introduction to Statistical Learning or similar; pre-approval is required)		3
Four (4) Advanced Level Neuroscience Courses (pre-approval is required)		12

Students Enrolled Starting Autumn 2014 and Earlier

- Introduction to Neurobiology (NBIO 206 The Nervous System or equivalent).
- Nine (9) quarters of NBIO 300/MCP 300 /NEPR 280 Neuroscience Journal Club and Professional Development Series

- Five (5) advanced level courses within - and at least one course in each of - the following three areas:

1. Systems, Computational, Cognitive and Behavioral Neuroscience. Courses at this level focus on the computations performed by neural circuits and the role such computations play in behavior, perceptions, and plasticity. Students can expect to learn how neurons: Organize circuits into larger functional units; Represent and transform information; Produce myriad movement; and Subserve higher-level processing related to perception, reasoning and learning. Predominant methods in this area include modeling single cells and circuits, design of behavioral paradigms, and statistical analysis of behavioral and electrophysiological data.

Courses offered this academic year that can fulfill this include:

- COMPMED 207 Comparative Brain Evolution
- NBIO 258 Information and Signaling Mechanisms in Neurons and Circuits
- NENS 220 Computational Neuroscience
- PSYCH 202 Cognitive Neuroscience
- PSYCH 204A Human Neuroimaging Methods
- PSYCH 232 Brain and Decision
- PSYCH 251 Experimental Methods
- PSYCH 266 Current Debates in Learning and Memory

Courses offered in previous years that fulfilled this requirement include:

- NBIO 218 Neural Basis of Behavior
- NBIO 220
- NENS 205 Neurobiology of Disease Seminar

2. Cellular, Molecular and Developmental Neuroscience. Courses in this area address fundamental mechanisms that enable cells of the nervous system to develop, function in adulthood, change during learning and memory, and/or malfunction in disease states. Students can expect to learn core concepts in: Cell-cell communication; Intracellular signal transduction; Transcriptional and translational control; mRNA and protein trafficking; Membrane biophysics; and Cell motility. Dominant methods include molecular biology, genetics, cell biology, electrophysiology, and subcellular or multicellular imaging.

Courses offered this academic year that can fulfill this include:

- BIO 214 Advanced Cell Biology/BIOC 224 Advanced Cell Biology/MCP 221 Advanced Cell Biology
- BIO 254 Molecular and Cellular Neurobiology
- BIOS 200 Foundations in Experimental Biology
- GENE 221 Current Issues in Aging
- NBIO 254 Molecular and Cellular Neurobiology
- NBIO 258 Information and Signaling Mechanisms in Neurons and Circuits
- PSYCH 204B Computational Neuroimaging

Courses offered in previous years that fulfilled this requirement include:

- MCP 216 Genetic Analysis of Behavior (NBIO 216)
- NBIO 216 Genetic Analysis of Behavior (MCP 216)
- BIO 217
- COMPMED 215 Synaptic Properties and Neuronal Circuits
- MCP 256 How Cells Work: Energetics, Compartments, and Coupling in Cell Biology/MCP 156 How Cells Work: Energetics, Compartments, and Coupling in Cell Biology
- NBIO 218 Neural Basis of Behavior
- NBIO 220

3. Translational Neuroscience. Courses in this area address fundamental concepts in studying disorders of the human brain and the peripheral nervous system and their treatment. Students can expect to learn about basic themes in: Pathophysiological mechanisms; Modeling of human diseases; Approaches to designing diagnoses and treatments; Implementing diagnoses and treatments. The courses highlight studies of human diseases that use genetics, molecular biology, psychological testing, and functional imaging.

Courses offered this academic year that can fulfill this include:

- BIO 267 Molecular Mechanisms of Neurodegenerative Disease / NENS 267 Molecular Mechanisms of Neurodegenerative Disease
- GENE 210 Genomics and Personalized Medicine / DBIO 220 Genomics and Personalized Medicine

Courses offered in previous years that fulfilled this requirement include:

- CSB 278 Systems Biology
- IMMUNOL 285 Brain and the Immune System
- NENS 205 Neurobiology of Disease Seminar

The previously-approved courses from outside the Neuroscience core listed below can satisfy the remaining elective requirements:

- BIO 217
- BIO 222 Exploring Neural Circuits
- BIO 230 Molecular and Cellular Immunology
- BIO 245 Ecology and Evolution of Animal Behavior
- BIO 258 Developmental Neurobiology
- BIOC 224 Advanced Cell Biology/BIO 214 Advanced Cell Biology/MCP 221 Advanced Cell Biology
- BIOE 291 Principles and Practice of Optogenetics for Optical Control of Biological Tissues
- BIOE 332
- BIOS 200 Foundations in Experimental Biology
- BIOS 210 Axonal Transport and Neurodegenerative Diseases
- BIOS 241 Dissecting algorithms for RNA Sequencing
- COMPMED 207 Comparative Brain Evolution
- COMPMED 215 Synaptic Properties and Neuronal Circuits
- CS 221 Artificial Intelligence: Principles and Techniques
- CS 229 Machine Learning
- CSB 210 Cell Signaling
- DBIO 201 Cells and Signaling in Regenerative Medicine
- DBIO 210 Developmental Biology
- EE 263 Introduction to Linear Dynamical Systems/CME 263 Introduction to Linear Dynamical Systems
- MCP 221 Advanced Cell Biology/BIO 214 Advanced Cell Biology/BIOC 224 Advanced Cell Biology
- MCP 222 Imaging: Biological Light Microscopy

- NENS 267 Molecular Mechanisms of Neurodegenerative Disease/BIO 267 Molecular Mechanisms of Neurodegenerative Disease
- PSYCH 204 Computation and Cognition: The Probabilistic Approach
- RAD 227 Functional MRI Methods/BIOPHYS 227 Functional MRI Methods

The previously-approved courses from outside the Neuroscience core listed below satisfied the remaining elective requirements:

- BIO 222 Exploring Neural Circuits
- CS 379 Interdisciplinary Topics
- IMMUNOL 285 Brain and the Immune System
- MUSIC 257 Neuroplasticity and Musical Gaming
- NENS 204 Stroke Seminar

Other courses not listed here can satisfy program requirements with prior approval of the Program Director.

The School of Law and the Neurosciences IDP offer a joint program leading to a J.D. degree combined with a Ph.D. in Neurosciences. The joint degree program provides an opportunity for students to develop expertise in both fields, and, in some cases, to prepare themselves intensively for careers in areas relating to both neuroscience and law.

Students interested in the joint degree program must apply and gain entrance separately to the School of Law and the Neurosciences IDP and, as an additional step, must secure permission from both academic units to pursue degrees in those units as part of a joint degree program. Interest in either joint degree program should be noted on the student's admission applications and may be considered by the admission committee of each program. Alternatively, an enrolled student in either the Law School or the Neurosciences IDP may apply for admission to the other program and for joint degree status in both academic units after commencing study in either program.

Joint degree students may elect to begin their course of study in either the School of Law or the Neurosciences IDP. Faculty advisers from each academic unit will participate in the planning and supervising of the student's joint program. Students must be enrolled full time in the Law School for the first year of law school and must be enrolled full time in the Neurosciences IDP for the first two years of that program, or until the student has passed the Qualifying Exam. At all other times, enrollment may be in the School of Medicine or the Law School, and students may choose courses from either program regardless of where enrolled. Students must satisfy the requirements for both the J.D. and the Ph.D. degrees as specified in the *Stanford Bulletin* or elsewhere.

The Law School shall approve courses from the Neurosciences IDP that may count toward the J.D. degree, and the Neurosciences IDP shall approve courses from the Law School that may count toward the Ph.D. degree in Neurosciences. In either case, approval may consist of a list applicable to all joint degree students or may be tailored to each individual student's program. The total minimum number of university residency units required for both degrees is 190. No more than 54 units of approved courses may be counted toward both degrees.

Graduate Advising Expectations

The Neurosciences Program is committed to providing academic advising in support of graduate student scholarly and professional development. When most effective, this advising relationship entails collaborative and sustained engagement by both the adviser and the advisee. As a best practice, advising expectations should be periodically discussed and reviewed to ensure mutual understanding. Both the adviser and the advisee are expected to maintain professionalism and integrity.

Faculty advisers guide students in key areas such as selecting courses, designing and conducting research, developing of teaching pedagogy, navigating policies and degree requirements, and exploring academic opportunities and professional pathways.

Graduate students are active contributors to the advising relationship, proactively seeking academic and professional guidance and taking responsibility for informing themselves of policies and degree requirements for their graduate program.

For a statement of University policy on graduate advising, see the "Graduate Advising (http://exploredegrees.stanford.edu/graduatedegrees/#advisingandcredentialstext)" section of this bulletin. For Neurosciences IDP advising guidelines, see the program website (http://med.stanford.edu/neurogradprogram.html).

Director: Anthony J. Ricci (Edward C. and Amy H. Sewall Professor in the School of Medicine and, Professor, by courtesy, of Molecular and Cellular Physiology)

Anesthesia: Bruce MacIver, Gregory Scherrer

Applied Physics: Surya Ganguli

Biochemistry: Suzanne Pfeffer

Bioengineering: Kwabena Boahen, Karl Deisseroth

Biology: Xiaoke Chen, Russ Fernald, H. Craig Heller, Liqun Luo, Susan McConnell, Mark Schnitzer, Carla Shatz, Kang Shen, Marc Tessier-Lavigne

Chemical and Systems Biology: Joanna Wysocka

Comparative Medicine: Paul Buckmaster, Shaul Hestrin

Developmental Biology: Seung Kim

Education: Candace Thille

Electrical Engineering: Krishna Shenoy

Genetics: Michael Bassik, Anne Brunet, Aaron Gitler

Molecular and Cellular Physiology: Axel Brunger, Miriam Goodman, Daniel Madison, Merritt Maduke, Thomas Sudhof

Neurobiology: Stephen Baccus, Thomas Clandinin, Shaul Druckmann, Lisa Giocomo, Keren Haroush, Michael Lin, Tirin Moore, William Newsome, Jennifer Raymond

Neurology and Neurological Sciences: Katrin Andreasson, Marion Buckwalter, Michael Greicius, Ting-Ting Huang, John Huguenard, Michelle Monje-Deisseroth, Josef Parvizi, David Prince, Thomas Rando, Richard Reimer, Tony Wyss-Coray, Yanmin Yang

Neurosurgery: Lu Chen, E.J. Chichilnisky, Jun Ding, Julia Kaltschmidt, Paul Nuyujukian, Theo Palmer, Giles Plant, Ivan Soltesz, Gary Steinberg, Suzanne Tharin, Xinnan Wang, Bradley Zuchero

Ophthalmology: Jeffrey Goldberg, Yang Hu, Y. Joyce Liao, Sui Wang

Otolaryngology: Alan Cheng, Nicolas Grillet, Lloyd Minor, Anthony Ricci

Pathology: Isabella Graef, Bingwei Lu, Marius Wernig

Pediatrics (Systems Medicine): Dennis Wall

Psychiatry and Behavioral Sciences: Luis de Lecea, Amit Etkin, Robert Malenka, Vinod Menon, Karen Parker, Sergiu Pasca, Allan Reiss, Nirao Shah, Leanne Williams

Psychology: Justin Gardner, Ian Gotlib, Kalanit Grill-Spector, Brian Knutson, James McClelland, Anthony Norcia, Russell Poldrack, Anthony Wagner, Brian Wandell, Daniel Yamins

Radiology: Raag Airan, Jennifer McNab