Computational Neuroscience

Faculty Adviser: Philip S. Ulinski, Organismal Biology and Anatomy,
*   CH 206, 702-8081, pulinski@uchicago.edu*

Computational neuroscience is a relatively new interdisciplinary area of inquiry that is concerned with how components of animal and human nervous systems interact to produce behaviors. It relies on quantitative and modeling approaches to understand the function of the nervous system and to design human-made devices that duplicate behaviors. Course work in computational neuroscience can prepare students for graduate studies in neurobiology or psychology, in the mathematical or engineering sciences, or in areas of medicine such as neurology or psychiatry. It can lead to either traditional academic careers or to opportunities in the corporate world.

An undergraduate degree in computational neuroscience is not available at the University of Chicago, but a minor in computational neuroscience is offered by the Biological Sciences Collegiate Division. This minor is a good option for students who are majoring in biological sciences and are interested in mathematical approaches to biology; or for students who are majoring in computer science, mathematics, physics, psychology, or statistics and are interested in neuroscience. For details, see the Biological Sciences section elsewhere in this catalog.

Students electing this minor must have completed, or placed out of, the equivalent of a year of collegiate-level calculus and must have completed the general education requirement for the biological sciences. Students interested in computational neuroscience are encouraged, but not required, to take the Mathematical Methods for Biological Sciences sequence (BIOS 26210-26211-26212). The minor requires completion of the following two (three-course) sequences: BIOS 24221-24222-24223 (Computational Neuroscience I, II, III) and BIOS 29405-29406-29407 (Mathematical and Statistical Methods for Neuroscience I, II, III).

Instead of completing a formal minor, students can easily fashion an organized course of study in computational neuroscience by selecting appropriate general education courses and electives.

For updated information on computational neuroscience activities and undergraduate programs, visit *cns.bsd.uchicago.edu.*

Suggested General Education Courses

Students majoring in biological science can elect either the
   BIOS 20180s or the BIOS 20190s sequence. Students taking the AP 5
   sequence should consider BIOS 20243.
MATH 15100-15200. Calculus I, II; or
   MATH 16100-16200. Honors Calculus I, II
SOSC 14100-14200-14300. Mind I, II, III

Suggested Electives

BIOS 24203. Introduction to Neuroscience
BIOS 24204. Cellular Neurobiology
BIOS 24205. Systems Neuroscience
BIOS 24211. Neuroethology
BIOS 24221-24222-24223. Computational Neuroscience I, II, III
BIOS 29405-29406-29407. Mathematical and Statistical Methods for
   Neuroscience, I, II, III
PSYC 20300. Biological Psychology
PSYC 20400. Cognitive Psychology
PSYC 20700. Sensation and Perception
PSYC 21900. Color Vision
PSYC 25000. Physiology of Vision

Faculty

Faculty associated with this interdisciplinary area participate in a three-quarter sequence in computational neuroscience, teach upper-level courses relevant to computational neuroscience, and participate in an ongoing computational neuroscience seminar series.

Y. Amit, D. Bradley, J. Cowan, J. Ebersole, J. Goldberg, J. Goldsmith, S. Goldstsein, M. Hale, D. Hanck, N. Hatsopoulos, N. Issa, L. Kay, D. Margoliash, M. McClintock, R. McCrea, J. MacLean, P. Niyogi, H. Nusbaum, E. Perozo, J. Pokorny, J. Ramirez, T. Regier, S. M. Sherman, S. Shevell, S. Small, J.-P. Spire, V. L. Towle, P. Ulinski

Courses

BIOS 24221. Computational Neuroscience I: Single Neuron Computation. (=CPNS 33000) *PQ: A college-level course in calculus required; some background in neurobiology helpful. P. Ulinski, Staff. Autumn. L.*

BIOS 24222. Computational Neuroscience II: Vision. (=CPNS 33100) *PQ: BIOS 24221. P. Ulinski, Staff. Winter. L.*

BIOS 24223. Computational Neuroscience III: Cognitive Neuroscience. (=CPNS 32000) *PQ: BIOS 24222. H. Hatsopoulos. Spring.*

BIOS 29405. Mathematical and Statistical Methods for Neuroscience I. (=CPNS 30020) *PQ: Some prior experience with linear algebra and ordinary differential equations. W. van Drongelen. Autumn.*

BIOS 29406. Mathematical and Statistical Methods for Neuroscience II. (=CPNS 30021) *PQ: BIOS 29405. W. van Drongelen, Staff. Winter.*

BIOS 29407. Mathematical and Statistical Methods for Neuroscience III. (=CPNS 30022) *PQ: BIOS 29406. P. Ulinski, D. Mogul. Spring.*