

Computational Neuroscience

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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 sequences: BIOS 24221-24222-24223 (Computational Neuroscience I, II, III) and BIOS 29405-29406 (Mathematical and Statistical Methods for Neuroscience I, II).

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 24221-24222-24223. Computational Neuroscience I, II, III

BIOS 29405-29406. Mathematical and Statistical Methods for Neuroscience I, II

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. Goldstein, 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, W. VanDrongelen

Courses

BIOS 24208. Vertebrate Neural Systems. (=CPNS 30116, NURB 31600) *PQ: Consent of instructor. C. Ragsdale. Autumn. L.*

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. N. Issa, Staff. Winter. L.*

BIOS 24223. Computational Neuroscience III: Cognitive Neuroscience. (=ORG 34600, PSYC 34400) *PQ: BIOS 24222. H. Hatsopoulos. Spring. L.*

BIOS 24246. Neurobiology of Disease I. (=CPNS 34600, NURB 34600) *PQ: NURB 31800 or BIOS 24203. C. Gomez, Staff. Winter.*

BIOS 24247. Neurobiology of Disease II. (=CPNS 34700, NURB 34700) *PQ: BIOS 24246. C. Gomez, Staff. Spring.*

BIOS 26210-26211-26212. Mathematical Methods for Biological Sciences I, II, III. (=CPNS 31000-31100-31200) *PQ: MATH 15300 or equivalent. D. Kondrashov. Autumn, Winter, Spring. L.*

BIOS 29405. Mathematical and Statistical Methods for Neuroscience I. (=CPNS 32000) *PQ: Some background in linear algebra and ordinary differential equations. This course meets requirements for the biological sciences major only for students who are specializing in neuroscience. W. VanDrongelen. Autumn.*

BIOS 29406. Mathematical and Statistical Methods for Neuroscience II. *PQ: BIOS 29405 or consent of instructor. This course meets requirements for the biological sciences major only for students specializing in neuroscience. W. VanDrongelen. Winter.*

PSYC 21900/32000. Color Vision. (=CPNS 30500, OPTH 32000) *PQ: PSYC 20700 or consent of instructor. S. Shevell. Winter, 2009.*