

Cell Biology and Neuroscience

Subject abbreviation: CBNS
College of Natural and Agricultural Sciences

David A. Eastmond, Ph.D., Chair
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Professors

Michael E. Adams, Ph.D. (Cell Biology and Neuroscience/Entomology)
Nancy E. Beckage, Ph.D. (Cell Biology and Neuroscience/Entomology)
David A. Eastmond, Ph.D.
Sarjeet S. Gill, Ph.D.
Manuela Martins-Green, Ph.D.
Frances M. Sladek, Ph.D.
B. Glenn Stanley, Ph.D. (Cell Biology and Neuroscience/Psychology)
Prudence Talbot, Ph.D.
Raphael Zidovetzki, Ph.D.

Professors Emeriti

Katharine D. Atkinson, Ph.D.
Paul D. Wilson, Ph.D. (Cell Biology and Neuroscience/Psychology)

Associate Professors

Margarita C. Currás-Collazo, Ph.D.
Scott N. Currie, Ph.D.
Maksim Bazhenov, Ph.D.

Assistant Professors

Jeffrey B. Bachant, Ph.D.
Todd Fiacco, Ph.D.
Nicole zur Nieden, Ph.D.
Karine G. Le Roch, Ph.D.
Constance I. Nugent, Ph.D.
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Adjunct Associate Professor

André Obenaus, Ph.D.

Adjunct Assistant Professor

Yanhong Shi, Ph.D.

Research in the Department of Cell Biology and Neuroscience uses multidisciplinary approaches to understanding basic cellular processes in various tissues, including the nervous system, as well as more integrative levels of analysis, including behavior. Areas of research represented in the department include the following:

- Biophysical properties of excitable membranes
- DNA repair
- Transcriptional regulation
- Mechanisms of toxicity
- Insect development
- Membrane transport
- Mechanisms of mitotic chromosome transmission
- Telomere maintenance
- Synaptic structure and function
- Changes in nervous system with experience
- Interactions of nervous and endocrine systems
- Reproductive biology and fertilization
- Chemokine function in wound healing and tumor development

- Glia-neuron signaling and sensory and motor integrative processes

Undergraduate Curriculum

Students interested in cell, molecular, and developmental biology can obtain training through the interdepartmental major in Biological Sciences with a specialization in Cell, Molecular, and Developmental Biology leading to the B.S. degree. Students interested in neuroscience can obtain training in behavioral neuroscience, neurobiology, and neurochemistry through the Neuroscience major leading to the B.A. or B.S. degree. The Neuroscience major is an intercollege major offered by the College of Humanities, Arts, and Social Sciences and the College of Natural and Agricultural Sciences. See Biological Sciences section and Neuroscience Undergraduate Major section, respectively.

Graduate Curriculum

Courses and research opportunities are offered by the interdepartmental graduate programs in Cell, Molecular, and Developmental Biology; Environmental Toxicology; and Neuroscience. See the respective graduate program section.

Lower-Division Course

CBNS 004. Concepts in Medical Cell Biology (3)

Lecture, 1 hour; workshop, 4 hours. Prerequisite(s): CHEM 001A or CHEM 01HA (may be taken concurrently). Introduces fundamental concepts in molecular cell biology, with emphasis on human health and disease. Modules involve lectures and interactive, problem-oriented discussions with faculty. Through classical and contemporary examples, modules acquaint students with the scientific process and how it leads to insights into human biology. Credit is not awarded for CBNS 004 if it has already been awarded for BIOL 005A.

Upper-Division Courses

CBNS 101. Fundamentals of Cell Biology (4)

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CHEM 112C; BCH 100 or BCH 110A (BCH 100 or BCH 110A may be taken concurrently). Introduces the principles of eukaryotic cell biology. Includes an examination of the molecules and systems that mediate cell function and an overview of membrane architecture and function, cell signaling and signal transduction, the cytoskeleton, organelles, protein targeting and secretion, and the nucleus and nuclear transport. Credit is not awarded for CBNS 101 if it has already been awarded for BIOL 113 or BIOL 114.

CBNS 106. Introduction to Neuroscience (4)

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, CHEM 001A, CHEM 001B, CHEM 001C; or consent of instructor. An introduction to cellular, organismal, and behavioral neuroscience for science majors. Topics include structure and functions of the brain, neurons, and synapses; sensory systems and perception; control of movement; neurobiology of hormones and sexual behavior; biorhythms, learning, memory, and psychoses.

CBNS 108. Introduction to Developmental Biology (4)

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 102, CHEM 112C; or consent of instructor. Emphasizes common principles and key concepts that govern development of multiple eukaryotic systems, and how genes control cell behavior during development.

CBNS 116. Cellular Neuroscience: Structure-Function Relationships (4)

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or consent of instructor. Examination of structures comprising nervous systems and the functional principles around which these structures are organized. Topics range from whole brain anatomy to the cellular units (neurons and glia) that constitute nervous systems, and to subcellular elements important in neural functioning.

CBNS 120. Cellular Neuroscience: Membrane and Synaptic Phenomena (4)

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or consent of instructor. An examination of cellular and molecular mechanisms of nervous system function using concepts drawn from the study of vertebrates and invertebrates with emphasis on mammalian systems. Cross-listed with PSYC 120.

CBNS 120L. Neuroscience Laboratory (2)

Lecture, 1 hour; laboratory, 3 hours. Prerequisite(s): CBNS 120/PSYC 120 or concurrent enrollment. Laboratory experiments using electrophysiological, chemical, and anatomical research methods fundamental to understanding neurons and neural systems. Cross-listed with PSYC 120L.

CBNS 121. Developmental Neuroscience (4)

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or consent of instructor. A study of the development of nervous systems. Examines the cellular and molecular mechanisms of neural development and the determinants of cell birth and death, axonal pathfinding, neuronal connections, and development of neural systems underlying behavior. Cross-listed with PSYC 121.

CBNS 123. Brain Control of Bodily Functions (4)

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or PSYC 110 or consent of instructor. Emphasizes principles of organization and function related to endocrine and other physiological systems. Selected topics include control of breathing, body water, temperature, cardiovascular function, and the stress response.

CBNS 124. Systems Neuroscience (4)

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or PSYC 110 or consent of instructor. Study of the structure and function of motor and sensory systems in vertebrate and invertebrate nervous systems. Cross-listed with PSYC 124.

CBNS 125. Neuropharmacology (4)

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 120/PSYC 120; previous or concurrent enrollment in CBNS 120L/PSYC 120L and CBNS 124/PSYC 124 recommended. Examines synaptic neurotransmitter systems, mechanisms, and pharmacological agents and effects, which are fundamental to neural information processing. Cross-listed with PSYC 125.

CBNS 126. Neuroscience of Learning and Memory (4)

Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or PSYC 110 or consent of instructor. Covers mechanisms of learning and memory across levels of analysis, including genetic, neuronal, systems and theory. Topics include the multiple memory systems, memory consolidation, working memory, emotional memory, recognition memory, spatial memory, and human amnesia. Cross-listed with PSYC 126.

CBNS 127. Behavioral Control Systems (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 120/PSYC 120; CBNS 124/PSYC 124 strongly recommended. An analysis of the principles of nervous system operation from the processing of sensory inputs for object recognition and localization to the organization of central patterns for generation of sequenced motor output. Cross-listed with PSYC 127.

CBNS 128. Immunology (3) Lecture, 3 hours. Prerequisite(s): BIOL 005C; PHYS 002C; PHYS 02LC; BCH 100 or BCH 110A. A study of humoral and cellular immunology. Topics include lymphoid systems, cells, antigens, antibodies, antibody formation, cellular immunity, and tumor and transplantation immunology. Diseases and altered immune states associated with each topic are discussed in detail. Cross-listed with BIOL 128.

CBNS 150. Cancer Biology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110C or BIOL 107A; CBNS 101 is recommended (may be taken concurrently). The origin, development, and treatment of cancer are explored with emphasis on molecular mechanisms. Topics such as oncogenes, tumor suppressors, cell cycle and differentiation, AIDS, and hereditary and environmental factors in the development of cancer are covered. Cross-listed with ENTX 150.

CBNS 169. Human Embryology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C or consent of instructor. An in-depth study of normal human development from conception through the early postnatal period. Demonstrations use microscopic and other materials specifically adapted for the course. Some consideration is given to abnormal development.

CBNS 190. Special Studies (1-4) Individual study, 3-12 hours. Prerequisite(s): upper-division standing; consent of instructor and department chair. Individual study to meet special curricular needs. Grading basis to be determined in consultation with the instructor and department chair. Course is repeatable to a maximum of 12 units.

CBNS 194. Independent Reading (1-2) Individual study, 3-6 hours. Prerequisite(s): consent of instructor. Individual reading under faculty direction. Course is repeatable to a maximum of 4 units.

CBNS 197. Research for Undergraduates (1-4) Outside research, 3-12 hours. Prerequisite(s): either sophomore standing and one course in Cell Biology and Neuroscience or upper-division standing; consent of instructor. An introduction to laboratory research conducted under faculty supervision. Students who submit a written report or give an oral presentation receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. Course is repeatable.

CBNS 199. Senior Research (1-4) Outside research, 3-12 hours. Prerequisite(s): senior standing; consent of instructor. Original research undertaken under the direction of a faculty member. Students who submit a written report or give an oral presentation receive a letter grade; other students receive a Satisfactory (S) or No Credit (NC) grade. Course is repeatable.

Cell, Molecular, and Developmental Biology

Subject abbreviation: CMDB

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Professors

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James Baldwin, Ph.D. (Nematology)
Nancy Beckage, Ph.D. (Entomology/Cell Biology and Neuroscience)
Katherine Borkovich, Ph.D. (Plant Pathology and Microbiology)
Richard Cardullo, Ph.D. (Biology)
Wilfred Chen, Ph.D. *President's Chair*, (Chemical and Environmental Engineering)
Xuemei Chen, Ph.D. (Botany and Plant Sciences)
Carl Cranor, Ph.D. (Philosophy)
Shou-Wei Ding, Ph.D. (Plant Pathology and Microbiology)
Brian Federici, Ph.D. (Entomology)
Sarjeet S. Gill, Ph.D. (Cell Biology and Neuroscience)
Leah Haimo, Ph.D. (Biology)
Bradley Hyman, Ph.D. (Biology)
Howard Judelson, Ph.D. (Plant Pathology and Microbiology)
Xuan Liu, Ph.D. (Biochemistry)
David Lo, Ph.D., M.D. (Biomedical Sciences)
Manuela Martins-Green, Ph.D. (Cell Biology and Neuroscience)
Dmitri Maslov, Ph.D. (Biology)
Thomas Miller, Ph.D. (Entomology)
Ashok Mulchandani, Ph.D. (Chemistry)
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Michael Pirrung, Ph.D. *President's Chair* (Chemistry)
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Raphael Zidovetzki, Ph.D. (Cell Biology and Neuroscience)

Professors Emeriti

Robert Heath, Ph.D. (Botany and Plant Sciences)
Helen Henry, Ph.D. (Biochemistry)
Anthony H.C. Huang, Ph.D. (Botany and Plant Sciences)
Elizabeth M. Lord, Ph.D. (Biochemistry)
Charles F. Louis, Ph.D. (Biochemistry)
Anthony W. Norman, Ph.D. (Biochemistry/Biomedical Sciences)

Associate Professors

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Monica J. Carson, Ph.D. (Biomedical Sciences)
Quan Cheng, Ph.D. (Chemistry)
Margarita Currás-Collazo, Ph.D. (Cell Biology and Neuroscience)
Scott N. Currie, Ph.D. (Cell Biology and Neuroscience)
Kathryn DeFea, Ph.D. (Biomedical Sciences)
Iryna M. Ethell, Ph.D. (Biomedical Sciences)
Hailing Jin, Ph.D. (Plant Pathology and Microbiology)
Isgouhi Kaloshian, Ph.D. (Nematology)
Paul Larsen, Ph.D. (Biochemistry)
Stefano Lonardi, Ph.D. (Computer Science and Engineering)
Christian Lytle, Ph.D. (Biomedical Sciences)
Morris F. Maduro, Ph.D. (Biology)
Ernest Martinez, Ph.D. (Biochemistry)
Cengiz Ozkan, Ph.D. (Mechanical Engineering)
Mihri Ozkan, Ph.D. (Electrical Engineering)
Frank Sauer, Ph.D. (Biochemistry)
Patricia S. Springer, Ph.D. (Botany and Plant Sciences)

Assistant Professors

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Emma Wilson, Ph.D. (Biomedical Sciences)
Laura Zanello, Ph.D. (Biochemistry)
Nicole zur Nieden, Ph.D. (Cell Biology and Neuroscience)

The Cell, Molecular, and Developmental Biology Graduate Program is an interdepartmental program offering M.S. and Ph.D. degrees to students seeking advanced training in these disciplines. The program focuses on the bridge between basic and applied research and on the interface between cell, molecular, and developmental biology. Participating faculty are drawn from numerous biological sciences departments whose research interests in cell, molecular, and developmental biology span