BUS 169B. Quality Assurance in Auditing (4) Lecture, 3 hours; case analyses, 3 hours. Prerequisite(s): BUS 169A. Covers the audit process (internal control, compliance tests, sampling, substantive evidence gathering, electronic data processing auditing) and the audit procedures for various types of accounts such as sales, cash, accounts receivable, payroll, inventory, and capital acquisitions.

BUS 171. Systems Analysis and Design (4) Lecture, 3 hours; extra reading; 2 hours; projects, 1 hour. Prerequisite(s): BUS 101 or equivalent. Involves detailed analysis, specification, design, and implementation of computer-based information systems. Includes economic analyses, evaluation of alternatives, analysis or design tools, and systems project management and planning. Case studies are used.

BUS 172. Information Economics (4) Lecture, 3 hours; assigned and projects, 3 hours. Prerequisite(s): BUS 103; ECON 004 or equivalent. Discusses economic concepts and strategies related to the network economy. Topics include economic issues surrounding information goods, competition in electronic business, pricing strategies, and intellectual property protections. Examines business strategies for the information (software) and infrastructure (hardware) elements of electronic business.

BUS 173. Introduction to Databases for Management (4) Lecture, 3 hours; extra reading, 2 hours; projects, 1 hour. Prerequisite(s): BUS 101 or equivalent. Covers physical and conceptual aspects of database management systems, including familiarity with the variety of database systems based on different data models. Examines the role of database systems in management information systems (MIS) and issues in database design for effective support of MIS. Requires the use of a database package.

BUS 174. Electronic Commerce (4) Lecture, 3 hours; extra reading, 2 hours; project, 1 hour. Prerequisite(s): BUS 101. Reviews the technological evolution of electronic commerce (EC). Investigates how EC can be used to interact with customers, other organizations, and those within the organization. Studies technical innovations, provides a critical evaluation of strategies, and examines current applications and their impact on the business environment.

BUS 175. Business Data Communications (4) Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): BUS 101. Surveys components of telecommunication systems; examines major design and analysis issues in the development and implementation of computer communication systems. Studies both voice and data communication systems including local area networks, wireless systems, satellite systems, and distributed computer and database systems. Emphasizes evaluation of these systems for business purposes.

BUS 176. The Sociology of Work in Organizations (4) Lecture, 3 hours; outside research, 3 hours. Prerequisite(s): SOC 001 or SOC 001H or consent of instructor. Emphasizes the roles of individuals in organizations. Topics include the effects of jobs on workers, long-term trends in the nature of work, and differences in work among major segments of the labor force. Cross-listed with SOC 176.

BUS 177. Strategies in Information Systems (4) Lecture, 3 hours; project, 3 hours. Prerequisite(s): BUS 101. Reviews techniques and methodologies for strategic planning and management. Explores how corporate or strategic planning must be revised for and adapted to the new global telecommunications environment. Topics include time-based management, forecasting and modeling, and construction of a detailed storage plan. Uses detailed case studies.

BUS 178. International Trade (4) Lecture, 3 hours; individual study, 3 hours. Prerequisite(s): ECON 102A. A study of the pure theory of trade, trade policy, and international factor movements including illustrative applications to current issues and problems. Cross-listed with ECON 178.

BUS 179. Business Information Systems Development (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 101. Introduces concepts and programming techniques for building successful interactive business systems. Students use systems development tools to study event-driven programs with graphical user interfaces.

BUS 180A. Seminar in Management: Entrepreneurship (4) Seminar, 30 hours per quarter; individual study, 30 hours per quarter. Prerequisite(s): upper-division standing. Discusses issues and challenges faced by leaders in entrepreneurial organizations. Covers topics such as idea generation, team management, evaluation of core competencies, and ethics. Includes case studies and presentations by guest speakers.

BUS 180B. Seminar in Management: Creating Value (4) Seminar, 30 hours per quarter; outside research, 30 hours per quarter. Prerequisite(s): upper-division standing. Discusses business strategies for creating value in a knowledge-based economy. Focuses on innovative business models in areas such as marketing, finance, information technology, e-commerce, and corporate organization.

BUS 180C. Seminar in Management: Developing Leadership Skills (4) Seminar, 30 hours per quarter; individual study, 30 hours per quarter. Prerequisite(s): upper-division standing. Focuses on approaches to leadership in innovative organizations. Discusses topics such as competencies and characteristics of effective leaders, team building and leadership styles, innovation in functional management practices, and implementing change. Includes exercises, case studies, and invited guest speakers. Credit is awarded for only one of BUS 156 or BUS 180C.

BUS 185. International Strategy and Management (4) Lecture, 3 hours; outside project, 3 hours. Prerequisite(s): senior standing. BUS 109 is recommended. Examines the management and strategic challenges of firms competing in international and global markets. Topics include recent trends in globalization of markets and industries, strategic alliances, foreign direct investment, emerging economies, political risk and cross-cultural interaction, and leadership.

BUS 190. Special Studies (1-5) Individual study. 3-15 hours. Prerequisite(s): upper-division standing; consent of instructor and program chair. A project to be undertaken under faculty supervision. Course is repeatable to a maximum of 12 units.

BUS 198-I. Individual Internship in Business Administration (1-12) Seminar, 1 hour; internship, 3-36 term paper, 1-11 hours. Prerequisite(s): upper-division standing in Business Administration; consent of instructor. Active participation in the work of a business concern or a public or quasi-public agency combining academic instruction and supervised field experience. A maximum of 4 quarter units may be counted toward the degree requirements for Business Administration. Course is repeatable to a maximum of 16 units.

BUS 199H. Senior Honors Research (1-5) Seminar, 1 hour; extra reading, 2-12 hours; term paper, 2-12 hours. Prerequisite(s): senior standing with a major in Business Administration; admission to the University Honors Program or consent of instructor. Involves research in business administration under faculty supervision. Students submit a written report. Graded In Progress (IP) until the last quarter is completed, at which time a final grade is awarded. Course is repeatable to a maximum of 12 units.

Cell Biology and Neuroscience

Subject abbreviation: CBNS
College of Natural and Agricultural Sciences

David A. Eastmond, Ph.D., Chair
Department Office, 1208 Spiehi Hall
(951) 827-1763; cbns.ucr.edu

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.
Samjee S. Gill, Ph.D.
Glenn I. Hatton, 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 Zivelcletski, Ph.D.

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

Associate Professors
Margarita C. Currá-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.

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
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; biophysics, 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. 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, neural 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 120/PSYC 120 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 an 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.