applied area of ethnography in the solution of contemporary social problems. Offered in alternate years.—(F. Jaffee)

298. Group Study for Graduate Students (1-5)
Prerequisite: graduate standing, consent of instructor. (S/U grading only.)

299. Special Study for Graduate Students (1-12)
Prerequisite: graduate standing, consent of instructor. (S/U grading only.)

Professional

396. Teaching Assistant Training Practicum (1-4)
Prerequisite: teaching standing. May be repeated for credit. (S/U grading only.)—F, W, S.

Natural Sciences

See Earth and Planetary Sciences, on page 237.

Nematology

Please see the department of Entomology and Nematology, on page 320, for further information. (College of Agricultural and Environmental Sciences)

Steve Nadler, Ph.D., Chairperson of the Department
Joanna Chiu, Ph.D., Vice Chairperson of the Department
Department Office. 367 Briggs; 530-752-0300

Faculty

Edward P. Caswell-Chen, Ph.D., Professor
Edwin E. Lewis, Professor
Steven A. Nadler, Ph.D., Professor
Becky B. Westerdahl, Ph.D., Professor

Emeriti Faculty

Howard Ferris, Ph.D., Professor Emeritus
Bruce A. Jaffee, Ph.D., Professor Emeritus
Harry K. Kaya, Ph.D., Professor Emeritus

(Entomology)

Minor Program Requirements:

<table>
<thead>
<tr>
<th>Units</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Entomology 100, 110, and Soil Science 100, 110, 111, 112</td>
</tr>
<tr>
<td></td>
<td>Two or three courses from one of the following areas:</td>
</tr>
<tr>
<td></td>
<td>(a) Plant Science: Microbiology 102; Entomology 100, 135, 153, 156, 156L; Evolution and Ecology 112; Plant Pathology 120, 148; Plant Biology 121; Soil Science 111, 112</td>
</tr>
<tr>
<td></td>
<td>(b) Entomology: One upper division Entomology course; Evolution and Ecology 112; Microbiology 102; Plant Biology 121; Plant Pathology 120, 148; Soil Science 102, 111, 112</td>
</tr>
<tr>
<td>112</td>
<td>Minor Adviser, S. Nadler</td>
</tr>
</tbody>
</table>

Graduate

201. Molecular and Physiological Plant Nematology (2)
Lecture—1 hour; discussion—1 hour. Prerequisite: Biological Sciences 101; Plant Pathology 120, course 100 or 110. Molecular biology and physiology of nematodes using Caenorhabditis elegans as a model, but with emphasis on plant-parasitic species. Plant responses to nematodes. Discussion of current literature emphasized. Offered in alternate years.—W.

202. Ecology of Parasitic Nematodes (2)
Lecture—1 hour; discussion—1 hour. Prerequisite: course 100 or 110 or Entomology 156; Evolution and Ecology 101 or Plant Biology 117. Major concepts in population and community ecology of animal-parasitic nematodes. Current advances in techniques, theory, and basic information about nematode-host dynamics, and application to management of nematode diseases. Offered in alternate years.—F, S. Westerdahl

204. Management of Plant-Parasitic Nematodes (2)
Lecture—1 hour; laboratory—3 hours. Prerequisite: course 100 or 110. Theory, foundation, principles and practices of nematode management. Techniques and equipment used to manage nematodes and methods used to analyze their effectiveness. Offered in alternate years.—S. Westerdahl

205. Insect Nematology and Biological Control (2)
Lecture—1 hour; discussion—1 hour. Prerequisite: courses 100 and 110, Entomology 100 or 110. The biology of insect-parasitic nematodes, their effect on the host, and their potential as biological control agents of insect and other invertebrate pests. Application of ecological theory in classical and augmentative biological control. Offered in alternate years.—(F. Jaffee)

206. Nematode Systematics and Evolution (2)
Lecture—1 hour; laboratory—3 hours. Prerequisite: course 100 or 110 or Entomology 156; Evolution and Ecology 100 recommended. Nematode diversity as revealed by morphological and molecular evidence. Laboratory experience focuses on structural features used in taxonomy. Phylogenetic relationships based on morphological and molecular data used to consider patterns of character change among taxa. Offered in alternate years.—(F. J. Nadler)

210. Molecular Phylogenetic Analysis (3)
Lecture—2 hours; laboratory—3 hours. Theory and practice of inferring phylogenetic trees using molecular sequence data. Practical techniques for obtaining sequence data, advantages and disadvantages of common approaches for inferring trees, statistical methods for comparing alternative hypotheses. (Same course as Evolution and Ecology 210.) Offered in alternate years.—(F. J. Nadler)

245. Field Nematology (1)
Fieldwork—6 days. Prerequisite: course 100. Six-day demonstration and field study in applied nematology including diagnosis and prediction of nematode field problem strategies for control field plot design, and establishment in association with diverse California crops. (S/U grading only.)—(F. Jaffee)

290. Seminar (1)
Seminar—1 hour. (S/U grading only.)—F, S. (F. Jaffee)

290C. Advanced Research Conference (1)
Discussion—1 hour. Prerequisite: graduate standing and consent of instructor. Planning and results of research programs, proposals, and experiments. Discussion and critical evaluation of original research being conducted by the group. Discussion led by individual research instructors for research group. (S/U grading only.)

298. Group Study (1-5)
(S/U grading only.)

299. Research (1-12)
(S/U grading only.)

Neurobiology, Physiology, and Behavior

(College of Biological Sciences)

W. Martin Usrey, Ph.D., Chairperson of the Department
Department Office. 196 Briggs Hall 530-752-0203; http://www.npb.ucdavis.edu

Faculty

Primary Department Members
Keith Baer, Ph.D., Associate Professor (Physiology & Membrane Biology)
Sue C. Bodine, Ph.D., Professor (Physiology & Membrane Biology)
Kenneth H. Britton, Ph.D., Professor
Rebecca M. Callis, Ph.D., Assistant Professor
Natalia Caporale, Ph.D., Lecturer with Potential for Security of Employment
Earl E. Carstens, Ph.D., Distinguished Professor (Anesthesiology & Pain Medicine)
Hwai-Jong Cheng, M.D., Ph.D., Professor (Pathology & Laboratory Medicine)
Stacey Cantos, Ph.D., Assistant Professor
Thomas P. Combs-Hahn, Ph.D., Professor
William DeBello, Ph.D., Associate Professor
Jochen Ditterich, Ph.D., Associate Professor
Daisynn Fieravante, Ph.D., Assistant Professor
Charles A. Fuller, Ph.D., Professor
John D. Furlow, Ph.D., Professor
Mark S. Goldman, Ph.D., Professor

(Phallopithylogy & Vision Science)
The Program. In the freshman and sophomore years, students majoring in Neurobiology, Physiology, and Behavior build a broad scientific background, taking courses in chemistry, biology, physics, and mathematics. As juniors or seniors, students can enroll in a variety of Neurobiology, Physiology, and Behavior courses and related upper division courses. The NPB major contains three tracks: the Neurobiology track, the Physiology track, and the Organism-Environmental Interactions track. If you wish to prepare to be successful in these tracks for yourself, please meet with your master adviser who can help you select courses and the individual course project guided by a member of the faculty.

Career Alternatives. Completion of the Neurobiology, Physiology, and Behavior major provides the foundation for advanced study leading to careers in high school teaching, college level teaching or research. It also serves as the basis for further training in the health professions, including but not limited to human and veterinary medicine, medical technology, physical therapy, pharmacy, nursing, dentistry and optometry. The major is also appropriate for those intending to seek careers in biotechnology and other biologically related industries.

B.S. Major Requirements:

**Preparatory Subject Matter**

<table>
<thead>
<tr>
<th>Course</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological Sciences 2A-2B-2C</td>
<td>15</td>
</tr>
<tr>
<td>Chemistry 2A-2B-2C</td>
<td>15</td>
</tr>
<tr>
<td>Chemistry 8A-BB or 118A-118B</td>
<td>15</td>
</tr>
<tr>
<td>Mathematics 17A-17B or 17C</td>
<td>1-12</td>
</tr>
<tr>
<td>Physics 7A-7B-7C</td>
<td>12</td>
</tr>
</tbody>
</table>

**Depth Subject Matter**

<table>
<thead>
<tr>
<th>Course</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurobiology, Physiology, and Behavior 101, 105 (or 102+103), 110</td>
<td>15</td>
</tr>
<tr>
<td>Neurobiology, Physiology, and Behavior 110A-110B-110C</td>
<td>15</td>
</tr>
<tr>
<td>Three units of laboratory course work from the following tracks below</td>
<td></td>
</tr>
<tr>
<td>Neurobiology track: Neurobiology, Physiology, and Behavior 124</td>
<td>1</td>
</tr>
<tr>
<td>Physiology track: Neurobiology, Physiology, and Behavior 101L</td>
<td></td>
</tr>
<tr>
<td>Organism-Environmental Interactions track: Neurobiology, Physiology, and Behavior 101L</td>
<td>1</td>
</tr>
<tr>
<td>Statistics 120</td>
<td>4</td>
</tr>
<tr>
<td>Additional Neurobiology, Physiology, and Behavior track-specific depth unit requirement</td>
<td></td>
</tr>
<tr>
<td>One of the following may be completed to reach the unit requirement:</td>
<td></td>
</tr>
<tr>
<td>Neurobiology track: Neurobiology, Physiology, and Behavior 124</td>
<td>1</td>
</tr>
<tr>
<td>Neurobiology, Physiology, and Behavior 124</td>
<td>1</td>
</tr>
<tr>
<td>Neurobiology, and Behavior 160/Neuroscience 160</td>
<td>1</td>
</tr>
<tr>
<td>Neurobiology, and Behavior 1000, 101L, 106, 107, 112, 161, 162, 163, 164, 165, 166, 167, 168, 169</td>
<td>1</td>
</tr>
<tr>
<td>Psychology 130, 135, 137</td>
<td>1</td>
</tr>
<tr>
<td>Physiology, and Science 123: Exercise Biology 106/Cell Biology and Human Anatomy 101</td>
<td>1</td>
</tr>
<tr>
<td>Exercise Biology 106/Cell Biology and Human Anatomy 101L</td>
<td>1</td>
</tr>
<tr>
<td>Exercise Biology 101, 103, 104, 110, 124, 126, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169</td>
<td>1</td>
</tr>
<tr>
<td>One of the following may be completed to reach the unit requirements:</td>
<td></td>
</tr>
<tr>
<td>Psychology 113, 121, 135, 137</td>
<td>1</td>
</tr>
<tr>
<td>Linguistics 175</td>
<td>1</td>
</tr>
<tr>
<td>Philosophy 103</td>
<td>1</td>
</tr>
<tr>
<td>Human Development 163</td>
<td>1</td>
</tr>
</tbody>
</table>

The following courses are crosslisted and either offering can be used to fulfill the course requirement: Neurobiology, Physiology, and Behavior 124/Neurobiology, Physiology, and Behavior 160/Neuroscience 160 | 1 |

**Total Units for Major** 100-115

Minor Program Requirements:

**Exercise Biology** 18

At least 15 upper division units in exercise biology from the following courses: Exercise Biology 101, 102, 103, 110, 111, 112, 113, 115, 117, 124, 126 | 15 |

Exercise Biology or other approved courses: | |
| An additional three upper division units from either the previous list of Exercise Biology courses OR the following courses: Exercise Biology 106; Neurobiology, Physiology, and Behavior 101; Biological Sciences, 101, 104, 105 | |

**Human Physiology**

**Neuroscience** 18

**Neurobiology, Physiology, and Behavior** 100 | 4 |

Choose a minimum of 14 units from the following: | |
| One of the following may be completed to reach the unit requirements: | |
| Psychology 113, 121, 135, 137 | 1 |
| Linguistics 175 | 1 |
| Philosophy 103 | 1 |
| Human Development 163 | 1 |

The following courses are crosslisted and either offering can be used to fulfill the course requirement: Neurobiology, Physiology, and Behavior 124/Neurobiology, Physiology, and Behavior 160/Neuroscience 160 | 1 |

**Master Adviser.** Dr. Hwai-Jong Cheng, M.D., Ph.D.

**Advising Center.** Biology Academic Success Center (BASC); 1023 Sciences Laboratory Building; 5307520410; http://basc.ucdavis.edu/
102. Introduction to Motor Learning and the Psychology of Sport and Exercise (4)
Lecture—4 hours. Prerequisite: Psychology 1 recommended. Theoretical and practical issues in motor learning, sport psychology, and exercise psychology. Emphasis on how motor skills are acquired and retained, and on the social psychology and human motivation studies to human performance. Only 2 units of credit allowed to students who have completed Exercise Science 104. Only 2 units of credit allowed to students who have completed Exercise Science 105. Not open for credit to students who have completed Exercise Science 104 and 105. (Former Exercise Science 104 and 105.) GE credit: SciEng | QL, S—S. (W.) Salitsky
103. Analysis and Control of Human Movement (4)
Lecture—4 hours. Prerequisite: Cell Biology and Human Anatomy 101 and 101L, Physics 7A and 7B. Neurobiology, Physiology, and Behavior 101 recommended. Introduction to functional anatomy, neurophysiological basis of motor control, and biomechanics of human movement. Human movement understood in the context of body structures, basic principles of physics, and functional characteristics of nerve and muscle. Only 1 unit of credit allowed to students who have completed Exercise Science 103. Only 3 units of credit allowed to students who have completed Exercise Science 104. Not open for credit to students who have completed Exercise Science 103 and 104. (Former Exercise Science 103 and 104.) GE credit: SciEng | QL, SE—S. (S.) Hawkin
104L. Exercise Biology Laboratory (3)
Lecture—3 hours; laboratory—1 hour; discussion—1 hour. Prerequisite: course 101, 102, 103 (the last course may be dropped). Principles and analytical procedures for assessing fundamental physiological, biomechanical, motor learning and motor control factors which underlie human movement and performance. Only 3 units of credit allowed to students who have completed Exercise Science 101L. Only 1 unit of credit allowed to students who have completed Exercise Science 103. Not open for credit to students who have completed Exercise Science 101 or 102. GE credit: SciEng | Writ | SE, WE—F, S. (F, S.) Shaffrath
106. Human Gross Anatomy (4)
Lecture—4 hours. Prerequisite: Biological Sciences 2A; concurrent enrollment in course 106L or Cell Biology and Human Anatomy 101 strongly recommended. Upper division students only; Pass One open to upper division Exercise Biology or Anthropology majors only; Pass Two open to seniors in any major; open enrollment at the start of the quarter for upper division students in any major. Detailed study of the gross anatomical structure of the human body, with emphasis on relevence to students entering health care professions. (Same course as Cell Biology and Human Anatomy 101.) GE credit: SciEng | SE—W. (W.) Gross
106L. Human Gross Anatomy Laboratory (3)
Laboratory—9 hours. Prerequisite: Biological Sciences 2A; must take course 106 or Cell Biology and Human Anatomy 101 concurrently (or have already completed). Undergraduate division students only; Pass One open to upper division Exercise Biology or Anthropology majors only; Pass Two open to Seniors in any major; open enrollment at the start of the quarter for upper division students. Mandatory attendance on first day of lab. Detailed study of protected cadaveric specimens in small group format with extensive hands-on experience. (Same course as Cell Biology and Human Anatomy 101L.) GE credit: SciEng | SE—W. (W.) Gross
110. Exercise Metabolism (3)
Lecture—3 hours. Prerequisite: course 101 or Neurobiology, Physiology and Behavior 101. Exercise metabolism, white matter and cardiac muscle metabolism during activity and inactivity. Basics of bioenergetics, substrate utilization, and cell signaling; mechanisms that regulate these properties, and differences between skeletal muscle and cardiac muscle metabolism. GE credit: SciEng | SE—W. (W.) Shaffrath
111. Environmental Effects on Physical Performance (3)
Lecture—2 hours; discussion/lab—3 hours. Prerequisite: courses 101 or consent of instructor. The effects of thermal, biochemical, and environmental conditions on physiological function and physical performance of humans. Acute and chronic effects, emphasizing physiological adaptations and limitations, will be studied. GE credit: SciEng | QL, SE—W. (W.) Shaffrath
112. Clinical Exercise Physiology (4)
Lecture—3 hours; laboratory/discussion—3 hours. Prerequisite: courses 101 or consent of instructor. Physical activity as a therapeutic modality in normal and diseased populations (cardiovascular, pulmonary, diabetic). Effects of exercise and inactivity in terms of normal physiology, pathophysiology, and therapeutic benefits. GE credit: SciEng | SE, SL—W. (W.) Shaffrath
115. Biomechanical Bases of Movement (3)
Lecture—2 hours; laboratory—3 hours to alternate weekly with discussion—1 hour. Prerequisite: course 103 or consent of instructor. Biomechanical bases of human movement investigated; topics include musculo-skeletal mechanics, tissue mechanics, electromyography, and measurement techniques. Application made to sport, clinical, and work environments, including extensive analysis of locomotion. GE credit: SciEng | QL, SE, VL, WE—F. (F.) Liets
116. Nutrition for Physically Active Persons (3)
Lecture—3 hours. Prerequisite: course 101, Neurobiology, Physiology, and Behavior 101. The role of nutrition and exercise in modifying metabolism, body composition, performance, and health of humans. Offered irregularly. GE credit: SciEng | SE
117. Exercise and Aging in Health and Disease (3)
Lecture—2 hours; discussion—1 hour. Prerequisite: course 101 or 113 (concurrently). Exercise and standard therapy for various diseases associated with aging (e.g., cardiovascular, pulmonary, and renal diseases, diabetes, obesity, lipemias, etc.). Exercise will then be considered as a protective and/or therapeutic modality. GE credit: SciEng | SE—S. (S.) Shaffrath
120. Sport in American Society (3)
Lecture—3 hours. Sociological approaches to the study of sport and sport participation in the United States, including sport interaction with politics, economics, religion, gender, race, media and ethics. Socialization factors involving youth, scholastic, collegiate, and Olympic sport. Social course as Physical Education 120.) GE credit: SocSci, Div | SS—F, S. (F.) Salitsky
121. Advanced Sport Psychology (3)
Lecture—3 hours. Prerequisite: course 102; Psychology 1 recommended. Advanced study and consideration of major theoretical and practical issues in sport psychology. Emphasis on practical application to sport and human performance. — Salitsky
122. Psychological Effects of Physical Activity (3)
Lecture—3 hours; practice—4 hours. Prerequisite: Psychology 1; upper division standing. Physical activity is evaluated in terms of its ability to enhance the quality of life. Topics studied include: individual factors (self concept, type A); special populations (elderly, cardiovascular); and mental health changes (depression, anxiety).—S. (S.) Salitsky
124. Physiology of Maximal Human Performance (4)
Lecture—3 hours; practice—4 hours. Prerequisite: course 101 or permission of instructor; Biological Sciences 101, 102, and 103 recommended. Molecular mechanisms underlying adaptation to training. Learn how to exercise to maximize their own performance as well as learning how the frequency, inten-
sity and timing of exercise and nutrition affect the molecular signals that underlie performance. GE credit: SciEng | SE.

125. Neuroanatomical and Behavioral Aspects of Motor Control (3)
Lecture—2 hours; lecture/discussion—2 hours. Prerequisite: course 101. Factors which affect control of movement from a neuromechanical, physiological, behavioral, and mechanical viewpoints. Topics include central vs. peripheral control mechanisms, open and closed loop theories, motor programming, cognition, and the effects of bio-chemical and biomechanical influences. Offered irregularly. GE credit: SciEng | SE.

126. Tissue Mechanics (3)
Lecture—2 hours; laboratory/discussion—3 hours. Prerequisite: course 103 or Engineering 45 or consent of instructor. Structural and mechanical properties of biological tissues including bone, cartilage, ligaments, tendons, nerves, and skeletal muscle. [SocSci=Domestic Diversity; SciEng=Engineering 129] GE credit: SciEng | QL, SE, SL, WE. —W. (W.) Hawkins

148. Theory and Practice of Exercise Testing (1)
Lecture/discussion—1 hour. Prerequisite: course 112 (may be taken concurrently). Theory and practice of exercise testing applied to older adult populations. Physiological responses to and limitations of exercise testing. Application of exercise testing and training to heart disease and diabetes populations. (P/NP grading only.) Offered irregularly. GE credit: SE. —Casazza

148L. Adult Fitness Testing Laboratory (1)
Laboratory—3 hours. Prerequisite: courses 148 (concurrently). Testing symptomatic and asymptomatic older adults for functional aerobic capacity, body composition, blood lipids, pulmonary function, and cardiovascular disease risk. Counseling adults in appropriate exercise programs and lifestyle modifications. Two quarters minimum; third quarter permitted. May be repeated twice for credit. [Former course Physical Education 148L] (P/NP grading only) GE credit: Irregularly. GE credit: Qi, SE. —Casa zza

179. Frontiers in Exercise Biology (3)
Lecture—2 hours; discussion—1 hour. Prerequisite: courses 101, 102 and 103 (may be taken concurrently); 104L recommended. Lectures by leading authorities and discussion of the latest research in newly emerging areas in exercise biology. Offered every fourth year. GE credit: SciEng | SE. —S.

189. International Perspectives in Exercise Biology (4)
Lecture—4 hours. Prerequisite: course 10 or upper division standing in Exercise Biology; consent of instructor: students will be accepted based upon academic merit, interest, and academic discipline in order to provide multidisciplinary perspectives. Restricted to 22 students. Compare and contrast exercise science issues between the US and an international location. Identifying and analyzing environmental, economic, cultural, technological and environmental issues that impact human exercise, physical activity, wellness, and sport from a global perspective. Offered irregularly.

190C. Research Conference (1)
Discussion—1 hour. Prerequisite: upper division standing in Exercise Biology or related biological science and consent of instructor; concurrent enrollment in course 199. Restricted to upper division students. Research findings and methods in exercise biology. Presentation and discussion of research by faculty and students. May be repeated for credit. (P/NP grading only) GE credit: SciEng | QL, SE, S. —W. (W.) Sutter

192. Exercise Biology Internship (1-12)
Internship—3-12 hours. Prerequisite: consent of instructor; enrollment dependent on availability of intern positions. Work experience in the application of physical activity programs to teaching, recreational, clinical, and educational programs. Offered only as an internship course for undergraduates. Written report required. May be repeated up to 15 units of credit, including course 92. (P/NP grading only) - F, W, S. (W.) Sutter

194H. Research Honors (2)
Independent study—6 hours. Prerequisite: senior standing, minimum of 6 units of course 199; 3.50 GPA or greater in major courses, consent of honors thesis adviser. Completion of individual honors research project in Exercise Biology, under the guidance of an Exercise Biology faculty advisor, culminating in written honors thesis. (P/NP grading only.) GE credit: SE. —F, W, S. (F, W, S.)

197T. Tutoring in Exercise Biology (1-5)
Tutorial—3-15 hours. Prerequisite: upper division standing and consent of instructor. Assisting the instructor by tutoring students in exercise biology course-related projects. May be repeated up to 10 units of credit including courses 97T. (P/NP grading only) —F, W, S. (F, W, S.)

197C. Tutoring Exercise Biology in the Community (1-5)
Tutorial—3-15 hours. Prerequisite: consent of instructor and chairperson. Tutoring in the community in exercise biology related projects under the guidance of the faculty. May be repeated up to 10 units of credit including courses 97T, 97TC and 97TCN. No tutorial units may be counted towards the Exercise Biology major. (P/NP grading only) —F, W, S. (F, W, S.)

198. Directed Group Study (1-5)
Prerequisite: consent of instructor and chairperson. (P/NP grading only) GE credit: SE. —F, W, S. (F, W, S.)

199. Special Study for Advanced Undergraduates (1-5)
Prerequisite: consent of instructor. (P/NP grading only) —F, W, S. (F, W, S.)

Courses in Neurobiology, Physiology, and Behavior (NPB)

10. Elementary Human Physiology (3)
Lecture—3 hours. Introduction to physiology for non-science majors. Includes basic cell physiology and survey of major organ systems and how they function in homeostasis and human health. Not open for credit to students who have completed course 101. GE credit: SciEng | SE. —W. (W.) Bautista

12. The Human Brain and Disease (3)
Lecture—3 hours. Normal function and diseases of the human brain and nervous system. Diseases discussed include Parkinson’s, Alzheimer’s, leprosy, amnesia and schizophrenia. Intended for non-science majors. Not open for credit to students who have completed courses 103, 112, or Psychology 121. GE credit: SciEng | QL, SE, SL. —W. (W.) Ditterich

15. The Biology and Physiology of Aging (4)
Lecture—3 hours; discussion—1 hour. Broad examination of age-associated changes in body functions. Includes basic cell physiology, a survey of major organ systems and the age-induced alterations in system function. Some age-associated diseases will also be examined. Not open for credit to students who have completed course 15V. GE credit: SciEng | QL, SE, SL. —W. (W.) Ditterich

17. The Path to Cyborgs: Introduction to Prostheses and Human Machine Interfaces (3)

68. Biology of Drug Addiction and Abuse (3)
Lecture—3 hours. Breadth examination of addictive substances and their use/abuse. Topics include historical perspective, physiological effects, etiology, neurobiology of addiction and the impact of drugs on contemporary society. Intended for non-science majors. Not open for credit to students who have completed course 168. GE credit: SciEng. —(S.) Bautista

90A. Lower Division Seminar: Issues in Body Weight Regulation (2)
Seminar—2 hours. Prerequisite: lower division standing, consent of instructor. Limited enrollment. Critical examination of issues in body weight regulation through shared readings, discussions, written assignments, debates and oral presentations.—C. Warden

90C. Current Issues in Animal Behavior (2)
Seminar—2 hours. Prerequisite: lower division standing. Not limited enrollment. Examination of current issues. Not open for credit to students who have completed course 101. GE credit: SciEng | QL, SE. —C. Warden

90D. Lower Division Seminar: Current Issues in Animal Behavior (2)
Seminar—2 hours. Prerequisite: lower division standing. Not limited enrollment. Examination of current issues. Not open for credit to students who have completed course 101. GE credit: SciEng | QL, SE. —C. Warden

90E. Biology of Aging (2)

90F. Visual Impairment and Blindness: A World Wide Problem (2)
Seminar—2 hours. Prerequisite: lower division standing. Examination of various abnormalities of the eye and the important geographic and cultural factors that influence the epidemiology of those abnormalities. Offered irregularly.

91C. Research Conference (1)
Discussion—1 hour. Prerequisite: lower division standing in Neurobiology, Physiology and Behavior or related biological science and consent of instructor; concurrent enrollment in course 99. Restricted to lower division students. Research findings and methods in neurobiology. Presentation and discussion of research by faculty and students. (P/NP grading only) —F, W, S. (F, W, S.)

92. Internship (1-12)
Internship—3-12 hours. Prerequisite: lower division standing; consent of instructor. Work experience off or on campus in all subject areas offered in the Department of Neurobiology, Physiology and Behavior. Internships supervised by a member of the faculty. May be repeated for credit. (P/NP grading only) —F, W, S. (F, W, S.)
98. Directed Group Study (1-5)
Prerequisite: lower division standing and consent of instructor. [P/NP grading only]—F, W, S. (F, W, S.)

99. Directed Study Undergraduates (1-5)
Prerequisite: lower division standing and consent of instructor. [P/NP grading only]—F, W, S. (F, W, S.)

Upper Division

100. Neurobiology (3)
Lecture—3 hours; discussion—1 hour. Prerequisite: Biological Sciences 1AB or 2ABC; Physics 9 ABC or 7ABC. Brains and nervous systems, neurons and neural circuits. Control of motion. Development of nervous systems. Vision, hearing, and feature extraction by the central nervous system. The cell biology of learning and memory. Not open for credit to students who have completed course 112, 160, 161 or 162, or Neuroscience 221 or 222. GE credit: QL—F, W, S. (F, W, S.)

100L. Neurobiology Laboratory (3)
Lecture—1 hour; laboratory—3 hours; extensive writing or discussion. Prerequisite: course 100 (may be taken concurrently). Experimental basis of neurobiology principles discussed in course 100. Topics include neurophysiology, sensory systems, motor systems, cellular neuroscience, cognitive neuroscience, and quantitative data analysis and modeling techniques. GE credit: SciEng | SE—S. (S.)

100Q. Quantitative Foundations of Neurobiology (1)
Autotutorial—1.5 hours; extensive problem solving—1.5 hours. Prerequisite: course 100 (may be taken concurrently). Computational methods and mathematical models used to study phenomena in neuroscience. Offered irregularly. GE credit: QL—V. (V.)

101. Systemic Physiology (5)
Lecture—5 hours. Prerequisite: Biological Sciences 1A, 1B, or 2A and Chemistry 28, Physics 1B or 7C; strong reading and writing skills. Systemic physiology with emphasis on aspects of human physiology. Functions of major organ systems, with the structure of those systems described as a basis for understanding the functions. GE credit: SciEng | SE—S. (S.)

101D. Systemic Physiology Discussion (1)
Discussion—1 hour. Prerequisite: course 101 (concurrently); consent of instructor. Discussion and problem solving related to fundamental principles of systemic physiology as presented in course 101. [P/NP grading only]—F, W, S. (F, W, S.)

101L. Systemic Physiology Laboratory (3)
Laboratory—3 hours; discussion—2 hours; term paper. Prerequisite: course 101. Selected experiments illustrating characteristics of organ systems discussed in course 101.——F, W, S. (F, W, S.)

102. Animal Behavior (3)
Lecture—3 hours. Prerequisite: Biological Sciences 1A, 1B, or 2A, 2B, 2C; Basic principles of behavioral organization in vertebrate and invertebrate animals. Underlying physiological and ethological mechanisms. The evolution of behavior, with special emphasis on behavior under natural conditions. Not open for credit to students who have completed course 155. [Former course 155.] GE credit: SL—F, S. (F. S.)

102Q. Quantitative Topics in Animal Behavior (1)
Autotutorial—1.5 hours; extensive problem solving—1.5 hours. Prerequisite: Mathematics 168; course 102 (may be taken concurrently). Study of the quantitative concepts and exemplar models used in animal behavior. Offered irregularly. GE credit: SciEng—Hahn

103. Cellular Physiology/Neurobiology (3)
Lecture—3 hours. Prerequisite: Biological Sciences 105 or 103 recommended, 105 prerequisite. GE credit: SciEng | SE—F, W, S. (F, S.)

104L. Cellular Physiology/Neurobiology Laboratory (4)
Lecture—1 hour; laboratory—3 hours; discussion—1 hour; term paper. Prerequisite: courses 101 and 101L; Biological Sciences 103 or 105. Experiments in the physical and chemical processes of cells and tissues. Offered irregularly. GE credit: Wrt—W. (W.)

105. Introduction to Computer Models (4)
Lecture—3 hours; lecture/laboratory—1 hour. Prerequisite: Mathematics 16C or the equivalent, Physics 7C, Chemistry 2C, and course 100 or 110. Introduction to the ideas, mathematical techniques, and computer tools required for developing models of cellular processes in physiology and neurobiology. Applications include membrane transport, ionic channels, action potentials, Ca2+ oscillations, respiration, and muscle contraction. Offered irregularly.

106. Experiments in Neurobiology, Physiology, and Behavior: Design and Execution (3)
Lab—7.5 hours; discussion—0.5 hours. Prerequisite: courses 102, 100, and 199 and consent of instructor. Design and execution of experiments in neurobiology, physiology, and/or behavior. Students choose and design a project in consultation with a senior faculty member. May be repeated one time for credit to complete the project, with consent of instructor. An additional repeat is permitted for a different project under the guidance of another faculty member. [P/NP grading only.] GE credit: OL, QL, VL, WE—F, W, S. (F, W, S.) Rosenquist

107. Cell Signaling in Health and Disease (3)
Lecture—3 hours. Prerequisite: Biological Sciences 102 or 105. Basics of cell signaling pathways, their disruption in disease, and their current utility and future potential as therapeutic targets. Focus is on signaling pathways specific to nervous, endocrine, and immune systems, and those fundamental to all cells. GE credit: SL—S. (S.)

110A. Foundations 1: From Molecules to Individuals (5)
Lecture—4 hours; discussion—1 hour. Prerequisite: Biological Sciences 2A, 2B and 2C, Chemistry 2A and 2B, Physics 7A, 7B, and 7C at least concurrent. Pass One restricted to majors in Neurobiology, Physiology and Behavior. Presentation of concepts in cell biology with special emphasis on connections between cell biology and behavior. Includes: cellular metabolism, cellular sensing and signaling, membrane structure-function, molecular switches, tissue and organ systems, and integrative examples. Credit limited to 3 units for students who have taken Biological Sciences 104. GE credit: SciEng | SE—F, W, S. (F, S.)

110B. Foundations 2: Neurobiology (5)
Lecture—4 hours; discussion—1 hour. Prerequisite: Physics 7C and course 110A completed with a grade of C- or above. Open only to declared NPB majors only. Core concepts of neurobiology including single-neuron biophysics, synapses and transmitters, neuronal development, motor systems, central pattern generation, neuronal circuits, intracellular signal transduction, sensory processing, multisensory integration, autonomic nervous system, neuromodulation, learning and memory, and higher cognition and disease. Credit limited to 2 units for students who have taken course 100. GE credit: SciEng | SE—F, W, S. (F, W.) Britten, Sutter

110C. Foundations 3: Physiology (5)
Lecture—4 hours; discussion—1 hour. Prerequisite: course 110B completed with a grade of C- or above. Open only to declared NPB majors only. Focuses on the structure, function, and interactions of animal organ systems in homeostasis and reproduction, and the response to perturbations of homeostasis; neural and endocrine signaling; skeletal muscle and movement; cardiovascular and respiratory systems; renal, digestive, immune, and reproductive systems. Credit limited to two units for students who have taken course 101. GE credit: SciEng | SE—W. (W.)

111C. Advanced System Physiology Laboratory (3)
Lecture—1 hour; laboratory—6 hours. Prerequisite: courses 101, 101L, Statistics 13; course 112, 113, or 114 recommended. Interfacing physiological recording equipment with computer and data acquisition and analysis using the microcomputer; data interpretation within the framework of physiological concepts. Offered irregularly. GE credit: QL, VL, WE

111L. Advanced System Physiology Laboratory (4)
Lecture—1 hour; discussion—2 hours; laboratory—6 hours; term paper. Prerequisite: courses 101 and 111L. Selected comprehensive experiments in the autonomic nervous system and the cardiovascular, respiratory, and neuromuscular systems. Emphasis on conceptual and methodological approaches in demonstrating the physiology of organ systems. GE credit: Wrt—W. (W.)

112. Neuroscience (3)
Lecture—3 hours. Prerequisite: course 100 or 101. Presentation of concepts in neuroscience including sensory systems, motor systems, and higher neural integration. Emphasis on mammalian nervous system. Offered irregularly. GE credit: SL

113. Cardiovascular, Respiratory, and Renal Physiology (4)
Lecture—4 hours. Prerequisite: course 101; Chemistry 88, Physics 76 and 7C recommended. An advanced and intense introduction to the concept of cardiovascular, respiratory, and renal physiology including discussion of acid-base balance.

114. Gastrointestinal Physiology (3)
Lecture—3 hours. Prerequisite: course 101; Biological Sciences 105 or 103 recommended, 105 preferred. Gastrointestinal anatomy and physiology. Digestion, secretion, absorption, motility, comparative physiology and pathology. Strong emphasis on neural and hormonal regulation and on cellular mechanisms of secretion and absorption. —F. (F.)

117. Avian Physiology (3)
Lecture—3 hours. Prerequisite: Biological Sciences 18, or 2A and 2B and Chemistry 28; course 101 strongly recommended. Physiology of the various systems and organs with emphasis on digestion, respiration, excretion, and endocrine systems. —S. (S.)

121. Physiology of Reproduction (4)
Lecture—4 hours. Prerequisite: course 101. Physiological mechanisms related to reproduction, including sperm motility and fertilization. Offered irregularly.

122. Developmental Endocrinology (3)
Lecture—3 hours. Prerequisite: course 101. Restricted to upper division standing. Hormonal control of development, mammalian and avian systems. Focus on the cellular and molecular mechanisms from the cellular to the organismal level, with emphasis on the effects of hormones on cell differentiation and gene expression. May be repeated one time for credit to complete the course.

123. Comparative Vertebrate Organology (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: Biological Science 1A and 1B or 2A and 2B. Functional anatomy of major organ systems in vertebrates. Each system examined from cellular to gross structure.
level in fish, birds, and mammals. Emphasis on how differentiated cell types are integrated into tissues and organs to perform physiological functions. (Same course as Anatomy, Physiology and Cell Biology 100.)—W. Ginnetra

124. Comparative Neuroanatomy (4)
Lecture—3 hours; laboratory—2 hours. Prerequisite: Psychology 101, or course 100 or 101. Overview of the neuroanatomy of the nervous system in a variety of mammalian and non-mammalian vertebrates. Examine changes or modifications to neural structures as a result of morphological or behavioral specializations. (Same course as Psychology 124.) GE credit: VL, WE. —W. (W.) Krubitzer, Recanzone

125. Comparative Physiology: Neurointegrative Mechanisms (3)
Lecture—3 hours. Prerequisite: course 101. Comparisons of physiological functions in the animal kingdom: neurointegrative mechanisms of integration, including aspects of phylogenetic development as both neuronal and systemic levels. Offered irregularly.

126. Comparative Physiology: Sensory Systems (3)
Lecture—3 hours. Prerequisite: course 100 or 101. Basic physiological mechanisms involved in sensory systems. Comparative approach to considerations of mechanosensitive systems (audition, lateral lines, touch, echolocation, equilibrium), chemosensitive systems (olfaction, taste, pheromones), photosensitive systems (vision, infrared detection, UV detection), electroreception, and pain. Emphasis on receptors. Offered irregularly.

127. Comparative Physiology: Circulation (3)
Lecture—3 hours. Prerequisite: course 101. Comparisons of physiological functions in the animal kingdom: circulation. Comparative approach to cardiovascular function in vertebrates and invertebrates. Offered irregularly. GE credit: VL, SL.

128. Comparative Physiology: Endocrinology (3)
Lecture—3 hours. Prerequisite: course 101. Comparison of physiological functions in the animal kingdom: animal hormones and their functions.—W. (W.)

130. Physiology of the Endocrine Glands (4)
Lecture—4 hours. Prerequisite: course 101. Advanced presentation of concepts in endocrinology with emphasis on the role of hormones in reproduction, metabolism, and disease. GE credit: VL. —F. (F.)

132. Nature vs. Nurture: Physiological Interactions Among Genes, Nutrients and Health (3)
Lecture—3 hours. Prerequisite: Biological Sciences 1A or 2A or consent of the instructor. Biochemical, physiological, psychological, and nutritional causes of important medical problems such as obesity, anorexia, heart disease and diabetes. One unit of credit allowed to students who have completed course 131. GE credit: SciEng. —F. (F.) Pinney, Warden

139. Frontiers in Physiology (3)
Lecture—2 hours; discussion—1 hour. Prerequisite: courses 100 and 101; 102 may be taken concurrently. Lectures by leading authorities and discussion of the latest research in newly emerging areas in physiology. Offered every fourth year. Offered irregularly. GE credit: SciEng | QL, GE.

140. Principles of Environmental Physiology (10)
Lecture—3 hours. Prerequisite: course 101; Biological Sciences 102 recommended. Physiological aspects of interactions of organisms and environmental conditions at organismal levels. Emphasis on regulatory responses/mechanisms to thermal, pressure, gravity and light environmental variables. Not open for credit to students who have completed course 148. [ Former course 148.] GE credit: VL.

141. Physiological Adaptation of Marine Organisms (3)
Lecture—2 hours; laboratory—3 hours. Prerequisite: upper division standing; consent of the instructor; residence at Bodega Marine Laboratory required. Students must submit application available at http://www.bml.ucdavis.edu/Physiological adaptation to the environment among various marine and estuarine habitats. GE credit: QL, VL, WE. —S. (S.) Cheng, Cheng.

141P. Physiological Adaptation of Marine Organisms Laboratory Topi (3)
Lecture—12 hours; discussion—1 hour. Prerequisite: course 141 concurrently; residence at Bodega Marine Laboratory required. Students must submit application available at http://www.bml.ucdavis.edu. Training in scientific research from hypothesis to publication, including methods of library research. Related to a topic covered in course 141. GE credit: VL, WE. —S. (S.) Cher.

142. Environmental Endocrinology: Mechanisms for Life Cycles (3)

150. Advanced Animal Behavior (4)
Lecture—3 hours; laboratory—3 hours. Prerequisite: course 102 or Psychology 101. Advanced integrative survey of biological principles of behavior organization, emphasizing historical roots, current research directions, conceptual issues and controversies. Laboratory exercises on the description and analysis of the behavior of captive and free-living animals. (Same course as Psychology 122.) Offered irregularly.—Hahn

152. Hormones and Behavior (3)
Lecture—3 hours. Prerequisite: course 101 or Psychology 101. Endocrine physiology with an emphasis on the principles of behavior. Fundamental relationships between hormones and various behaviors engaged in by the organism during its lifetime. Role of hormones in behavioral homeostasis, social behavior, reproductive behavior, parental behavior, adaptation to stress. (Same course as Psychology 123.) —S. (S.) Baies, Furlow, Horn, Hornack

159. Frontiers in Behavior (3)
Lecture—2 hours; discussion—1 hour. Prerequisite: courses 100, 101, 102. Lectures by leading authorities and discussion of the latest research in newly emerging areas in behavioral biology. Offered every fourth year. Offered irregularly. GE credit: SciEng | QL, GE.

160. Molecular and Cellular Neurobiology (3)
Lecture—1.5 hours; discussion—1.5 hours. Prerequisite: course 100, Biological Sciences 101 and consent of instructor. Selected topics in neurobiology. Topics include channel biophysics, action potential propagation, neurotransmitter extraction pathways, synaptic physiology and quantal analysis, cellular mechanisms of synaptic plasticity, and neuromodulation of synaptic circuitry. (Same course as Neuroscience 160.) Offered irregularly. GE credit: VL.

160L. Advanced Cellular Neurobiology Laboratory (4)
Laboratory—12 hours. Prerequisite: course 160, Physics 7C recommended. Students will learn to record neural activity, to interpret their recordings, and to label neurons with antibodies against neurotransmitters. Offered irregularly.

161. Developmental Neurobiology (3)
Lecture—3 hours. Prerequisite: course 100 or 101. Issues, theoretical concepts, and methodologies in developmental neurobiology. Topics include prenatal and postnatal differentiation of neurons, and plasticity in the mature and aging brain. Integration of neurochemical, structural, physiological and behavioral perspectives. GE credit: SciEng | WE. —W. (W.) McAllister, Zito

162. Neural Mechanisms of Behavior (3)
Lecture—3 hours. Prerequisite: course 100 or 101. The relationship between brain and behavior. Identification and analysis of pathways involved in cognitive processes and the conscious experiences that they involve. Examples of systems to be considered are bardsong, locomotion, echolocation.—S. (S.) Britten

163. Systems Neuroscience (3)
Lecture—3 hours. Prerequisite: course 100 or equivalent basic neuroscience training with consent of instructor. Concepts and techniques in systems neuroscience: e.g., measuring and manipulating neural activity, structure of neocortex, sensory processing, motor control, short-term and long-term storage of information, neural codes, neural mechanisms underlying cognitive functions. GE credit: QL. —S. (S.) Ditrich

164. Mammalian Vision (4)
Lecture—2 hours; discussion—1 hour. Prerequisite: course 101, 112, or Psychology 101. Structure and function of the mammalian visual system, from the formation of images on the retina through visually guided behaviors and perception. Emphasis on biological mechanisms underlying vision.—W. (W.) Britten, Werner

165. Neurobiology of Speech Perception (3)
Lecture—3 hours. Prerequisite: course 100 or 101, or consent of instructor. Introduction to an interdisciplinary approach to speech perception with emphasis on functional neuroanatomy and behavior. Topics include auditory processing in time and space, intelligibility in noisy environments, visual speech, and aspects of vocal communication, models of speech perception, development, and hearing impairment. GE credit: SL. —S. (S.) Miller

166. Math Tools for Neuroscience (4)
Lecture—4 hours. Prerequisite: course 100 or permission of instructor; Math 16A, B, or C equivalent; Physics 7C strongly recommended. Introduction to mathematics techniques used in neuroscience. Applications to neuroscience of differential equations, linear algebra, Fourier transforms, correlation and convolution, and probability theory. Offered irregularly. GE credit: QL. —Goldman

167. Computational Neuroscience (5)
Lecture—4 hours; lecture/laboratory—3 hours. Prerequisite: course 100 or permission of instructor; Math 17A, 17B, 17C, or equivalent; Physics 7A, B, C or equivalent strongly recommended; consent of instructor. Mathematical methods and computational techniques used to describe computations performed by nervous systems. Topics include single neuron biophysics, neural coding, network dynamics, memory, plasticity, and learning. Lectures include programming mathematical models and data analysis techniques in MATLAB. Offered irregularly. GE credit: SciEng | QL, GE. —Goldman

168. Neurobiology of Addictive Drugs (4)
Lecture—2 hours; discussion—1 hour. Prerequisite: course 100 or 101 or the equivalent. Neurobiological basis for the effects and mechanisms of action of drugs with addictive potential, including opiates (morphine, heroin, methadone), sedative-hypnotics, ethanol, nicotine, marijuana (cannabis), alcohol, caffeine, and mind-altering drugs such as LSD and anti-depressants. GE credit: SL, VL. —S. (S.) Lieb

169. Frontiers in Neurobiology (3)
Lecture—2 hours; discussion—1 hour. Prerequisite: courses 100 and 101. [ May be taken concurrently. ] Lectures by leading authorities and discussion of the latest research in newly emerging areas in neuroscience. Offered every fourth year. Offered irregularly. GE credit: QL. —Goldman

190C. Research Conference (1)
Discussion—1 hour. Prerequisite: upper division standing in Neurobiology, Physiology, and Behavior or related biological science courses and instructor consent. Concurrent enrollment in 199. Research findings and methods in neurobiology, physiology,
and/or behavior. Presentation and discussion of research by faculty and students. May be repeated for credit. (P/NP grading only)—F, W, S. (F, W, S.)

192. Internship (1-12)
Internship—3-36 hours. Prerequisite: completion of 84 units and consent of instructor. Work experience off and on campus in all subject areas offered in neuroscience, physiology, & behavior. May be repeated for credit. (P/NP grading only)—F, W, S. (F, W, S.)

194HA. Neurobiology, Physiology, and Behavior–Honors (1-4)
Laboratory—3–12 hours. Prerequisite: senior standing; minimum 3.500 GPA in courses counted toward major; approval by the Master Adviser. Honors project in Neurobiology, Physiology, and Behavior. Laboratory research on a specific question. The project is developed with the sponsoring faculty member and approved by the student’s Honors Thesis Committee. Honors thesis is to be submitted upon completion of the project. (P/NP grading only)—F, W, S. (F, W, S.)

194HB. Neurobiology, Physiology, and Behavior–Honors (1-4–2)
Laboratory—3–12 hours. Prerequisite: senior standing; minimum 3.500 GPA in courses counted toward major; approval by the Master Adviser. Honors project in Neurobiology, Physiology, and Behavior. Laboratory research on a specific question. The project is developed with the sponsoring faculty member and approved by the student’s Honors Thesis Committee. Honors thesis is to be submitted upon completion of the project. (P/NP grading only)—F, W, S. (F, W, S.)

197T. Tutoring in Neurobiology, Physiology, and Behavior (1-3)
Discussion—2–6 hours. Prerequisite: upper division standing and consent of instructor. Assisting the instructor by tutoring students in one of the Department’s regular courses. May be repeated for credit. (P/NP grading only)—F, W, S. (F, W, S.)

198. Directed Group Study (1-5)
(P/NP grading only)—F, W, S. (F, W, S.)

199. Special Study for Advanced Undergraduates (1-5)
(P/NP grading only)—F, W, S. (F, W, S.)

Graduate

211. Advanced Topics in Neuroimagining (2)
Seminar—2 hours. Prerequisite: Psychology 210 or consent of instructor. Restricted to 16 students. Theory and practical presentation and discussion of the most influential advanced issues in neuroimagining, emphasizing fMRI design/analysis and the integration of fMRI with electrophysiology (course as Neuroscience 211 and Psychology 211) may be repeated for credit. (S/U grading only)—W. (W.) Miller

212. Light and Fluorescence Microscopy (2)
Lecture—2 hours. Prerequisite: consent of instructor. Restricted to majors and graduate students. Theory and practical application of light and fluorescence microscopy in the biological sciences. (S/U grading only)—W. (W.) Zettler

217. Advanced Avian Physiology (1)
Project—1 hour. Prerequisite: graduate standing and concurrent enrollment in course 117; consent of instructor. Study in depth of a topic in avian physiology through development of a lecture with associated instructional materials such as lesson plans, readings, presentation, and evaluation aids. —S. (S.) Millan

221. Cellular Neuroscience (4)
Lecture—3 hours; discussion—1.5 hours. Advanced course on cellular and subcellular organization of the nervous system. Membrane channels, sensory transduction, synaptic transmission and cellular aspects of development and learning. —F. (F.) Burns, McAllister, Trimmer, Zito

222. Systems Neuroscience (5)
Lecture—4 hours; discussion—1 hour. Prerequisite: graduate standing or consent of instructor. Integrative and information-processing aspects of nervous system organization. Topics include sensory systems, motor function, sensorimotor integration, the limbic system, and the neurobiology of learning and memory. (Same course as Neuroscience 222.)—W. (W.) Debello, Ditterich, Usrey

245. Computational Models of Cellular Signaling (3)
Lecture—3 hours. Prerequisite: consent of instructor. Computational and mathematical techniques in modeling of regulatory and signaling phenomena in neurobiology and cell physiology, focusing on linear and nonlinear ordinary differential equation models. Applications include ion channel kinetics, electrical activity, signal transduction, calcium oscillations, and simple neural circuits. Offered irregularly.

247. Topics in Functional Neurogenomics (2)
Lecture—1 hour; discussion—1 hour. Prerequisite: graduate standing or consent of instructor. The theory, methods and principles of functional neurogenomics with emphasis on the relationship to molecular mechanisms involved in development and disease of the nervous system. (Same course as Neuroscience 247.)

261A. Topics in Vision: Eyes and Retinal Mechanisms (2)
Lecture/discussion—2 hours. Prerequisite: graduate standing, course 100 or 112 or the equivalent. Structure and function of the visual system, with emphasis on the eye and retina, including optics, anatomy, transduction, retinal synapses, adaptation, and parallel processing. (Same course as Neuroscience 261A and Molecular, Cellular, and Integrative Physiology 261A.)—F. (F.) Iida

261B. Topics in Vision: Systems, Psychophysics, Computational Models (2)
Lecture/discussion—2 hours. Prerequisite: consent of instructor, course 117 recommended. Functions of the central visual pathways and their underlying mechanisms. Recent research on aspects of anatomy, biochemistry, electrophysiology, psychophysics, development, and genetics of the visual system. (Same course as Neuroscience 261A and Molecular, Cellular, and Integrative Physiology 261B.)—S. U. grading only.)—W. (W.) Britten

261C. Topics in Vision: Clinical Vision Science (2)
Lecture/discussion—2 hours. Prerequisite: courses 261A and 261B or consent of instructor. Causes and mechanisms of major blinding diseases. Recent research on aspects of anatomy, biochemistry, electrophysiology, psychophysics, development, and genetics of the visual system related to disease. (Same course as Neuroscience 261C and Molecular, Cellular, and Integrative Physiology 261C.)—S. U. grading only.)

263. Modeling in Systems Neuroscience (4)
Lecture—3 hours; lecture/laboratory—1 hour. Prerequisite: consent of instructor. Modeling as a tool in systems neuroscience. Mathematical techniques will be introduced and used to explore advanced topics in echolocation, auditory localization, electroreception, and motor systems. Other topics include transforms, modeling assumptions, scales and linearity. Offered in alternate years.

267. Computational Neuroscience (5)
Lecture—4 hours; lecture/laboratory—3 hours. Prerequisite: one course in general neuroscience at the level of course 100; one year college-level Calculus at level of Math 16A, B, C; one year Physics at the level of Physics 7A, B, C, strongly recommended; students from other departments should contact the instructor. Mathematical models and data analysis techniques used to describe computations performed by nervous systems. Lectures include single-neuron biophysics, neural coding, network dynamics, memory, plasticity, and learning. Lab topics include programming mathematical models and data analysis techniques in MATLAB. Offered in alternate years. (Same course as Neuroscience 267.)—F. (F.) Goldman

270. How to Write a Fundable Grant Proposal in the Biomedical Sciences (2)
Lecture/discussion—2 hours. Prerequisite: consent of instructor. Restricted to members of the Neuroscience and BMCD graduate groups; graduate students in other biomedical programs may enroll with instructor permission. Teaches the do’s and don’ts of writing grants in the biomedical sciences and the mechanisms of the review process. Offered in alternate years. May be repeated for credit. (S/U grading only.)—W. (W.) Burns

285. Literature in Visual Neuroscience (2)
Seminar—2 hours. Literature in Visual Neuroscience. (Same course as Neuroscience 285.)—W. (W.) Britten, Ditterich, Goldman, Usrey

287A. Topics in Theoretical Neuroscience (2)
Seminar—2 hours. Prerequisite: consent of instructor. In-depth exploration of topics in theoretical neuroscience. Topic varies each year. Fall quarter (287A): foundational material from books and review articles. Spring quarter (287B): continuation of year’s topic through readings of seminal articles from the primary literature. Offered in alternate years. May be repeated for credit. (Same course as Neuroscience 287A.) (S/U grading only.)—F. (F.) Ditterich, Goldman

287B. Topics in Theoretical Neuroscience (2)
Seminar—2 hours. Prerequisite: consent of instructor. In-depth exploration of topics in theoretical neuroscience. Topic varies each year. Fall quarter (287A): foundational material from books and review articles. Spring quarter (287B): continuation of year’s topic through readings of seminal articles from the primary literature. May be repeated for credit. (Same course as Neuroscience 287B.) (S/U grading only.)—S. (S.) Ditterich, Goldman

291. Auditory Neuroscience (1)
Seminar—0.5 hours; discussion—0.5 hours. Prerequisite: course 100 or 112 or Neuroscience 222 or the equivalent. Exploration of various important aspects of auditory physiology, behavior and psychophysics through review of original literature. New topic each quarter. May be repeated for credit. (S/U grading only) —F, W, S. (F, W, S.) Recanzone, S."