Plant Biotechnology Option .................................. 38-45
Microbiology 101, Molecular and Cellular Biology 126, Plant Sciences 152, Biotechnology 160, 161A, 161B, Biochemistry, Biological Sciences 105; or Biological Sciences 180L, Biological Sciences 183 following areas:
Select at least one course from each of the following areas:
(a) Pests, Pathogens and Production: Biological Sciences 181, 183, Biotechnology 150, 188, Chemistry 130A, 130B, Engineering: Computer Science 124, 129, Entomology 110, Evolution and Ecology 100, Microbiology 115, 126, Molecular and Cellular Biology 120L, 164, 182, NematoLOGY 100 or 110, Plant Pathology 120, 123, 130, 140, Plant Biology 143, Plants Sciences 153, 154, 172, 174.
Animal Biotechnology Option ............................. 37-45
Microbiology 101, Animal Genetics 111, Neurobiology, Physiology, and Behavior 101, Molecular and Cellular Biology 150 or 163, 182, Animal Science 170, Biochemistry, Biological Sciences 105; or Biological Sciences 102 and 103; or Animal Biology 102 and 103_________________ 27-35
Selected Electives ________________________________ 10
Select at least one course from each of the following areas:
(a) Animal Cell Biology/Microbiology/Immunology: Biological Sciences 183, Biotechnology 150, 161A, 161B, 188, Evolution and Ecology 100, Medical Microbiology 188, Microbiology 115, 126, 162, Molecular and Cellular Biology 120L, 160L, Pathology 115, Molecular and Microbiology, and Immunology 126, 126L, 127, 128, Molecular, Cellular, and Integrative Physiology 200L, Neurobiology, Physiology and Behavior 132, Plant Pathology 140
(b) Animal Reproduction and Breeding: Animal Genetics 107 and Animal Science 131, 140, Avian Sciences 121, 140, Topics Sciences 181, Evolution and Ecology 102, Molecular and Cellular Biology 164, Neurobiology, Physiology, and Behavior 121, 121L, Plant Pathology 140
Bioinformatics Option ...................................... 38-45
Biological Sciences 180L, Biological Sciences 181 or 183, Microbiology 101, Engineering: Computer Science 20, 30, Engineering: Computer Science 124, 129, Molecular and Cellular Biology 182, Biochemistry: Biological Sciences 105; or Biological Sciences 102 and 103; or Animal Biology 102 and 103_________________ 33-38
Restricted Electives ______________________________ 7
Total Units for the Major ................................. 110-135
Major Advisers: J. I. Yoder (Plant Sciences) in 101 Asmundson Hall
Advising Center for the major is located in 1220 Plant and Environmental Sciences 530.752.1715.
Courses in Biotechnology (BIT) Courses in Biotechnology (BIT) are listed below; courses in Biotechnology, Design Emphasis (NEB) follow, see Courses in Biotechnology; Design Emphasis, Fall 2017.
Lower Division
192. Internship in Biotechnology (1-12) Internship—3-36 hours. Prerequisite: consent of instructor. Work experience on or off campus in a subject area pertaining to biotechnology or in a business, industry or agency associated with biotechnology. Internship supervised by faculty member in the animal or plant sciences. (P/NP grading only.)
99. Special Study for Undergraduates (1-5) Prerequisite: consent of instructor. (P/NP grading only.)
Upper Division
150. Applied Bioinformatics (4) Lecture—2 hours, laboratory/discussion—2 hours. Prerequisite: Computer Science Engineering 10 or 15 or Plant Science 21; Biological Sciences 101 and 104; Plant Science 120 or Statistics 13 or Statistics 100. Limited enrollment. Concepts and programs needed to apply bioinformatics in biotechnology research. Sequence analysis and annotation and use of plant and animal databases for students in biological and agricultural sciences. Two units of credit for students who have completed Computer Science Engineering 124. GE credit: SciEng | SE, VL—Runcie.
160. Principles of Plant Biotechnology (3) Lecture—3 hours. Prerequisite: Biological Sciences 1A or 2A; Biological Sciences 101 or Plant Sciences 152. Principles and concepts of plant biotechnology including recombinant DNA technology, molecular biology, genomics, cell and tissue culture, gene transfer and crop improvement strategies using transgenic crops. Not open for credit to students who have completed Plant Biology 160. (Former course Plant Biology 160) GE credit: SciEng | SE. —W. (W.) Dandekar
161A. Genetics and Biotechnology Laboratory (6) Lecture—3 hours, laboratory—9 hours. Prerequisite: Plant Sciences 152 or Biological Sciences 101; consent of instructor. Techniques of genetic analysis at the molecular level including recombinant DNA, gene mapping and basic computational biology. Not open for credit to students who have completed Plant Biology 161A. GE credit: SciEng | SE. —W. (W.) Beckles
161B. Plant Genetics and Biotechnology Laboratory (4) Lecture—1 hours, laboratory—8 hours. Prerequisite: Plant Sciences 152 or Biological Sciences 101; consent of instructor. Advanced techniques of genetic analysis at the molecular and cellular levels, including transformation, genetic analysis, and manipulation of transgenic plants. Not open for credit to students who have taken Plant Biology 161B. (Former course Plant Biology 161B) GE credit: SciEng | SE, SL. —S. (S.) Bennett, Slumwald
171. Professionalism and Ethics in Genomics and Biotechnology (3) Lecture—1 hour, discussion—3 hours. Prerequisite: upper division standing in a natural science major. Real and hypothetical case studies to illustrate ethical issues in genomics and biotechnology. Training and practice in difficult ethical situations and evaluating personal and social consequences. GE credit: SciEng | SE, SL, WE. —F, W, S. (F, W, S.) Bennett, Bradford, Yoder
188. Undergraduate Research Proposal (3) Lecture/discussion—3 hours. Prerequisite: upper division standing. Preparation and review of a scientific proposal. Problem definition, identification of objectives, literature survey, hypothesis generation, design of experiments, data analysis planning, proposal outline and preparation. (Same course as Plant Sciences 188.) GE credit: SciEng, Wtr | OL, SE, WE. —S. (S.) Kliebenstein
189L. Laboratory Research in Genomics and Biotechnology (1-2) Laboratory—3-12 hours; discussion—1 hour. Prerequisite: course 188 and consent of instructor. Formulating experimental approaches to current questions in biotechnology; performance of proposed experiments. May be repeated for credit up to 12 units. (P/NP grading only.)
192. Internship in Biotechnology (1-12) Internship—3-36 hours. Prerequisite: consent of instructor. Work experience on or off campus in a subject area pertaining to biotechnology or in a business, industry or agency associated with biotechnology. Internship supervised by faculty member in the animal or plant sciences. (P/NP grading only.)
194H. Honors Thesis in Biotechnology (1-2) Independent Study—3-6 hours. Prerequisite: senior standing in Biotechnology with 3.250 GPA or higher and completion of courses 188 and 189L. Independent study of selected topics under the direction of a member or members of the staff. Completion will involve the writing of a senior thesis. (Deferred grading only, pending completion of sequence) | P/NP grading only | GE credit: SciEng | SE, WE. —F, W, S. (F, W, S.) Bennett, Slumwald
199. Special Study for Advanced Undergraduates (1-5) Prerequisite: consent of instructor. (P/NP grading only)
Courses in Biotechnology; Design Emphasis (NEB) Graduate
263. Biotechnology Fundamentals and Application (2) Lecture—2 hours. Prerequisite: Biological Sciences 101, 102 and Microbiology 102 or consent of instructor; must be a graduate student in good standing. Fundamentals of molecular biology and chemical engineering involved in recombinant DNA technology. Topics: principles and rates of processes of biological systems, optimization of bioreactors, and issues related to overexpression and production of recombinant molecules. Participation in student-directed team projects. —W. (W.) McDonald, Privalsky, Rodriguez, VanderGheynst

Bodega Marine Laboratory Program
http://bml.ucdavis.edu/
See also Biological Sciences, Bodega Marine Laboratory Program, on page 92.
In 2014, the new multi-college B.S. in Marine and Coastal Science (MCS) major started and the MCS field requirement can be fulfilled by any of the courses below.
Spring Quarter Program
A full quarter (15 units) of undergraduate course work in marine biology is available each spring quarter at the Bodega Marine Laboratory, located in Bodega Bay, California. Course offerings include lecture and laboratory instruction in the developmental biology and physiological adaptation of marine organisms, and population biology and ecology; a weekly colloquium; and an intensive individual research experience under the direction of laboratory faculty (Biological Sciences courses 122, 122P, 123; Neurobiology, Physiology, and Behavior 141, 141P). This is a 15 unit program and course offerings and instructors may vary from year to year. Applications are due January 31.

For more course detail, see full description under appropriate academic department listing or http://bml.ucdavis.edu/.

Summer Session Courses
This integrated program offers students a multidisciplinary understanding of coastal ecosystems through intensive, hands on lab and field courses taught at Bodega Marine Laboratory. Applications are due April 15.

For more course detail, see full description under appropriate academic department listing or http://bml.ucdavis.edu/.

Course offerings and instructors may vary from year to year.

Bodega Marine Laboratory spring and summer programs are residential, with students housed on the laboratory grounds. Participants are assigned a room and board fee in addition to standard campus registration fees. Applications and consent of instructors are required.

Additional information is available from the Biology Academic Success Center, in 1023 Sciences Laboratory Building, or directly from: Bodega Marine Laboratory P.O. Box 247 Bodega Bay, CA 94923 707-875-2211; http://bml.ucdavis.edu/.

Botany
See Plant Biology, on page 509; and Plant Biology (A Graduate Group), on page 511.

Business Management
See Managerial Economics, on page 415, for undergraduate study; and Management, Graduate School of, on page 410.

Cantonese
See Asian American Studies, on page 182.

Cell Biology
See Molecular and Cellular Biology, on page 463.

Cell and Developmental Biology (A Graduate Group)
The Cell and Developmental Biology program has merged with the Biochemistry and Molecular Biology program to form Biochemistry, Molecular, Cellular, and Developmental Biology (BMCDB); see Biochemistry, Molecular, Cellular and Developmental Biology, on page 189.

Group Office. 227B life Sciences 530-752-9091; http://bio3c.ucdavis.edu/GradGroups/BMCDB/

Cell Biology and Human Anatomy
See Medicine, School of, on page 427.

Chemistry
(On College of Letters and Science)
Department Administration. For a complete list of department administration, see http://chemistry.ucdavis.edu/homepage/department_administration.html

Department Office.
Department of Chemistry Building 530-752-8900; Fax 530-752-8995; http://chemistry.ucdavis.edu/

Faculty
James Ames, Ph.D., Professor
Shota Atsumi, Ph.D., Associate Professor
Matthew P. Augustine, Ph.D., Professor
Alan L. Baich, Ph.D., Professor
Enoch Baldwin, Ph.D., Associate Professor
Peter Beal, Ph.D., Professor
Louise A. Berben, Ph.D., Associate Professor
R. David Brit, Ph.D., Professor
William Casey, Ph.D., Professor
Julia Chamberlain, Ph.D., Lecturer PSEO
Xi Chen, Ph.D., Professor
Kyle Crabtree, Ph.D., Assistant Professor
Stephen Cramer, Ph.D., Professor
Shelia David, Ph.D., Professor
Davide Donadio, Ph.D., Assistant Professor
Andrew J. Fisher, Ph.D., Professor
Annaliese K. Franz, Ph.D., Associate Professor
Jacquelyn Gervay Haque, Ph.D., Professor
David Goodin, Ph.D., Professor
Ozcan Gulacor, Ph.D., Lecturer PSEO
Ting Guo, Ph.D., Professor
Susan M. Kaulzarich, Ph.D., Professor
Distinguished Graduate Mentoring Award
Peters B. Kelly, Ph.D., Professor
Kfir Kavir, Ph.D., Assistant Professor
Mark J. Kurth, Ph.D., Professor
Donald P. Land, Ph.D., Professor
Determ Larsen, Ph.D., Assistant Professor
Carlin B. Lebrilla, Ph.D., Professor
Gangyu Liu, Ph.D., Professor
C. William McCurdy, Ph.D., Professor
Mark Mascial, Ph.D., Professor
Alexandra Novotny, Ph.D., Professor
Cheuk-Yiu Ng, Ph.D., Professor
David Olson, Ph.D., Assistant Professor
Frank Ostervall, Ph.D., Professor
Philip P. Power, FRS, Ph.D., Professor
Neil E. Schore, Ph.D., Professor
Academic Senate Distinguished Teaching Award
Jared T. Shaw, Ph.D., Professor
Justin Siegel, Ph.D., Assistant Professor
Alexei P. Stuchebekhov, Ph.D., Professor
Dean Tantillo, Ph.D., Professor
Academic Senate Distinguished Teaching Award

Michael Toney, Ph.D., Professor
Lee-Ping Wang, Ph.D., Assistant Professor

Emeriti Faculty
Thomas L. Allen, Ph.D., Professor Emeritus
W. Ronald Fawcett, Ph.D., Professor Emeritus
William H. Fink, Ph.D., Professor Emeritus
Edwin Friedrich, Ph.D., Professor Emeritus
Hokon Hope, Cand. ReaL, Professor Emeritus
William M. Jackson, Ph.D., Professor Emeritus
Gerd N. LaMar, Ph.D., Professor Emeritus
Claude F. Meares, Ph.D., Professor Emeritus
W. Kenneth Musker, Ph.D., Professor Emeritus
Martin Olmstead, Ph.D., Professor Emeritus
Krishnan P. Nambiar, Ph.D., Professor Emeritus
Distinguished Graduate Mentoring Award
Carl W. Schmid, Ph.D., Professor Emeritus
James H. Swinehart, Ph.D., Professor Emeritus
Dino S. Tinti, Ph.D., Professor Emeritus
Nancy S. True, Ph.D., Professor Emeritus
George S. Zweifel, Sc.D., Professor Emeritus

Affiliated Faculty
Toby Allen, Ph.D., Associate Professor
Giulia Galli, Ph.D., Adjunct Professor

The Major Programs
Chemistry studies the composition of matter, its structure, and the means by which it is converted from one form to another.

The Program. The Department of Chemistry offers several degree programs leading to the Bachelor of Arts and the Bachelor of Science. The curriculum leading to the B.A. degree offers a substantive program in chemistry while allowing students the freedom to take more courses in other disciplines and pursue a broad liberal arts education. Students who have a deeper interest in chemistry normally elect one of the several programs leading to the B.S. degree. The standard B.S. program, the only chemistry program accredited by the American Chemical Society, is appropriate for students who are interested in chemistry as a profession. The B.S. in Chemical Physics, the B.S. in Pharmaceutical Chemistry, and the two B.S. Applied Chemistry emphases are slightly less intense in chemistry, and draw on significant course materials from areas relevant to their particular focus but outside of a classical chemistry degree. Students following the A.B or one of the B.S. programs may consider taking advantage of the Education Abroad Program. Our major advisor can assist students in planning a curriculum while abroad that assures regular progress in the major. A minor program in chemistry is also available.

Career Alternatives. Chemistry graduates with bachelor’s degrees are employed extensively throughout the various industries in quality control research and development, production supervision, technical marketing, and other areas. The types of industries employing these graduates include chemical, energy, pharmaceutical, genetic engineering, biotechnology, food and beverage, petroleum and petrochemical, paper and textile, electronics and computer, and environmental and regulatory agencies. The bachelor’s programs also provide chemistry graduates with the rigorous preparation needed for an advanced degree in chemistry and various professional schools in the health sciences.

Chemistry
A.B. Major Requirements: ........................ UNITS
Preparatory Subject Matter ................. 36-42
Chemistry 2A-2B-2C or 2AIH-2BH-2CIH .......... 15
Physics 7A-7B-7C or 9A-9B-9C ........... 12-15
Mathematics 1A-1B-1C or 17A-17B-17C or 21A-21B-21C .... 9-12
Depth Subject Matter .................... 43
At least 11 additional upper division units in chemistry (except Chemistry 107A or 107B) or related areas, including one course with

Fall 2011 and on Revised General Education (GE) AI=Arts and Humanities; SE=Science and Engineering; SS=Social Sciences;
AGCH=American Cultures; DD=Diverse; OI=Other; OL=Other Languages; SL=Social Sciences; FL=Foreign; WC=World Cultures; WE=Writing Experience
Pre-Fall 2011 General Education (GE): Arthum=Arts and Humanities; SciEng=Science and Engineering; SocSci=Social Sciences; Div=Domestic Diversity; Wrt=Writing Experience
Quarter Offered: F=Fall, W=Winter, S=Spring, Su=Summer; 2017-2018 offering in parentheses