Biology and Agricultural Engineering

299. Research (1-12)  
Prerequisite: consent of instructor. (S/U grading only.)—F, W, S (F, W, S.)

Biological and Agricultural Engineering

[College of Agricultural and Environmental Sciences and College of Engineering]

Bryan M. Jenkins, Ph.D., Chair of the Department  
Department Office.  
2030 Bainer Hall, 530-752-0102;  
http://bae.engineering.ucdavis.edu

Faculty

Gail M. Bornhorst, Ph.D., Assistant Professor  
Juliana de Moura Bell, Ph.D., Assistant Professor  
(Food Science and Technology)  
Irwin Donis-Gonzales, Ph.D., Assistant Extension Specialist  
Zhihong (Julia) Fan, Ph.D., Associate Professor  
Farid A. Fathallah, Ph.D., Professor  
D. Ken Giles, Ph.D., Professor  
Mark E. Grismer, Ph.D., Professor  
(land and Air Resources)  
Bryan M. Jenkins, Ph.D., Professor  
Tina Jeoh, Ph.D., Associate Professor  
Michael J. McCarthy, Ph.D., Professor  
(Food Science and Technology)  
Nitin N. Patil, Ph.D., Associate Professor  
(Food Science and Technology)  
Ning Pan, Ph.D., Professor  
(Textures and Clothing)  
David C. Slaughter, Ph.D., Professor  
Shrinivasan K. Upadhyay, Ph.D., Professor  
Jean S. Vandenheuvel, Ph.D., Professor  
Stavros Vougioukas, Ph.D., Assistant Professor  
Ruihong Zhang, Ph.D., Professor

Emeriti Faculty

William J. Chancellor, Ph.D., Professor Emeritus  
Picthaw (Paul) Chen, Ph.D., Professor Emeritus  
Michael J. Delwiche, Ph.D., Professor Emeritus  
Roger E. Garrett, Ph.D., Professor Emeritus  
John R. Goss, M.S., Professor Emeritus  
Bruce R. Harbaugh, Ph.D., Professor Emeritus  
David J. Hiles, Ph.D., Professor Emeritus  
John M. Krochta, Ph.D., Professor Emeritus  
Miguel A. Marititio, Ph.D., Professor Emeritus  
Kathryn McCarthy, Ph.D., Professor Emeritus  
R. Larry Merson, Ph.D., Professor Emeritus  
John A. Miles, Ph.D., Professor Emeritus  
Stanton R. Morrison, Ph.D., Professor Emeritus  
Raul H. Pimentel, Ph.D., Professor Emeritus  
Richard E. Plant, Ph.D., Professor Emeritus  
James W. Rumsey, M.S., Senior Lecturer Emeritus  
Thomas R. Rumsey, Ph.D., Professor Emeritus  
Verne H. Scott, Ph.D., Professor Emeritus  
R. Paul Singh, Ph.D., Distinguished Professor Emeritus  
James F. Thompson, M.S., Extension Specialist Emeritus  
Wesley W. Wallender, Ph.D., Professor Emeritus  
Wesley E. Yates, M.S., Professor Emeritus

Affiliated Faculty

Tien-Chieh Hung, Ph.D., Assistant Adjunct Professor  
Kurt Kornbluh, Ph.D., Assistant Adjunct Professor  
Zhangli Pan, Ph.D., Adjunct Professor  
Herbert Schonewald, Ph.D. Researcher  
Mir I. Shafii, Ph.D., Lecturer

Major Programs and Graduate Study.  
For the Bachelor of Science program, see the major in  
Engineering: Biological and Agricultural, on page 562,  
for graduate study, see also Graduate Studies, on page 570.

Minor Programs.  
The Department of Biological and Agricultural Engineering offers two minors through the College of Agricultural and Environmental Sciences: Geographic Information Systems and Precision Agriculture.

The minor in Geographic Information Systems is open to all majors, including those in engineering. This minor is for students interested in information processing of spatial data related to remote sensing for geographical and environmental planning and related areas.

The minor in Precision Agriculture is open to all majors, including those in engineering, and acquires students with recent developments and their applications to agriculture, in geographic information systems, global positioning systems, and variable rate technologies.

The Department of Biological and Agricultural Engineering administers three minors through the College of Engineering in Energy Science and Technology, Energy Efficiency, and Energy Policy. Courses. Courses are listed under Applied Biological Systems Technology, and Engineering: Biological and Agricultural (Biological Systems Engineering).

Biological Sciences

[College of Biological Sciences]

Biology Academic Success Center (BASC), 1023 Sciences laboratory Building, 530-752-0410;  
http://basc.ucdavis.edu

Faculty

The Biological Science major and the Bodega Marine Laboratory Spring Quarter Program are offered jointly by the departments of the college. The faculty in the college are members of the Departments of Evolution and Ecology; Microbiology; Molecular and Cellular Biology; Neurobiology, Physiology, and Behavior; Plant Biology. See each department for a list of their faculty.

The Biological Sciences Major

Departments of Evolution and Ecology, Microbiology and Molecular Genetics; Molecular and Cellular Biology; Neurobiology, Physiology, and Behavior; and Plant Biology

The Program. The Biological Sciences major is broad in concept, spanning the numerous core disciplines of biology. The Bachelor of Science (B.S.) and Bachelor of Arts (B.A.) programs include preparatory work in mathematics, general and organic chemistry, physics, and introductory level biology, as well as upper division courses that emphasize the breadth of biological sciences. Students in the B.S. degree program complete additional upper division coursework, for which they can choose classes from a variety of different areas such as molecular biology and genetics, animal behavior, plant growth and development, bioinformatics, marine biology, forensics, and microbiology. Students in the Bachelor of Arts (B.A.) program can pursue upper division coursework outside of the biological sciences. Research and internships are encouraged in both programs.

Career Alternatives. Both degree programs prepare students for admission to graduate schools or professional schools, leading to either a variety of professional health careers or further study in basic and applied areas of biology. They provide suitable preparation for careers in teaching, biological and biotechnological research with various governmental agencies or private companies, government regulatory agencies, environmental consulting, biological illustration and writing, pharmaceutical sales, biological/environmental law, and biomedical engineering.

A.B. Major Requirements:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Mathematics 17A-17B or 21A-21B</td>
<td>8</td>
</tr>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Physics 1A-1B or 7A-7B-C</td>
<td>6-12</td>
</tr>
<tr>
<td>(Recommended: Chemistry 2C and Math 17C or 21C)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Depth Subject Matter..........................28-36

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Biological Sciences 101</td>
<td>4</td>
</tr>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Biological Sciences 105</td>
<td>4</td>
</tr>
<tr>
<td>(or 102 + 103)</td>
<td>3-6</td>
<td></td>
</tr>
<tr>
<td>Statistics 100</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Evolution and Ecology 100</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Select one course from each topic.  
* Ecology: Environmental Science and Policy  
* Microbiology: Food Science and Technology  
* Neurobiology: Physiology and Behavior  
* Animal Physiology, Behavior or Development: Biological Sciences 104, Molecular and Cellular Biology 150, Neurobiology, Physiology and Behavior 101, 102, 141, 116**  
* Plant Physiology or Development: Plant Biology 105**  
* 111, 112, 113, 116**  
* 3-5 |

Laboratory Requirement

Select course(s) for a minimum total of 6 hours/week of laboratory or field work from the list of courses below.

** PB 105 or PB 116 may fulfill the topic area and laboratory requirement.  
Courses with 3 hours lab or field work/week (select two): Evolution and Ecology 110, 117, 119, 140, 180A, 180B; Exercise Biology 104L, 115L; Microbiology 103L; Neurobiology, Physiology and Behavior 101, 101L, 121, 125, Plant Biology 117, 119, other courses with approval of the master adviser.

Courses with 6 hours lab or field work/week (select one): Biological Sciences 180L; Evolution and Ecology 105, 106, 108, 112L, 114; Exercise Biology 106L, Food Science and Technology 104L, Microbiology 104L, 105L; Molecular and Cellular Biology 120L, 140L, 160L, Neurobiology, Physiology and Behavior 111L, 141L; Plant Biology 102, 106**, 116**, 148, other courses with approval of the master adviser.

Total Units for the Major ..................73-93

B.S. Major Requirements:

UNITS

Preparatory Subject Matter....................56-66

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Biological Sciences 2A-2B-2C</td>
<td>15</td>
</tr>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Chemistry 2A-2B-2C</td>
<td>15</td>
</tr>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Chemistry 6A-6B-6C</td>
<td>30</td>
</tr>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Statistics 100</td>
<td>4</td>
</tr>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Biological Sciences 104, 105, 111, 112B-118A-118B-118C</td>
<td>6-12</td>
</tr>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Mathematics 17A-17B-17C or 21A-21B</td>
<td>(21C recommended)</td>
</tr>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Physics 7A-7B-C</td>
<td>12</td>
</tr>
</tbody>
</table>

Depth Subject Matter..........................42-51

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Genetics: Biological Sciences 101</td>
<td>4</td>
</tr>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Biochemistry: Biological Sciences 105</td>
<td>4</td>
</tr>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Cell Biology: Biological Sciences 104</td>
<td>3</td>
</tr>
<tr>
<td>1  7 Co r2 1 C )</td>
<td>Statistics 100</td>
<td>4</td>
</tr>
</tbody>
</table>
| (Select one course from each topic)  
* Evolution: Ecology and Evolution  
* Microbiology: Microbiology 202, 104, 162, 170; Food Science and Technology  
* Animal Physiology, Behavior or Development: Neurobiology, Physiology and Behavior 101, 102, 141, Molecular and Cellular Biology 150; Plant Biology 105**; 111, 112, 113, 116**  
* Plant Physiology or Development: Plant Biology 104L, 115L, 116**  
| 1  7 Co r2 1 C ) | 3-5 |

Laboratory Requirement

Select course(s) for a minimum total of 6 hours/week of laboratory or field work from the list of courses below.
Approved Upper Division Restricted Electives

Total Units for the Major .......................... 98-117
Restricted Electives................................ 11

Select at least 3 or more courses for a minimum of 11 units from the list of Approved Upper Division Restrictive Electives and/or laboratory courses.

Students may choose any combination of approved courses that align with their academic or career objectives, or choose from a list of approved courses listed on the BASC website at http://basc.ucdavis.edu/

Up to 3 of the 11 units may be fulfilled by approved seminar or research courses.

Total Units for the Major ................. 98-117

Approved Upper Division Restricted Electives:

Animal Genetics ANG 105, 107
Animal Sciences ANS 104, 119, 123, 131, 142, 170
Anthropology ANT 151, 152, 153, 154A, 154B, 157
Anatomy, Physiology, and Cell Biology APC 101
Avian Sciences AVS 100, 150
Biomedical Engineering BIM 117, 140
Biological Sciences BIS all upper division courses

Biotechnology BIT 150, 160, 161A, 161B, 171
Cell Biology and Human Anatomy CHA 101


Computer Engineering: Computer Science ECS 124

Education EDU 100, 181

Environmental Horticulture ENH 102, 105

Entomology ENT all upper division courses

Environmental and Policy ESP 110, 116N, 121, 123, 124, 130A, 130B, 150C, 151, 151L, 155

Environmental Toxicology ETX 101, 102B, 103A, 104

Evolution and Ecology EVE all upper division courses

Exercise Science EXB 101, 103, 106, 106L, 110, 111, 124

Food Science and Technology FST 102A, 103A, 104

Geology GEO 107, 1071, 108, 116N, 141, 141L, 144, 150A, 150B, 150C

Mathematics MAT 124

Molecular and Cellular Biology MCB all upper division courses

Microbiology MIC all upper division courses

Medical Microbiology MMB 188

Neurobiology, Physiology, and Behavior NPB all upper division courses

Philosophy PHI 108

Plant Biology PLB all upper division courses

Pathology, Microbiology, and Immunology PMI 126, 126L, 128

Psychology PSC 121, 122, 123, 124

Sociology SOC 154

Soil Science SSSC 111

Science and Technology Studies STS 108, 129, 130A, 131, 164, 180

University Writing Program UWP 102B, 104L, 111C, 112A

Wildlife, Fish, and Conservation Biology WFC 100, 101, 110, 110L, 111, 120, 120L, 121, 122, 130, 134, 134L, 136, 140, 141, 151, 154, 157

*** Courses numbered 198 do not fulfill restricted elective units without adviser approval. Does not include courses that no is noted with a “D” that do not fulfill restricted elective units. Only 3 units of approved seminar or research courses can be applied to the restrictive electives.

Approved Seminar/Research Courses


Minor Program Requirements:

Biological Sciences ................................ 18

Complete at least three units from each of the five numbered groups to total at least 18 units. Appropriate alternative courses may be used with approval of an adviser.

1. Cell and Molecular Biology: Biological Sciences 101, 103, 105


3. Microbiology: Microbiology 101, 102, 102D, Pathology, Microbiology, and Immunology 128, Plant Biology/Plant Pathology 148, 148L, 149, 158, 168, 173, 173-176


Additional courses (if necessary) from above numbered groups to reach 18 units.

Advisers and Advising.

Information on the Biological Sciences 100 minor can be obtained at the Biology Academic Success Center (BASC) in 1023 Sciences Laboratory Building, or directly from Biological Sciences Advisers and Advising.

Fall 2011 and on Revised General Education (GE): AH=Arts and Humanities; SE=Science and Engineering; SS=Social Sciences; ACCH=American Cultures; DD=Diversity; OL=Oral Skills; QL=Quantitative; VL=Visual; WC=World Cultures; WE=Writing Experience

Pre-Fall 2011 General Education (GE): AthHum=Arts and Humanities; ScEng=Science and Engineering; SocSci=Social Sciences; Div=Diversity; Wrt=Writing Experience

Quarter Offered: F,Spring, S,Summer; 2017 offering in parentheses

 Citation for Outstanding Performance. The College of Biological Sciences awards Citations for Outstanding Performance on undergraduates majoring in Biological Sciences who have demonstrated superior academic performance and individual achievement in their research. Students who wish to be considered for a citation must first meet or exceed a specified grade point average and participate in an appropriate research project.

Teaching Credential Subject Representative. Associate Director of Teacher Education (School of Education); see the Teaching Credential/M.A. Program on page 124.

Bodega Marine Laboratory Program

See also Biological Sciences, Bodega Marine Laboratory Program, on page 197.

Courses in Biological Sciences (BIS)

Lower Division

2A. Introduction to Biology: Essentials of Life on Earth (5)

Lecture—3 hours; discussion—2 hours. Essentials of life including sources and use of energy, information storage, responsibilities to natural selection and cellular, origin of life and influence of living things on the chemistry of the Earth. Not open for credit to students who have completed course 1A with a grade of C- or better. GE credit: SciEng | SE—F, W, S; Su; (F, W, S, Su)

2B. Introduction to Biology: Principles of Ecology and Evolution (5)

Lecture—3 hours; discussion—1 hour; laboratory—3 hours. Prerequisite: grade of C- in course 1A or 2A. Introduction to basic principles of ecology and evolutionary biology, focusing on the fundamental mechanisms that generate and maintain biological diversity across scales ranging from molecules and genes to global processes and patterns. Not open for credit to students who have completed Biological Sciences 18 with a grade of C or better. GE credit: SciEng | GL, SE, SL, VL—F, W, S; Su; (F, W, S, Su)

2C. Introduction to Biology: Biodiversity and the Tree of Life (5)

Lecture—4 hours; laboratory—3 hours. Prerequisite: course 1B or 2B completed with a C- or better. Introduction to organisms living by the phylogenetic tree of life as an organizing theme. Lectures and laboratories cover methods of phylogenetic reconstruction, current knowledge of the tree of life, and the evolution of life’s most important and interesting innovations. Not open for credit to students who have completed course 1C with a grade of C- or better. GE credit: SciEng | GL, SE, SL, VL—F, W, S; Su; (F, W, S, Su)

5. Exploring Biological Sciences (1)

Seminar—1 hour. Prerequisite: consent of instructor. Enrollment limited to first year CBS students. Introduction to biology at UC Davis through discussions with faculty and speakers from both and medicine. (P/NP grading only)—F, W, S, Su; (F, W, S, Su)

10. Everyday Biology (4)

Lecture—3 hours; discussion—1 hour. Everyday biological concepts using contemporary readings for non-scientists. Key topics include: personal genomics; food and health; climate and evolution; brain and the law. Innovative projects apply bio-
11. Basic Life Sciences Laboratory (1) Lecture—4 hours. Prerequisite: enrollment limited to BUSP students; consent of instructor required. Basic laboratory skills in science research, including microbiology, molecular biology, and genetics. —Su. (Su.)

20Q. Modeling in Biology (2) Lecture—1 hour; discussion—1 hour. Prerequisite: Mathematics 168 [may be taken concurrently]. Introduction to the application of quantitative methods to biological problems. Students will use computer software package to tackle problems drawn from all aspects of biology. Offered irregularly. —Mogilner, Sutter

92. Internship in Biological Sciences (1-12) Internship—3 hours. Prerequisite: lower division standing; consent of instructor. Restricted to lower division standing. [P/NP grading only.]

98. Directed Group Study (1-5) Laboratory—6 hours. Prerequisite: enrollment limited to BUSP students; consent of instructor required. The range of subjects and approaches in the field of biology, including both basic and applied research topics. —F, W, S, Su. (F, W, S, J.)

101. Genes and Gene Expression (4) Lecture—4 hours. Prerequisite: course 2A and 2B, Chemistry 8A or 118A or 128A, Statistics 100 or 13 or 102 or 130A (Statistics 100 preferred). Nucleic acid structure and function; gene expression and its regulation; replication; transcription; translation; transmission genetics; molecular evolution. GE credit: SciEng | SE, SL, VL, WE. —F, W, S, Su. (F, W, S, Su.) Callis, Fiene, Hilt, Theg

102. Structure and Function of Biomolecules (3) Lecture—3 hours. Prerequisite: course 1A or 2A; Chemistry 8B or 118B or 128B. Structure and function of macromolecules with emphasis on proteins, catalysis, enzyme kinetics, lipids, membranes, and proteins as machines. Only one unit of credit for students who have completed Animal Biology 102 & 1 or 102 & 130A (Statistics 100 preferred). GE credit: SciEng | QL, SL, VL, WE. —F, W, Su. (F, W, Su.) Cheng, Gasser, Hilt, Leal, Montlare

103. Bioinformatics and Metabolism (3) Lecture—3 hours. Prerequisite: course 1A or 2A. Fundamentals of the carbon, nitrogen, and sulfur cycles in nature, including key reactions of biomolecules such as carbohydrates, amino acids, lipids, and nucleotides, and of extracellular products that are synthesized by different types of organisms. Principles of metabolic regulation. 1.5 units of credit for student who has completed course 103; 1 unit of credit for students who have completed Animal Biology 103. GE credit: SciEng | SE. —F, W, Su. (F, W, Su.) Callis, Fiene, Hilt, Theg

104. Cell Biology (3) Lecture—3 hours. Prerequisite: course 101; 102 or 105. Membrane receptors and signal transduction; cell trafficking; cell cycle; cell growth and division; extracellular matrix and cell-cell junctions; cell development; immune system. GE credit: SciEng | SE. —F, W, S, Su. (F, W, S, J.) Carrasco, Dinesh-Kumar, S. Lin, B. Liu, McNally, Privalsky, Starr, Xu

105. Biomolecules and Metabolism (3) Lecture—3 hours. Prerequisite: courses 1A, 1B, 1C, or 1A, 2A, 2B, and 2C; Chemistry 8B or 118B or 128B. Fundamentals of biochemical processes, with emphasis on protein structure and activity; energy metabolism; amino acids, amino acids, and lipids; gluconeogenesis. One and one half units of credit for students who have completed course 102 or 103; no credit for students who have completed both courses. GE credit: SciEng | SE, VL. —F, W, S, Su. (F, W, S, Su.) Callis, Fiene, Hilt, Theg

122. Population Biology and Ecology (3) Lecture—2 hours; laboratory—3 hours. Prerequisite: courses 1A, 1B, 1C, or 2A, 2B, 2C; residence at Bodega Marine Laboratory required. Biological and physical processes affecting plant and animal populations in the rich array of habitats at the Bodega Marine Laboratory ecological preserve. Emphasis on field experience, with complementing lectures to address population and community processes. See Bodega Marine Laboratory Program. GE credit: SciEng | QL, QL, SE, SL, VL, WE. —F, S. (J.) Morgan

122P. Population Biology and Ecology/Advances in Laboratory Practice (5) Laboratory—12 hours; discussion—1 hour. Prerequisite: course 122 concurrently. Residence at Bodega Marine Laboratory required. Training in scientific research, from hypothesis testing to publication, including methods of library research. Research related to topic covered in course 122. Final presentation both oral and written. See Bodega Marine Laboratory Program. GE credit: SciEng | SE, VL, WE. —S. (J.) Morgan

123. Undergraduate Colloquium in Marine Science (1) Seminar—1 hour. Prerequisite: enrolled student at Bodega Marine Laboratory for week of seminar recognized by authorities in various disciplines of marine science from within and outside the UC system. Includes informal discussion with speakers. Class will be held at Bodega Marine Laboratory. [P/NP grading only.] (See above description for Bodega Marine Laboratory Program.) —S. (J.) Cherr, Morgan

124. Coastal Marine Research (3) Laboratory—4–6 hours; laboratory/administrative—1 hour. Prerequisite: upper division standing or consent of instructor; concurrent enrollment in at least one course from Environmental Science Policy and Practice 124, 152, Evolution and Ecology 106, 110, 114, residence at or near Bodega Marine Lab required. Students must complete the application at http://www.bml.ucsd.edu. Independent research projects under the supervision of the accompanying core Bodega Marine Laboratory summer course. Students will select one instructor to be primary mentor, but integrative topics that draw on the expertise of several BML faculty members will be encouraged. May be repeated two times for credit. GE credit: SciEng | QL, QL, SE, SL, VL. —Su. (Su.) Hill, Gaylord, Largent, Finder

132. Introduction to Dynamic Models in Modern Biology (3) Lecture—3 hours; laboratory—2 hours. Prerequisite: Mathematics 16C, Statistics 13, one lower division course in biology, or the equivalents. Dynamic modeling in the biological sciences, including matrix models, difference equations, differential equations, and complex dynamics. Examples include classical models in ecology, cell biology, and neuroscience. Emphasis on understanding models, their assumptions, and implications for modern biology. GE credit: SciEng | QL, QL, SE, SL, VL. —Grosberg

140. Internship in Biological Sciences (1-12) Internship—3 hours. Prerequisite: course 101 and one course from Molecular and Cellular Biology 121 or Plant Biology 113, Mathematics 16ABC or 17ABC, or consent of instructor. Applying systems theory to understand the properties of biological networks in a variety of model organisms. Emphasis on research in local and genome-wide biological circuits, and genome-scale biological networks. Topics include network motifs, robustness, modeling, emergent properties and integration of networks. GE credit: SciEng | QL, QL, SE, WE. —S. (J.) Brady, Dawson, Dinesh-Kumar, Harada, Karofsky, Maloof, May*

180L. Genomics Laboratory (5) Lecture—2 hours; laboratory—6 hours; discussion—1 hour. Prerequisite: course 181; course 183 (may be taken concurrently); Molecular and Cellular Biology 102 or 105 recommended. Computer programming experience not required. GE credit: SciEng | QL, QL, SE, SL, VL. —F, W, S, Su. (F, W, S, Su.) Dawson, Dinesh-Kumar, Harada, Karofsky, Maloof, May*

181. Comparative Genomics (3) Lecture—3 hours. Prerequisite: course 101. Comparison of genomes at the population and species level. Genomic techniques for mapping disease (and other) genes, reconstruction of evolutionary history and migration patterns, determination of gene function, prediction of organizational traits, and metageomics: determination of community composition and functionality. GE credit: SciEng | QL, SL, VL. —S. (J.) Brady, Dawson, Maloof

183. Functional Genomics (3) Lecture—3 hours. Prerequisite: course 101; course 102 or 105 recommended. Overview of genomic microarray technologies and biological findings obtained using genome-wide analyses. RNA profiling, small RNAs, epigenomics, chromatin immunoprecipitation, protein-DNA interactions, proteomics and network analysis, and comparative genomics. Computer programming experience not required. GE credit: SciEng | QL, QL, SE. —F. (F.) Dawson, Maloof

194. Research Honors (2) Independent study—6 hours. Prerequisite: senior standing. Students majoring in Biological Sciences who have completed two quarters (3-5 units per quarter) of 199 and who qualify for the honors program as defined by the current catalog. Opportunity for Biological Sciences majors to pursue intensive research culminating in the writing of a senior thesis with the guidance of faculty advisors. [P/NP grading only] GE credit: SE, WE.
Biomedical Engineering (A Graduate Group)

J. Kent Leach, Ph.D., Chairperson of the Group
530-754-9149

Graduate

Biomedical Engineering (A Graduate Group)

J. Kent Leach, Ph.D., Chairperson of the Group
530-754-9149

Group Office. 2316 Genome and Biomedical Sciences Facility 530-752-2611; http://bme.ucdavis.edu/graduate/

Faculty

Biomedical Engineering

Biomedical Engineering (A Graduate Group)

Blaine Christiansen, Ph.D., Assistant Professor (Orthopaedic Surgery, Medicine)
Calleen Clancy, Ph.D., Assistant Professor (Pharmacology)

Cristina Davis, Ph.D., Professor (Mechanical and Aerospace Engineering)

Sonja Dietrich, Ph.D., Associate Professor (Radiation Oncology)

Yong Duan, Ph.D., Professor (Biomedical Engineering)

Marc T. Faccioi, Ph.D., Assistant Professor (Biomedical Engineering)

Fadi A. Fathallah, Ph.D., Professor (Biological and Agricultural Engineering)

Katherine W. Ferrara, Ph.D., Professor (Biomedical Engineering)

David Fryhire, Ph.D., Professor (Orthopaedic Surgery, Medicine, Biomedical Engineering)

Jeffery C. Gibling, Ph.D., Professor (Chemical Engineering and Materials Science)

Mark Goldman, Ph.D., Professor (Neurobiology, Physiology, and Behavior)

Frederic Gorin, Ph.D., Professor (Neurology)

Eleonora Grandi, Ph.D., Assistant Professor (Pharmacology)

Dominik R. Haedenschild, Ph.D., Associate Professor (Orthopaedic Surgery)

David A. Hawkins, Ph.D., Professor (Neurobiology, Physiology, and Behavior)

Volkmair Heinrich, Ph.D., Associate Professor (Biomedical Engineering)

Johannes W. Hell, Ph.D., Professor (Pharmacology)

Stephen Howell, M.D., Adjunct Professor (Biomedical Engineering)

Thomas Huwer, Ph.D., Adjunct Professor (Internal Medicine)

Sanjay Joshi, Ph.D., Associate Professor (Mechanical and Aerospace Engineering)

Thomas Jue, Ph.D., Professor (Biological Chemistry)

Patrice Koehl, Ph.D., Associate Professor (Computer Science)

Gerald J. Kost, Ph.D., M.D., Professor (Pathology)

Tonya L. Kuhl, Ph.D., Professor (Chemical Engineering and Materials Science, Biomedical Engineering)

Kit S. Lam, Ph.D., Professor (Biochemistry & Molecular Medicine)

J. Kent Leach, Ph.D., Professor (Biomedical Engineering, Orthopaedic Surgery)

Jamil Lewis, Ph.D., Assistant Professor (Biomedical Engineering)

Angelique Louie, Ph.D., Professor (Biomedical Engineering)

Laura Marco, Ph.D., Professor (Biomedical Engineering, Neurological Surgery)

Dennis L. Matthews, Ph.D., Professor (Neurological Surgery)

Alexandra Marquard, Ph.D., Professor (Mathematics)

Christopher J. Murphy, D.V.M., Ph.D., Professor (Surgical & Radiological Sciences)

Nitin Nitin, Ph.D., Associate Professor (Food Science and Technology, Biological and Agricultural Engineering)

Jan Nolta, Ph.D., Professor (Internal Medicine)

Tingrui Pan, Ph.D., Associate Professor (Biomedical Engineering)

Atul Parikh, Ph.D., Professor (Biomedical Engineering, Chemical Engineering and Materials Science)

Anthony G. Parisi, Ph.D., Associate Professor (Biomedical Engineering)

Jinyi Qi, Ph.D., Professor (Biomedical Engineering)

Bahram Ravani, Ph.D., Professor (Mechanical and Aerospace Engineering)

A. Hari Reddi, Ph.D., Professor (Orthopaedic Surgery, Medicine)

Alexender Revzin, Ph.D., Professor (Biomedical Engineering)

Crystal M. Ripplinger, Ph.D., Assistant Professor (Pharmacology)

David Rocke, Ph.D., Distinguished Professor (Biomedical Engineering, Public Health Sciences)

Leonar Saiz, Ph.D., Associate Professor (Biomedical Engineering)

Nesrin Sarigul-Klijn, Ph.D., Professor (Mechanical and Aerospace Engineering)

Michael A. Savageau, Ph.D., Distinguished Professor (Biomedical Engineering)

J. Anthony Seibert, Ph.D., Professor (Diagnostic Radiology)

Erkin Seker, Ph.D., Assistant Professor (Electrical and Computer Engineering)

Eduardo Silver, Ph.D., Assistant Professor (Biomedical Engineering)

Scott L. Simon, Ph.D., Professor (Biomedical Engineering)

Vivek J. Srivastava, Ph.D., Assistant Professor (Biomedical Engineering)

Susan M. Stover, D.V.M., Ph.D., Professor (Anatomy, Physiology and Cell Biology)

Julie Suckliffe, Ph.D., Associate Professor (Biomedical Engineering, Medicine: Hematology and Oncology)

Ilias Tagkopoulos, Ph.D.,Assistant Professor (Computer Science, Genome Center)

Yoshikazu Takada, M.D., Professor (Dermatology)

Cheemeng Tan, Ph.D., Assistant Professor (Biomedical Engineering)

Alice Tarantal, Ph.D., Professor (Pediatrics, Cell Biology and Human Anatomy, Medicine)

Sebastian Wachsmann-Hogiu, Ph.D., Associate Professor (Pathology and Laboratory Medicine)

John Werner, Ph.D., Professor (Ophthalmology)

Jeffrey Walton, Ph.D., Associate Research Physicist (NMR Facility)

Saichiro Yamada, Ph.D., Assistant Professor (Biomedical Engineering)

Tokihiro Yamamoto, Ph.D., Assistant Professor (Radiation Oncology)

Emeriti Faculty

Maury L. Hull, Ph.D., Distinguished Professor Emeritus (Mechanical and Aerospace Engineering, Biomedical Engineering)

Graduate Study. The Graduate Group in Biomedical Engineering offers programs of study and research leading to the M.S. and Ph.D. degrees. The programs of study prepare students for professional work in the effective integration of engineering with medical and biological sciences. Research strengths lie in the areas of imaging, tissue engineering and regenerative medicine, sensor and MEMs systems, cellular and molecular mechanics, computational modeling, targeted therapeutics, orthopedic biomechanics, biofluids and transport, and human movement. This broad interdepartmental program is best suited for students who are capable of and comfortable with considerable independence. Each student, together with an adviser, defines a specific course of study suited to individual goals.

Preparation. The Group regards strong competence in mathematics and engineering as necessary for successful completion of study. Prior course work in these areas is emphasized in the evaluation of applications. Some undergraduate training can be acquired after admission to the Group, but it may require an additional year of study.

Courses. See Engineering: Biomedical, on page 271.

Biophysics (A Graduate Group)

John Voss, Ph.D., Chairperson of the Group
530-752-3963

Group Office. 310 Life Sciences;

Faculty

Biophysics (A Graduate Group)

Jawad Al-Bassam, Ph.D., Assistant Professor (Molecular and Cellular Biology)

James B. Ames, Ph.D., Associate Professor (Chemistry)

Enoch Baldwin, Ph.D., Associate Professor (Molecular and Cellular Biology)

R. David Brit, Ph.D., Professor (Chemistry)

Tsung-Yu Chen, Ph.D., Professor (Neurology)