Professional Course

BIEN 302. Teaching Practicum (1-4) Practicum, 3-12 hours. Prerequisite(s): graduate standing; appointment as a teaching assistant or associate in Bioengineering. Provides supervised teaching in undergraduate courses. Graded Satisfactory (S) or No Credit (NC). Course is repeatable.

Bioengineering Interdepartmental Graduate Program

Jerome S. Schultz, Ph.D., Director
Department Office, A231 Bourns Hall
(951) 827-2111; jssbio@engr.ucr.edu

Participating Faculty

Distinguished Professors
Robert C. Haddon, Ph.D. (Chemistry)
Dallas Rabenstein, Ph.D. (Chemistry)
Natalia Raikhe, Ph.D. (Botany & Plant Sciences)
Jerome Schultz, Ph.D. (Bioengineering)

Professors
Michael E. Adams, Ph.D. (Cell Biology & Neuroscience/Entomology)
Bahrman Anvari, Ph.D. (Bioengineering)
G. John Andersen, Ph.D. (Psychology)
Bir Bhanu, Ph.D. (Electrical Engineering)
David Bocian, Ph.D. (Chemistry)
Wilfred Chen, Ph.D. (Chemical & Environmental Engineering)
Sarjeet Gill, Ph.D. (Cell Biology & Neuroscience)
Tao Jiang, Ph.D. (Computer Science)
David Johnson, Ph.D. (Biomedical Sciences)
Cynthia K. Larive, Ph.D. (Chemistry)
Elizabeth Lord, Ph.D. (Botany & Plant Sciences)
Manuela Martins-Green, Ph.D. (Cell Biology & Neuroscience)
Umar Mohideen, Ph.D. (Physics & Astronomy)
Dimitrios Morikis, Ph.D. (Bioengineering)
Thomas H. Morton, Ph.D. (Chemistry)
Ashok Mulchandani, Ph.D. (Chemical & Environmental Engineering)
Eugene Nothnagel, Ph.D. (Botany & Plant Sciences)
Victor G. J. Rodgers, D.Sc. (Bioengineering)
John Shyy, Ph.D. (Biomedical Sciences)
Harry W. K. Tom, Ph.D. (Physics & Astronomy)
Kambiz Vafa, Ph.D. (Mechanical Engineering)
Yushan Yan, Ph.D. (Chemical & Environmental Engineering)

Professor Emeritus
Richard A. Luben, Ph.D. (Biochemistry & Biomedical Sciences)

Associate Professors
Guillermo Aguilar, Ph.D. (Mechanical Engineering)
Stefano Lonardi, Ph.D. (Computer Science)
Michael Marsella, Ph.D. (Chemistry)
Cengiz S. Ozkaz, Ph.D. (Mechanical Engineering)
Mihr T. Ozkan, Ph.D. (Electrical Engineering)
Thomas F. Stahovich, Ph.D. (Mechanical Engineering)
Jianzhong W. Wu, Ph.D. (Chemical & Environmental Engineering)

Assistant Professors
Christopher J. Bardeen, Ph.D. (Chemistry)
Quan Cheng, Ph.D. (Chemistry)
Jiayu Liao, Ph.D. (Bioengineering)
Julia Lyubovitsky, Ph.D. (Bioengineering)
Nosang Myung, Ph.D. (Chemical & Environmental Engineering)
Vladimir Parpura, Ph.D. (Cell Biology & Neuroscience)
Valentine Vulche, Ph.D. (Bioengineering)
Sharon Walker, Ph.D. (Chemical & Environmental Engineering)

Visiting Assistant Professor
Angelika Dimoka, Ph.D. (Bioengineering)

Program Overview

The interdepartmental graduate program is the umbrella for graduate level research effort associated with the faculty in the Department of Bioengineering as well as other faculty at UCR who have an interest in training graduate students in bioengineering. The program offers graduate instruction leading to M.S. and Ph.D. degrees in Bioengineering.

Our interdisciplinary program combines a solid fundamental foundation in biological science and engineering, and aims to equip the students with diverse communication skills and training in the most advanced quantitative bioengineering research so that they can become leaders in their respective fields. The result is a rigorous, but exceptionally interactive and welcoming educational training for Bioengineering graduate students.

The interdepartmental aspect of the program allows students to develop skills related to bioengineering with faculty in a broad range of disciplines. The research vision is to build strength from experts in biochemistry, biophysics, biology and engineering to focus on critical themes that impact bioengineering.

Contributing departments include: Bioengineering, Biomedical Sciences, Botany & Plant Sciences, Cell Biology & Neuroscience, Chemical & Environmental Engineering, Computer Science, Electrical Engineering, Entomology, Mechanical Engineering, Physics & Astronomy, and Psychology.

The dominant research theme of the interdisciplinary graduate program is BioCellular Engineering. BioCellular Engineering envisions the design and implementation of processes that incorporate biomolecular assemblies and cellular structures for the development of advanced technologies. Specifically, these efforts include: cellular control and regulation (signal transduction pathways, regulation of immune system, metabolic controls, intracellular biosensors); mathematical and in-silico computational modeling (transport and kinetics of reactive species in organelles, biomolecules and biomolecular interactions, analysis of neural systems); and macromolecular, supramolecular, and membrane biophysics.

Other research areas of the interdepartmental graduate program faculty include: structural bioinformatics, rational protein, peptide, and drug design, drug delivery and pharmacokinetics, bioreactor design and analysis, microfluidics, charge transfer in biological and biomimetic systems, thermodynamics of proteins, electrophysiology and non-linear neural modeling, site specific, diagnostic-guided optical therapy, immunophysics, auditory bioengineering, molecular mechanisms of platelets activation, high-throughput screening systems, fatty acid contributions to obesity and diabetes, brain imaging, and bioseparations.

Please visit the UCR website to determine the research emphasis of the various participating faculty. The research efforts of faculty in the Department of Bioengineering can be found at www.bioeng.ucr.edu.

Admission

In addition to the following requirements, all applicants must meet the general requirements as set forth in this catalog under the Graduate Studies section.

Applicants will need to have completed coursework in chemistry, physics, math, biochemistry and biology, and engineering. Students without an undergraduate engineering degree should have excellent training in mathematics and the physical sciences.

Specific recommendations for students without an undergraduate engineering degree are:

- Two years of mathematics (equivalent UCR course = Math 9A-C, Math 10A-B)
- One year of physics (equivalent UCR course = Phys 2 A-C with lab)
- One year of inorganic chemistry including lab (equivalent UCR course = Chem 1A-C)
- One year of organic chemistry including lab (equivalent UCR course = Chem 112 A-C).
- One course in biochemistry (equivalent UCR course = BCH 100 or BCH 110A or B or C).
- One course in molecular biology (equivalent UCR course = BCH 110C or BioI 107).

Students with strong academic records may be admitted with limited coursework deficiencies, provided that these are satisfied by appropriate coursework taken during the first two years of graduate study.

Language Requirement

All International students whose first language is not English must satisfactorily complete the SPEAK test.

Students may be admitted to either the Master’s or the Ph.D. program. Students in the Master’s program may petition for admission into the Ph.D. program.

Masters Program

The M.S. program is ideal for professionals seeking greater depth in several areas of bioengineering. The degree requires a minimum of 36 quarter credits and may be completed in three to four academic quarters of full-time
study. Both thesis and non-thesis options are offered for the degree program (Plan I, Thesis and Plan II, Comprehensive Examination).

Student must request permission to pursue an M.S. in Bioengineering while simultaneously pursing a Ph.D. in a program other than Bioengineering.

**Normative Time to Degree**

Two years.

**Plan I (Thesis)**

In addition to the following requirements, all applicants must meet the requirements for Plan I as set forth in this catalog under the Graduate Studies section Master’s Degree Plan I (Thesis).

**Course Requirements** Students must satisfy the core course requirements (see Core Courses). Students enroll in the interdepartmental colloquium series in Bioengineering each quarter it is offered.

**Plan II (Comprehensive Examination)**

This plan is designed primarily for students who do not intend to pursue a Ph.D. in Bioengineering.

In addition to the following requirements, all applicants must meet the requirements for Plan I as set forth in this catalog under the Graduate Studies section Master’s Degree Plan II (Comprehensive Examination).

**Course Requirements** Students must satisfy the core course requirements (see Core Courses). Students enroll in the interdepartmental colloquium series in Bioengineering each quarter it is offered.

The comprehensive examination is prepared and administered by the Graduate Examination Committee. The student is allowed to choose between an oral and a written examination. The examination covers a broad range of topics chosen from upper division undergraduate courses and graduate courses taken by M.S. students.

Subsequent to the examination, the Graduate Examination Committee issues a passing or failing grade. Students who fail in the first attempt may retake the examination at the next scheduled comprehensive examination period. No more than two attempts to pass the exam are allowed.

The M.S. Comprehensive Examination may be held at the end of any quarters throughout the year. The committee to administer the M.S. Comprehensive Examination is selected by the Graduate Advisor and approved by the Graduate Program Committee.

**Doctoral Program**

The Ph.D. program is heavily integrated with research activities and is intended for well-qualified individuals who wish to pursue leadership careers in academic or industrial research. The Ph.D. program requires approximately three years of full-time study beyond the master’s degree. In consultation with a faculty advisor, Ph.D. students plan their program of study. The doctoral dissertation is based on original research in the field of specialization. An M.S. degree is not a prerequisite for entering the Ph.D. program.

The doctoral program includes a teaching requirement, an oral and written qualifying examination, and a dissertation.

**Normative Time to Degree**

Five years.

**Course Requirements** Students must satisfy the core course requirements (see Core Courses). Students will enroll in the interdepartmental colloquium series in Bioengineering each quarter it is offered.

**Written Qualifying Examination** Students in the Ph.D. program must pass a written qualifying examination that covers the fields of engineering and biology that relate to the student’s dissertation project.

**Oral Qualifying Examination** Following successful completion of the written examination, candidates for the doctoral degree must pass an oral examination, normally within three quarters of the date of their written examination. The oral examination is scheduled only after the candidate has written a proposal detailing the rationale, specific aims and approaches to be undertaken for her/his dissertation research.

**Dissertation** A written dissertation is completed by each student.

Candidates for the degree of Ph.D. may be required to defend the dissertation in a public, oral presentation at a time announced to members of the University community.

**Core Courses** All Bioengineering graduate students are required to take at least three courses from the following six Bioengineering courses. Other courses may be substituted but must be approved by the bioengineering graduate advisor. Students from non-engineering backgrounds are also required to take BIEN 268 in addition to the courses stipulated here.

**Bioengineering Core**

1. BIEN 220 - Chemical Genomics Design Studio
2. BIEN 223 - Engineering Analysis of Physiological Systems
3. BIEN 224 - Cellular and Molecular Engineering
4. BIEN 249 - Integration of Computational and Experimental Biology
5. BIEN 264 - Dynamics of Biological Systems
6. BIEN 268 - Bioengineering Experimentation and Analysis

Other required courses:

1. One bioscience class chosen from: BCH 210, BCH 211, BCH 212, BIOL/CMDB 200, BIOL/CMDB 201,BIOL 203, BIOL 221, or, with consent of instructor, BMSC 229, BMSC 230, BMSC 231, BMSC 232, BMSC 234, and BMSC 235.
2. Other courses may be substituted but must be approved by the Bioengineering Graduate Advisor.
3. BIEN 286 - Colloquium in Bioengineering

**Biological Sciences**

**Subject abbreviation:** BLSC

**College of Natural and Agricultural Sciences**

Bradley C. Hyman, Ph.D.  Bioinformatics and Genomics
Roger D. Farley, Ph.D.  Biology
Thomas A. Miller, Ph.D.  Cell, Molecular, and Developmental Biology
William E. Walton, Ph.D.  Conservation Biology
P. Kirk Visscher, Ph.D.  Entomology
Janet T. Arey, Ph.D.  Environmental Toxicology
J. Daniel Hare, Ph.D.  Evolution and Ecology
David A. Johnson, Ph.D.  Medical Biology
James G. Borneman, Ph.D.  Microbiology
Darleen A. DeMason, Ph.D.  Plant Biology
Linda L. Walling, Ph.D.

Associate Dean, College of Natural and Agricultural Sciences, ex officio

**Faculty**, see listings for

- Department of Biology
- Department of Botany and Plant Sciences
- Department of Cell Biology and Neuroscience
- Department of Entomology
- Department of Environmental Sciences
- Department of Nematology
- Department of Plant Pathology and Microbiology

**Major**

Biological Sciences is an interdepartmental major that includes faculty (more than 150) from seven departments in the College of Natural and Agricultural Sciences. The major offers the B.S. degree and is unified by the Life Sciences core curriculum (see below, Major