

BIOENGINEERING (PHD)

Visit program website. (<https://bioegrad.berkeley.edu/>)

Degree Offered: PhD

Program Leadership:

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Program Description

The UCSF-UC Berkeley Joint PhD Program in Bioengineering combines the outstanding resources and faculty in biomedical sciences at UCSF with the excellence in engineering, physical, and life sciences at UC Berkeley. Students in this highly interdisciplinary program learn to bring the methods of cutting-edge engineering to bear on some of the most pressing problems in biology and medicine.

Bioengineering is a young but rapidly evolving discipline. The UCSF-UCB Bioengineering program offers students unparalleled opportunities to do basic and applied bioengineering research in a wide variety of related fields, reflecting the strengths and breadth of program faculty across the two campuses and in multiple departments.

Faculty

There are 121 core faculty members and 67 additional affiliate faculty members in the joint program. The Bioengineering program combines the research activities of faculty from more than 20 departments from all four professional schools at UCSF together with six departments from the College of Engineering at Berkeley, as well as several non-engineering departments there.

The Bioengineering program is a member of the Quantitative Biosciences Consortium (<https://qbc.ucsf.edu/>) (QBC) at UCSF.

Sub-Disciplines

- Biomaterials, Cell and Tissue Engineering
- Biomedical Imaging
- BioMEMS and Nanotechnology
- Computational Biology, Bioinformatics, and Genomics
- Neural Systems Engineering and Vision Science
- Systems and Synthetic Biology

The Bioengineering program's UCSF office is located at the Mission Bay campus.

The Bioengineering program is offered by the UCSF Graduate Division, administered by the UCSF schools of pharmacy and medicine and the UC Berkeley College of Engineering, and delivered by faculty members in the UCSF schools of pharmacy and medicine and the UC Berkeley College of Engineering.

Admission Requirements

All Admissions requirements are available on our website: bioegrad.berkeley.edu/prospectivegrads/admissions (<https://bioegrad.berkeley.edu/prospectivegrads/admissions/>)

- c. Three letters of recommendation
- d. A completed recommendation waiver form (to be completed online)
- e. Unofficial transcripts (submitted online)
- f. Conversion of GPA (for international students only)
- g. Test of English as a Foreign Language (TOEFL) or The International English Language Testing System (IELTS) official scores (for international students only)
- h. Application fee
- i. Graduate Record Exam (GRE) official scores (optional)

Applications that are incomplete by the time of review will not be competitive for admission. Making sure an application is complete is solely the responsibility of the applicant and should be done in a timely manner.

The application process is **entirely online**. Please **do not** mail copies of the statement of purpose, GRE **and** TOEFL scores, publications, resumes, recommendation letters or transcripts. Any supplemental data, such as publications, resumes, and home pages, should be uploaded with your application. All applications must be submitted through the Berkeley campus' online application site for graduate admissions. Please take care to ensure all email addresses, as well as your own email address, are entered correctly.

Learning Outcomes

The PhD in Bioengineering is granted jointly by Berkeley and UCSF, two of the top public universities in the world in engineering and health sciences. Our interdisciplinary program combines the outstanding resources in biomedical and clinical sciences at UCSF with the excellence in engineering, physical, and life sciences at Berkeley.

Administered by the Department of Bioengineering at UC Berkeley and the Department of Bioengineering and Therapeutic Sciences at UCSF, all students in the program are simultaneously enrolled in the graduate divisions of both the San Francisco and Berkeley campuses and are free to take advantage of courses and research opportunities on both campuses. The program awards the PhD in Bioengineering degree from both campuses.

Students who complete the Bioengineering PhD will be able to

- a. Design, evaluate, execute and revise experiments and research methods in areas related to both advanced biology and engineering within their specific field of interest.
- b. Apply their knowledge to other scientific disciplines outside of their given research field.
- c. Defend their research results and author papers in distinguished scientific journals.
- d. Collaborate with other students, faculty and researchers in their specified field in order to produce tangible, quantifiable research results.
- e. Organize, schedule and instruct other researchers in their given field (teaching requirement).
- f. Present and communicate their research to a diverse variety of audiences.

- a. The online application (via UC Berkeley)
- b. Emphasis of specialty area of study (first and second choice)

Additional Information

Program Faculty

- Core Program Faculty
- Executive Committee (Includes Course Directors)

Career Outcomes

- Find career outcomes and other data on PhD programs (<https://graduate.ucsf.edu/program-statistics/#career>) on the Graduate Division website.

Degree Requirements

- Minimum GPA of 3.0
- All core courses and required activities taken and passed
- Six quarters in residence including a minimum of three registered quarters after advancement to candidacy
- Pass qualifying examination
- Complete and submit the dissertation
- For additional details, please see: graduate.ucsf.edu/bioe (<https://graduate.ucsf.edu/bioe/>)

Core Courses

UCSF Course Requirements

Code	Title	Units
BIOENGR 281	Biological Aspects of Bioengineering	1
BIOENGR 250	Research	1-8
GRAD 202	Racism in Science	3
Total Units		5-12

UCSF Approved Electives

Code	Title	Units
BIOENGR 215	Laboratory Rotation	1-8
BIOENGR 221	Tissue Mechanobiology	2.5-3
BIOENGR 240	Principles of Magnetic Resonance Imaging	4
BIOENGR 241	Metabolism and Magnetic Resonance Spectroscopy	3
BIOENGR 242	Principles of Tissue Engineering	2
BIOENGR 245	Machine Learning Algorithms for Medical Imaging	3-4
BIOENGR 249	Group Studies	1-8
BIOENGR 260	Translational Challenges in Medicine	1
BIOENGR 270	Translational Challenges: Diagnostics, Devices & Therapeutics	2
BIOENGR 283	Designing Clinical Research for Industry	2
BIOENGR 285	Health Care Finance & Economics	2
BIOENGR 297	Special Study	1-8
BIOENGR 299	Dissertation	0
BIO MD INF 203	Biocomputing Algorithms	4
BIO MD INF 206	Statistical Methods for Bioinformatics	4
BIOCHEM 210	Special Topics	3
BIOCHEM 241	Startup 101	3
BIOMED IMG 203	Imaging Probes for Nuclear and Optical Imaging	3

BIOMED IMG 204	Principles of Diagnostic and Therapeutic Ultrasound	2
BIOMED IMG 205	Imaging Study Design	3
BIOMED IMG 211	MR Pulse Sequences	3
BIOMED IMG 220	Advanced Neurological Imaging	3
BIOMED IMG 230	Cardiovascular Imaging	3
BIOMED IMG 260	Image Processing and Analysis I	2
BIOMED IMG 265	Image Processing and Analysis II	3
BIOMED IMG 270	Cancer Imaging	3
BIOMED IMG 280	Musculoskeletal, Abdominal, and Pelvic Imaging	3
BIOMED SCI 230	Advanced Topics in Cancer Research	0.5
BIOMED SCI 255	Basic Genetics & Genomics	4
BIOMED SCI 260	Cell Biology	4
BIOMED SCI 270	Special Topics in Biomedical Sciences	3
BIOPHRM SC 133	Pharmacokinetics in Drug Development	3
BIOPHYSICS 205B	Complex Biological Systems B	2.5-4
BIOPHYSICS 219	Special Topics in Biophysics	3
BIOPHYSICS 241	Physical Biology	5
CELL BIOL 245	Cell & Developmental Biology	4
CHEMISTRY 243	Chemical Biology	5
BIOPHYSICS 241	Physical Biology	5
EPIDEMIOLOG 210	Epidemiology of Aging	2
DEV STMCEL 257	Developmental and Stem Cell Biology	4
EPIDEMIOLOG 253	Methods in Infectious Disease Epidemiology	2-3
GENETICS 200A	Principles of Genetics	3
GLOBL HLTH 101X	Introduction to Global Health	1.5
GLOBL HLTH 202D	Social Determinants of Health	3
GRAD 213	Motivating Informed Decisions (MIND) Catalytic Course	2
GRAD 214	Responsible Conduct of Research and Rigor & Reproducibility	1.5
MICROBIOL 204	Molecular and Cellular Immunology	3
GRAD 219A	Special topics in racism and social justice in science	3
GRAD 219B	Special topics in racism and social justice in science	3
GRAD 219C	Special topics in racism and social justice in science	3
NEUROSCI 201A	Basic Concepts in Cellular and Molecular Neuroscience	5
NEUROSCI 201B	Basic Concepts for Cellular and Developmental Neuroscience	4
NEUROSCI 201C	Introduction to Systems and Behavioral Neuroscience	4
NEUROSCI 248	Analysis of Neural and Behavioral Data	3
PHARMGENOM 219	Special Topics in Pharm Sci and Pharmacogenomics	3
PHARMGENOM 245A	Basic Principles of Pharmaceutical Sciences	5
RAD ONCOL 235A	Radiation Therapy Physics I	3
RAD ONCOL 235B	Radiation Therapy Physics II	3

RAD ONCOL 235C	Radiation Therapy Physics III & Clinical Rotation	3
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Other elective courses may be approved by the program as appropriate. Please consult program administrators for more details.

UC Berkeley Course Requirements

URL for Berkeley BioE course listing: <http://guide.berkeley.edu/graduate/degree-programs/bioengineering/#coursestext>

Code	Title	Units
BIO ENG 200		1
BIO ENG 301		1
BIO ENG 201		1

UC Berkeley Approved Electives

Code	Title	Units
BIO ENG 203		4
BIO ENG C208		4
BIO ENG C209		4
BIO ENG 211		3
BIO ENG C212		3
BIO ENG C213		3
BIO ENG C214		3
BIO ENG C215		4
BIO ENG C216		4
BIO ENG C217		3
BIO ENG C218		3
BIO ENG C219		3
BIO ENG 220L		4
BIO ENG 221		4
BIO ENG 221L		4
BIO ENG C222		4
BIO ENG C223		3
BIO ENG 224		3
BIO ENG 225		3
BIO ENG C230		3
BIO ENG 231		4
BIO ENG C231		4
BIO ENG 232		4
BIO ENG 235		4
BIO ENG C237		4
BIO ENG 241		4
BIO ENG 243		4
BIO ENG 244		4
BIO ENG 244L		3
BIO ENG 245		4
BIO ENG 247		4
BIO ENG 248		3
BIO ENG C250		3
BIO ENG 251		4
BIO ENG 252		2
BIO ENG 253		2
BIO ENG C261		4

BIO ENG 263	4
BIO ENG 263L	4
BIO ENG C265	4
BIO ENG 266	4
BIO ENG 271	3
BIO ENG 280	1
BIO ENG C280	3
BIO ENG C281	3
BIO ENG 282	3
BIO ENG 290	1-4
BIO ENG C290D	3
BIO ENG 295	3
BIO ENG 296	3
BIO ENG 297	1
BIO ENG 298	1-8
BIO ENG 299	1-12
BIO ENG N299	1-6

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Non-course Core Requirements

Summary of Requirements

Graduation from the program depends on the successful completion of the following requirements. More details, including necessary forms, can be found in the subsequent sections.

a. Course Requirements and Program of Study

All students in the program must complete the following course requirements:

- A. Area Requirements: (breadth requirements, many satisfied by previous coursework)
- B. Major Area and Minor Area: (depth requirements completed by graduate courses) Major = 16 semester (24 quarter) units. Minor = 8 semester (12 quarter) units.
- C. First Year Seminars: BIOENGR 200 (UCB) and BIOENGR 281 Biological Aspects of Bioengineering (UCSF)
- D. Bioengineering Teaching Techniques: BIO ENG 301 (UCB)
- E. Ethics: BIO ENG 201 (UCB) or equivalent, taken in the first and fourth years

b. Grade Point Average (GPA) Requirements

Students are required to maintain a cumulative grade point average of 3.0 in academic coursework.

c. First Year Research Rotations and Research Mentor Selection

Students complete three research rotations with program core faculty members during their first year in the program. After completion of these rotations at the end of the spring semester, students select a rotation mentor as their dissertation research mentor.

d. Graduate Student Instructor/Teaching Assistantship

All students must complete a minimum of one 10-hour Graduate Student Instructor (GSI) assignment. Can be completed at either UCB or UCSF. Does not need to be a BioE course.

e. Qualifying Examination

Students identify qualifying exam committee members during their 2nd year and hold the qualifying exam (written and oral presentation) by the end of the fall of their 3rd year.

f. Advancement to Candidacy

After successful completion of the qualifying exam, students submit the proper Graduate Division and program forms to formally advance to candidacy.

g. Research Conference Presentation

Students must present (poster or a talk) at a research conference at least once. This can include presenting at the program's annual retreat.

h. Annual Progress Reports

Students are required to meet with their academic advisor and/or dissertation committee each year and submit annual progress reports.

i. Dissertation

Students write a dissertation compiling the results of their graduate research. Upon written approval of their dissertation committee, students file their dissertation with the Graduate Division of their home campus.

j. Exit Seminar

Graduating students hold a concluding research seminar to present their graduate work.