BIOENGINEERING

Courses offered by the Department of Bioengineering are listed under the subject code BIOE (https://explorecourses.stanford.edu/search?q=BIOE&view=catalog&page=0&academicYear=&collapse=&filter-coursestatus-Active=on&filter-departmentcode-BIOE=on&filter-catalognumber-BIOE=on) on the *Stanford Bulletin's* ExploreCourses web site.

Bioengineering is jointly supported by the School of Engineering and the School of Medicine. The facilities and personnel of the Department of Bioengineering are housed in the Shriram Center, James H. Clark Center, the William F. Durand Building for Space Engineering and Science, the William M. Keck Science Building, the Jerry Yang and Akiko Yamazaki Environment and Energy Building, and the Richard M. Lucas Center for Magnetic Resonance Spectroscopy and Imaging. The departmental headquarters is in the Shriram Center for Bioengineering and Chemical Engineering.

Courses in the teaching program lead to the degrees of Bachelor of Science in Bioengineering, Master of Science and Doctor of Philosophy. The department collaborates in research and teaching programs with faculty members in Chemical Engineering, Mechanical Engineering, Electrical Engineering, and departments in the School of Medicine. Quantitative biology is the core science base of the department. The research and educational thrusts are in biomedical computation, biomedical imaging, biomedical devices, regenerative medicine, and cell/molecular engineering. The clinical dimension of the department includes cardiovascular medicine, neuroscience, orthopedics, cancer care, neurology, and the environment.

Mission of the Undergraduate Program in Bioengineering

The Stanford Bioengineering (BIOE) major enables students to combine engineering and the life sciences in ways that advance scientific discovery, healthcare and medicine, manufacturing, environmental quality, culture, education, and policy. Students who major in bioengineering earn a fundamental engineering degree for which the raw materials, underlying basic sciences, fundamental toolkit, and future frontiers are all defined by the unique properties of living systems.

The department offers an undergraduate major in Bioengineering leading to the B.S. degree in Bioengineering.

Learning Outcomes (Undergraduate)

The learning outcomes are used in evaluating students as well as the department's undergraduate program. The department expects undergraduate majors in the program to be able to demonstrate the ability to:

1. Apply the knowledge of mathematics, science, and engineering.
2. Design and conduct experiments, as well to analyze and interpret data.
3. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. Function on multidisciplinary teams.
5. Identify, formulate, and solve engineering problems.
6. Understand professional and ethical responsibility.
7. Communicate effectively.
8. Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
9. Demonstrate a working knowledge of contemporary issues.
10. Apply the techniques, skills, and modern engineering tools necessary for engineering practice.
11. Transition from engineering concepts and theory to real engineering applications.

Learning Outcomes (Graduate)

The purpose of the master's program is to provide students with the knowledge and skills necessary for a professional career or doctoral studies. This is done through coursework with specialization in an area of the field, including biomedical computation, regenerative medicine and tissue engineering, molecular and cell bioengineering, biomedical imaging, and biomedical devices.

The Ph.D. is conferred upon candidates who have demonstrated substantial scholarship and the ability to conduct independent research. Through coursework and guided research, the program prepares students to make original contributions in Bioengineering and related fields.

Graduate Programs in Bioengineering

The University's requirements for the M.S. and Ph.D. degrees are outlined in the "Graduate Degrees (http://exploredegrees.stanford.edu/graduatedegrees)" section of this bulletin.

Admission

Students are expected to enter with a series of core competencies in mathematics, biology, chemistry, physics, computing, and engineering. Students entering the program are assessed by the examination of their undergraduate transcripts and research experiences. Specifically, the department requires that students have completed mathematics through multivariable calculus and differential equations, completed a series of undergraduate biology courses and completed physics, chemistry, and computer sciences courses required of all undergraduate majors in engineering.

Qualified applicants are encouraged to apply for predoctoral national competitive fellowships, especially those from the National Science Foundation. Applicants to the Ph.D. program should consult with their financial aid officers for information and applications.

The deadline for receiving applications is December 11, 2018.

Further information and application instructions for all graduate degree programs may be obtained from Graduate Admissions (http://gradadmissions.stanford.edu).

Bachelor of Science in Bioengineering

The department offers an undergraduate major in Bioengineering (BIOE) leading to the B.S. degree in Engineering. For additional information, see the *Handbook for Undergraduate Engineering Programs (UGHB)* at http://ughb.stanford.edu.

Bioengineering (BIOE)

Completion of the undergraduate program in Bioengineering leads to the conferral of the Bachelor of Science in Bioengineering.

Mission of the Undergraduate Program in Bioengineering

The Stanford Bioengineering major enables students to combine engineering and the life sciences in ways that advance scientific discovery, healthcare and medicine, manufacturing, environmental quality, culture, education, and policy. Students who major in BioE earn a fundamental engineering degree for which the raw materials, underlying basic sciences, fundamental toolkit, and future frontiers are all defined by the unique properties of living systems.

Students will complete engineering fundamentals courses, including an introduction to bioengineering and computer programming. A series of core BIOE classes beginning in the second year leads to a student-selected depth area and a senior capstone design project. The department also organizes a summer Research Experience for Undergraduates (REU) (http://bioengineering.stanford.edu/student-resources/reu) program. BIOE graduates are well prepared to pursue careers and lead projects in research, medicine, business, law, and policy.

Requirements

Mathematics		
14 units minimum (Prerequisites: 10 units of AP or IB credit or Mathematics 20-series) [1]		
Select one of the following sequences:		
CME 100 & CME 102	Vector Calculus for Engineers and Ordinary Differential Equations for Engineers (Recommended)	10
MATH 51 & MATH 53	Linear Algebra, Multivariable Calculus, and Modern Applications and Ordinary Differential Equations with Linear Algebra	10
Select one of the following:		
CME 106	Introduction to Probability and Statistics for Engineers (Recommended)	4-5
or STATS 110	Statistical Methods in Engineering and the Physical Sciences	
or STATS 141	Biostatistics	
Science		
26 units minimum [2]		
CHEM 31X	Chemical Principles Accelerated	5-10
or CHEM 31A & CHEM 31B	Chemical Principles I and Chemical Principles II	
CHEM 33	Structure and Reactivity of Organic Molecules	5
BIO 83	Biochemistry & Molecular Biology (Recommended)	4
or BIO 82	Genetics	
BIO 84	Physiology	4
PHYSICS 41	Mechanics	4
PHYSICS 43	Electricity and Magnetism	4
Technology in Society		
BIOE 131	Ethics in Bioengineering (WIM)	3
Engineering Fundamentals		
BIOE 80	Introduction to Bioengineering (Engineering Living Matter)	4
CS 106A	Programming Methodology (or CS 106B or CS 106X)	5
Fundamentals Elective; see UGHB for approved course list; only one CS class allowed to count toward Fundamentals requirements.		3-5
Bioengineering Core		
BIOE 42	Physical Biology	4
BIOE 44	Fundamentals for Engineering Biology Lab	4
BIOE 101	Systems Biology	3
BIOE 103	Systems Physiology and Design	4
BIOE 123	Biomedical System Prototyping Lab	4
BIOE 141A	Senior Capstone Design I	4
BIOE 141B	Senior Capstone Design II	4
Bioengineering Depth Electives		
Four courses, minimum 12 units:		12
BIOE 115	Computational Modeling of Microbial Communities	
BIOE 122	Biosecurity and Bioterrorism Response	
BIOE 140		
BIOE 201C	Diagnostic Devices Lab	
BIOE 211	Biophysics of Multi-cellular Systems and Amorphous Computing	
BIOE 212	Introduction to Biomedical Informatics Research Methodology	
BIOE 214	Representations and Algorithms for Computational Molecular Biology	
BIOE 217	Translational Bioinformatics	
BIOE 220	Introduction to Imaging and Image-based Human Anatomy	
or BIOE 51	Anatomy for Bioengineers	
BIOE 221	Physics and Engineering of Radionuclide-based Medical Imaging	
BIOE 222	Physics and Engineering Principles of Multi-modality Molecular Imaging of Living Subjects	
BIOE 223	Physics and Engineering of X-Ray Computed Tomography	
BIOE 224	Probes and Applications for Multi-modality Molecular Imaging of Living Subjects	
BIOE 225	Ultrasound Imaging and Therapeutic Applications	
BIOE 227	Functional MRI Methods	
BIOE 231	Protein Engineering	
BIOE 244	Advanced Frameworks and Approaches for Engineering Integrated Genetic Systems	
BIOE 260	Tissue Engineering	
BIOE 279	Computational Biology: Structure and Organization of Biomolecules and Cells	
BIOE 281	Biomechanics of Movement	
BIOE 291	Principles and Practice of Optogenetics for Optical Control of Biological Tissues	

1. It is strongly recommended that CME 100 Vector Calculus for Engineers and CME 102 Ordinary Differential Equations for Engineers be taken rather than MATH 51 Linear Algebra, Multivariable Calculus, and Modern Applications and MATH 53 Ordinary Differential Equations with Linear Algebra. If you are taking the MATH 50 series, it is strongly recommended to take CME 192 Introduction to MATLAB. CME 106 Introduction to Probability and Statistics for Engineers utilizes MATLAB, a powerful technical computing program, and should be taken rather than STATS 110 Statistical Methods in Engineering and the Physical Sciences or STATS 141 Biostatistics. Although not required, CME 104 Linear Algebra and Partial Differential Equations for Engineers is recommended for some Bioengineering courses.
2. Science must include both Chemistry (CHEM 31A Chemical Principles I and CHEM 31B Chemical Principles II; or CHEM 31X Chemical Principles Accelerated) and calculus-based Physics (PHYSICS 41 Mechanics and PHYSICS 43 Electricity and Magnetism), with two quarters of course work in each, in addition to two courses of BIO core. CHEM 31A Chemical Principles I and CHEM 31B Chemical Principles II are considered one course even though given over two quarters.
3. A course may only be counted towards one requirement; it may not be double-counted. All courses taken for the major must be taken for a letter grade if that option is offered by the instructor. Minimum Combined GPA for all courses in Engineering Fundamentals and Depth is 2.0.

For additional information and sample programs see the Handbook for Undergraduate Engineering Programs (UGHB) (http://ughb.stanford.edu).

Students pursuing a premed program need to take additional courses; see the UGHB, BioE Premed 4-Year Plan.

Honors Program

The School of Engineering offers a program leading to a Bachelor of Science in Bioengineering with Honors (BIOE-BSH). This program provides the opportunity for qualified BioE majors to conduct independent research at an advanced level with a faculty research adviser and documented in an honors thesis.

In order to receive departmental honors, students admitted to the program must:

1. Declare the honors program in Axess (BIOE-BSH).
2. Maintain an overall grade point average (GPA) of at least 3.5 as calculated on the unofficial transcript.
3. Complete at least two quarters of research with a minimum of nine units of BIOE 191 Bioengineering Problems and Experimental Investigation or BIOE 191X Out-of-Department Advanced Research Laboratory in Bioengineering for a letter grade; up to three units may be used towards the bioengineering depth elective requirements.
4. Submit a completed thesis draft to the honors adviser and second reader by the third week of Spring Quarter. Further revisions and final endorsement are to be finished by the second Monday in May, when two signed bound copies plus one PC-compatible CD-ROM are to be submitted to the student services officer.
5. Attend the Bioengineering Honors Symposium at the end of Spring Quarter and give a poster or oral presentation, or present in another approved suitable forum.

For more information and application instructions, see the Bioengineering Honors Program (http://bioengineering.stanford.edu/academics/undergraduate-programs/bioengineering-honors-program) web site.

Coterminal Master's Program in Bioengineering

This option is available to Stanford undergraduates who wish to work simultaneously toward a B.S. in another field and an M.S. in Bioengineering. The degrees may be granted simultaneously or at the conclusion of different quarters, though the bachelor's degree cannot be awarded after the master's degree has been granted.

The University minimum requirements for the coterminal program are 180 units for the bachelor's degree plus 45 unduplicated units for the master's degree.

In order to apply for the coterminal master's program student's must have completed six, non-summer quarters at Stanford (two non-summer quarters for transfer students), have completed 120 undergraduate units, and must have declared the undergraduate major. They must be accepted into our program one quarter before receiving the B.S. degree.

Students should apply directly to the Bioengineering student service office by December 11, 2018. Students interested in the coterminal master's degree must take the Graduate Record Examination (GRE) (http://www.gre.org). Prospective applicants should see the department's website for application instructions and supporting documents (http://bioengineering.stanford.edu/admissions/coterm).

The application must provide evidence of potential for strong academic performance as a graduate student. The application is evaluated and acted upon by the graduate admissions committee of the department. Students are expected to enter with a series of core competencies in mathematics, biology, chemistry, physics, computing, and engineering. Typically, a GPA of at least 3.5 in engineering, science, and math is expected.

University Coterminal Requirements

Coterminal master's degree candidates are expected to complete all master's degree requirements as described in this bulletin. University requirements for the coterminal master's degree are described in the "Coterminal Master's Program (http://exploredegrees.stanford.edu/cotermdegrees)" section. University requirements for the master's degree are described in the "Graduate Degrees (http://exploredegrees.stanford.edu/graduatedegrees/#masterstext)" section of this bulletin.

After accepting admission to this coterminal master's degree program, students may request transfer of courses from the undergraduate to the graduate career to satisfy requirements for the master's degree. Transfer of courses to the graduate career requires review and approval of both the undergraduate and graduate programs on a case by case basis.

In this master's program, courses taken during or after the first quarter of the sophomore year are eligible for consideration for transfer to the graduate career; the timing of the first graduate quarter is not a factor. No courses taken prior to the first quarter of the sophomore year may be used to meet master's degree requirements.

Course transfers are not possible after the bachelor's degree has been conferred.

The University requires that the graduate adviser be assigned in the student's first graduate quarter even though the undergraduate career may still be open. The University also requires that the Master's Degree Program Proposal be completed by the student and approved by the department by the end of the student's first graduate quarter.

Master of Science in Bioengineering

The Master of Science in Bioengineering requires 45 units of coursework. The curriculum consists of core bioengineering courses, technical electives, seminars and unrestricted electives. Core courses focus on quantitative biology and biological systems analysis. Approved technical electives are chosen by the student in consultation with his/her graduate adviser, and can be selected from graduate course offerings in mathematics, statistics, engineering, physical sciences, life sciences, and medicine. Seminars highlight emerging research in bioengineering and provide training in research ethics. Unrestricted electives can be freely chosen by the student in association with his/her adviser.

Requirements

The department's requirements for the M.S. in Bioengineering are:

1. Core Bioengineering courses (10 units)

The following courses are required:

		Units
BIOE 300A	Molecular and Cellular Bioengineering	3
BIOE 300B	Quantitative Physiology	3
Select two of the following:		4-5
BIOE 301A	Molecular and Cellular Engineering Lab	
BIOE 301B	Clinical Needs and Technology	
BIOE 301C	Diagnostic Devices Lab	
BIOE 301D	Microfluidic Device Laboratory	
Total Units		10-11

These courses, together with the approved technical electives, should form a cohesive course of study that provides depth and breadth.

2. Approved Technical Electives (26 units)

These units must be selected from graduate courses in mathematics, statistics, engineering, physical science, life science, and medicine. They should be chosen in concert with the bioengineering courses to provide a cohesive degree program in a bioengineering focus area. Students are required to take at least one course in some area of device or instrumentation. Up to 9 units of directed study and research may be used as approved electives.

3. Seminars (3 units)

The seminar units should be fulfilled through:

		Units
BIOE 393	Bioengineering Departmental Research Colloquium	2
MED 255	The Responsible Conduct of Research	1

Other relevant seminar units may also be used with the approval of the faculty adviser. One of the seminar units must be MED 255 The Responsible Conduct of Research.

4. Unrestricted Electives (6 units).

Students are assigned an initial faculty adviser to assist them in designing a plan of study that creates a cohesive degree program.

To ensure that an appropriate program is pursued by all M.S. candidates, students who first matriculate at Stanford at the graduate level must:

1. submit an adviser-approved Program Proposal for a Master's Degree form to the student services office during the first month of the first quarter of enrollment
2. obtain approval from the M.S. adviser and the Chair of Graduate Studies for any subsequent program change or changes.

It is expected that the requirements for the M.S. in Bioengineering can be completed within approximately one year. There is no thesis requirement for the M.S.

Due to the interdisciplinary nature of Bioengineering, a number of courses are offered directly through the Bioengineering Department but many are available through other departments. See respective ExploreCourses for course descriptions.

Doctor of Philosophy in Bioengineering

A student studying for the Ph.D. degree must complete a master's degree (45 units) comparable to that of the Stanford M.S. degree in Bioengineering. Up to 45 units of master's degree residency units may be counted towards the degree. The Ph.D. degree is awarded after the completion of a minimum of 135 units of graduate work as well as satisfactory completion of any additional University requirements. Students admitted to the Ph.D. program with an M.S. degree must complete at least 90 units of work at Stanford. The maximum number of transfer units is 45.

On the basis of the research interests expressed in their application, students are assigned an initial faculty adviser who assists them in choosing courses and identifying research opportunities. The department does not require formal lab rotations, but students are encouraged to explore research activities in two or three labs during their first academic year.

Prior to being formally admitted to candidacy for the Ph.D. degree, the student must demonstrate knowledge of bioengineering fundamentals and a potential for research by passing a qualifying oral examination before the end of the the second year.

Typically, the exam is taken shortly after the student earns a master's degree. The student must have a graduate Stanford GPA of 3.25 to be eligible for the exam. Once the student's faculty sponsor has agreed that the exam is to take place, the student must submit an application folder containing items including a curriculum vitae, research project abstract, and preliminary dissertation proposal to the student services office. Information about the exam may be obtained from the student services office.

In addition to the course requirements of the M.S. degree, doctoral candidates must complete a minimum of 15 additional units of approved formal course work (excluding research, directed study, and seminars).

Dissertation Reading Committee

Each Ph.D. candidate is required to establish a reading committee for the doctoral dissertation within six months after passing the department's Ph.D. qualifying exams. Thereafter, the student should consult frequently with all members of the committee about the direction and progress of the dissertation research, no less than once per year.

A dissertation reading committee consists of the principal dissertation adviser and at least two other readers. Reading committees in Bioengineering may include faculty from another department. It is required that at least one member of the Bioengineering faculty be on each reading committee. The initial committee and any subsequent changes must be officially approved by the Department Chair.

University Oral and Dissertation

The Ph.D. candidate is required to take the University oral examination after the dissertation is substantially completed (with the dissertation draft in writing) but before final approval. The examination consists of a public presentation of dissertation research, followed by substantive private questioning on the dissertation and related fields by the University oral committee (four selected faculty members, plus a chair from another department). Once the oral has been passed, the student finalizes the dissertation for reading committee review and final approval.

Ph.D. Minor in Bioengineering

Doctoral students pursuing a Ph.D. degree in a degree program other than Bioengineering may apply for the Ph.D. minor in Bioengineering. A minor is a not a requirement for any degree but is available when agreed upon by the student and the major and minor department.

Application forms, including the University's general requirements, can be found at http://registrar.stanford.edu/shared/forms.htm.

A student desiring a Ph.D. minor in Bioengineering must have a minor program advisor who is a regular Bioengineering faculty member. This advisor must be a member of the student's reading committee for the doctoral dissertation, and the entire reading committee must meet at least one year prior to the date of the student's dissertation defense.

The Ph.D. minor program must include at least 20 units of course work in Stanford Bioengineering or Bioengineering cognate courses at or above the 200 level. Of these 20 units, no more than 10 can be in cognate courses. All courses listed to fulfill the 20-unit requirement must be taken for a letter grade and the GPA must be at least 3.25. Courses used for a minor may not be used to also meet the requirements for a master's degree.

M.D./Ph.D. Dual Degree Program

Students interested in a career oriented towards bioengineering and medicine can pursue the combined M.D./Ph.D. degree program. Stanford has two ways to do an M.D./Ph.D. U.S. citizens and permanent residents can apply to the Medical Scientist Training Program and can be accepted with funding from both M.D. and Ph.D. programs for stipend and tuition. They then apply to the bioengineering Ph.D. during their first or second year of M.D. training. Students not admitted to the Medical Scientist Training Program must apply to be admitted separately to the M.D. program and the Ph.D. program of their choice.

The Ph.D. is administered by the Department of Bioengineering. To be formally admitted as a Ph.D. degree candidate in this combined degree program, the student must apply through normal departmental channels and must have earned or have plans to earn an M.S. in bioengineering or another engineering discipline at Stanford or another university. The M.S. requires 45 units of course work which consists of core bioengineering courses, technical electives, seminars, and 6 unrestricted units. Students must also pass the Department of Bioengineering Ph.D. qualifying examination.

For students fulfilling the full M.D. requirements who earned their master's level engineering degree at Stanford, the Department of Bioengineering waives the normal departmental requirement of 15 units applied towards the Ph.D. degree beyond the master's degree level through formal coursework. Consistent with the University Ph.D. requirements, the department accepts 15 units comprised of courses, research, or seminars approved by the student's academic adviser and the department chair. Students not completing their M.S. engineering degree at Stanford are required to take 15 units of formal course work in engineering-related areas as determined by their academic adviser.

Joint Degree Programs in Bioengineering and the School of Law

The School of Law and the Department of Bioengineering offer joint programs leading to either a J.D. degree combined with an M.S. degree in Bioengineering or to a J.D. degree combined with a Ph.D. in Bioengineering.

The J.D./M.S. and J.D./Ph.D. degree programs are designed for students who wish to prepare themselves intensively for careers in areas relating to both law and bioengineering. Students interested in either joint degree program must apply and gain entrance separately to the School of Law and the Department of Bioengineering and, as an additional step, must secure permission from both academic units to pursue degrees in those units as part of a joint degree program. Interest in either joint degree program should be noted on the student's admission applications and may be considered by the admission committee of each program. Alternatively, an enrolled student in either the Law School or the Bioengineering Department may apply for admission to the other program and for joint degree status in both academic units after commencing study in either program.

Joint degree students may elect to begin their course of study in either the School of Law or the Department of Bioengineering. Faculty advisers from each academic unit will participate in the planning and supervision of the student's joint program. Students must be enrolled full time in the Law School for the first year of law school, and, at some point during the joint program, may be required to devote one or more quarters largely or exclusively to studies in the Bioengineering program regardless of whether enrollment at that time is in the Law School or in the Department of Bioengineering. At all other times, enrollment may be in the graduate school or the Law School, and students may choose courses from either program regardless of where enrolled. Students must satisfy the requirements for both the J.D. and the M.S. or Ph.D. degrees as specified in the *Stanford Bulletin* or elsewhere.

The Law School shall approve courses from the Bioengineering Department that may count toward the J.D. degree, and the Bioengineering Department shall approve courses from the Law School that may count toward the M.S. or Ph.D. degree in Bioengineering. In either case, approval may consist of a list applicable to all joint degree students or may be tailored to each individual student's program. The lists may differ depending on whether the student is pursuing an M.S. or a Ph.D. in Bioengineering.

In the case of a J.D./M.S. program, no more than 45 units of approved courses may be counted toward both degrees. In the case of a J.D./Ph.D. program, no more than 54 units of approved courses may be counted toward both degrees. In either case, no more than 36 units of courses that originate outside the Law School may count toward the law degree. To the extent that courses under this joint degree program originate outside of the Law School but count toward the law degree, the law school credits permitted under Section 17(1) of the Law School Regulations shall be reduced on a unit-per-unit basis, but not below zero. The maximum number of law school credits that may be counted toward the M.S. or Ph.D. in Bioengineering is the greater of: (i) 15 units; or (ii) the maximum number of units from courses outside of the department that M.S. or Ph.D. candidates in Bioengineering are permitted to count toward the applicable degree under general departmental guidelines or in the case of a particular student's individual program. Tuition and financial aid arrangements will normally be through the school in which the student is then enrolled.

Graduate Advising Expectations

The Department of Bioengineering is committed to providing academic advising in support of graduate student scholarly and professional development. When most effective, this advising relationship entails collaborative and sustained engagement by both the adviser and the advisee. As a best practice, advising expectations should be periodically discussed and reviewed to ensure mutual understanding. Both the adviser and the advisee are expected to maintain professionalism and integrity.

Graduate students are active contributors to the advising relationship, proactively seeking academic and professional guidance and taking responsibility for informing themselves of policies and degree requirements for their graduate program.

For a statement of University policy on graduate advising, see the "Graduate Advising (http://exploredegrees.stanford.edu/graduatedegrees/#advisingandcredentialstext)" section of this bulletin.

Masters Advising

At the start of graduate study, each student is assigned a master's program adviser: a member of our faculty who provide guidance in course selection and in exploring academic opportunities and professional pathways. The department's graduate handbook provides information and suggested timelines for advising meetings. Usually, the same faculty member serves as program adviser for the duration of master's study, but the handbook does describe a process for formal adviser changes.

In addition, the Faculty Director of Graduate Studies (DGS) meets with all the master's students at the start of the first year and is available during the academic year by email and during office hours.

The department's student services office is also an important part of the master's advising team. They inform students and advisers about University and department requirements, procedures, and opportunities, and they maintain the official records of advising assignments and approvals.

Doctoral Advising

Faculty advisers guide students in key areas such as selecting courses, designing and conducting research, developing of teaching pedagogy, navigating policies and degree requirements, and exploring academic opportunities and professional pathways. The department's graduate handbook provides information and suggested timelines for advising meetings in the different stages of the doctoral program.

Ph.D. students are initially assigned a program adviser on the basis of the interests expressed in their application. This faculty member provides initial guidance in course selection, in exploring academic opportunities and professional pathways, and in identifying doctoral research opportunities. The department does not require formal lab rotations, but students are strongly encouraged to explore research activities in two or three labs during their first academic year.

Students identify their doctoral research/thesis adviser prior to the end of the first year of study. If an adviser has not been found by the end of the third quarter of study, permission to continue in the Ph.D. program is contingent upon approval of a petition requesting a fourth lab rotation quarter. The research supervisor assumes primary responsibility for the future direction of the student, taking on the roles previously filled by the program adviser, and ultimately directs the student's dissertation. Most students find an adviser from among the primary faculty members of our department. However, the research adviser may be a faculty member from another Stanford department who is a member of the Academic Council, familiar with supervising doctoral students, and able to provide both advising and funding for the duration of the doctoral program. When the research adviser is from outside our department, the student must also identify a program adviser from the department's primary faculty to provide guidance on departmental requirements and opportunities.

The Faculty Director of Graduate Studies (DGS) meets with all the doctoral students at the start of the first year and is available during the academic year by email and during office hours. The department's student services office is also an important part of the doctoral advising team: they inform students and advisers about University and department requirements, procedures, and opportunities, and they maintain the official records of advising assignments and approvals. Students are encouraged to talk with the DGS and the student services office as they consider adviser selection or for guidance in working with their adviser(s).

Chair: Jennifer R. Cochran

Professors: Russ B. Altman, Kwabena Boahen, Wah Chiu, Jennifer R. Cochran, Karl Deisseroth, Scott L. Delp, Norbert J. Pelc, Stephen R. Quake, Christina D. Smolke, James R. Swartz, Paul Yock

Associate Professors: Annelise E. Barron, Zev David Bryant, Markus Willard Covert, Andrew Endy, Michael Fischbach, Kerwyn C. Huang, Jin Hyung Lee, Michael Z. Lin, Jan T. Liphardt, Alison Lesley Marsden, Manu Prakash, Fan Yang

Assistant Professors: Lacramioara Bintu, David B. Camarillo, Polly M. Fordyce, Possu Huang, Paul Nuyujukian, Lei Stanley Qi, Ingmar Riedel-Kruse, Bo Wang

Professors, by courtesy: Bruce L. Daniel, James Dunn, Jeffrey A. Feinstein, Daniel S. Fisher, Sanjiv S. Gambhir, Garry E. Gold, Stuart B. Goodman, Geoffrey C. Gurtner, Brian Hargreaves, Thomas M. Krummel, Ellen Kuhl, Craig Levin, Michael T. Longaker, David Magnus, Lloyd B. Minor, Kim Butts Pauly, Krishna Shenoy, Paul J. Wang, Yiping Joseph Woo

Associate Professors, by courtesy: Sarah Heilshorn, Marc E. Levenston, Sakti Srivastava, Yunzhi Peter Yang

Assistant Professors, by courtesy: Eric Appel, Mary Frances Nunez Teruel, James K. Wall

Adjunct Professors: Uday Kumar, John Linehan, Vijay Pande, Marc L. Salit, Gordon Saul, Charles A. Taylor

Lecturers: Siavash Ahrar, Todd Brinton, Natalia Khuri, Joesph Mandato, Ryan K. Piece, Kara H. Rogers, Joseph Towles, Ross D. Venook

Graduate Related Courses

		Units
BIOMEDIN 210	Modeling Biomedical Systems: Ontology, Terminology, Problem Solving	3
BIOMEDIN 217	Translational Bioinformatics	4
EE 369A	Medical Imaging Systems I	3
EE 369B	Medical Imaging Systems II	3
ME 287	Mechanics of Biological Tissues	4