
# Graduate Handbook 2008-09

Department of Bioengineering
Stanford University

Dear New Bioengineering Graduate Students,

Welcome to the Stanford Bioengineering Department graduate program! You are one of 18 outstanding students who comprise the incoming, 2008 class of an exciting department that is a leader in preparing bioengineers for the future. You join with an internationally renowned faculty to create a prestigious center for graduate education that is committed to discovery and to the development of new technologies and therapies.

As you embark upon one of the most challenging phases of your career, I urge you to take advantage of the many special opportunities at Stanford. Meet with your advisors and talk with other faculty, students and staff to better understand the broad bioengineering environment here. Peruse the course offerings in departments throughout the university. Attend seminars and research meetings in labs of interest. If you are a Ph.D. student, take time to see and understand various research groups to find a research area and style that suits your needs and interests.

This handbook is designed to provide specific information and guidelines on the many aspects and stages of the MS and PhD programs. If you have any questions during your transition, please do not hesitate to contact me or Olgalydia Urbano-Winegar, Student Services Manager at ourbano@stanford.edu, 650-723-8632.

Our congratulations and warm welcome!

Sincerely,

Dennis R. Carter
Chair of Graduate Studies

## *Table of Contents*

## *Getting Started*

The Stanford Graduate Student Handbook is a very useful reference for graduate life at Stanford. Academic and financial information, resources for housing, general university policy and social activities are included in this manual.

**SUNet ID**
The SUNet ID is an account name that identifies each student, uniquely and permanently, as a member of the Stanford community. It is what is used to log into Stanford computer systems. Computing and Communication is a central source for information about Stanford's technology-based tools, from software and servers to cell phones and networks.

## *AXESS*

http://axess.stanford.edu
This is the University's web based administrative system wherein most student business is conducted. Students must use Axess to accomplish the following tasks:

- File or adjust a study list (the list of courses in which you wish to enroll) and elect grading options each quarter
- Confirm, through Axess, that the University has your correct address and telephone number
- Update Emergency Contact Information
- Print a history of courses and grades
- Check registration status each quarter (e.g. pending holds)
- Review Grades
- Ensure University bill is paid
- Apply to graduate in final quarter

Axess also provides students with the following services:

- Official transcript request
- Campus housing application
- Print an Enrollment Certification

## *Registration*

**For PhD Students Only**
The department requires that all students in the Ph.D. program register autumn, winter, spring and summer quarters. Depending on the funding source, Ph.D. students in Bioengineering will register for **10** units per quarter. Most funding, including the NSF predoctoral fellowship, pays for a maximum of 10 units. MSTP students should consult their Program Coordinator, Lorie Langdon.

Units for individual courses may vary depending on how the course is organized each year. You need not register for research units (BIOE 391, BIOE 392) unless you need the extra units to total 10.
Deadlines are set for each of these activities. The *Time Schedule*, a catalog of courses offered each quarter, is available online approximately one month before the start of classes. The *Time Schedule* can be found on the left-hand menu in Axess. The last possible day to register is usually two weeks after the official first day of classes, but you will need to check in Axess to be certain.

All students are strongly encouraged to read and keep as a reference *Registering at Stanford*, a brochure sent to students each summer, and the *Stanford Bulletin* which is available each autumn for pick-up from the Student Service Office. The *Stanford Bulletin* section on "Grading Systems" is especially recommended.

## *Grades*

Stanford allows a student the option of taking a course for a letter grade or for credit/no credit. Students are strongly encouraged to ask for grades in all courses when available. Please consult with the faculty member regarding the grading type for research courses (BIOE 391, 392).

Students are responsible for making sure grades are reported. If asterisks, incomplete grades or no credits (NC) appear on their transcripts, students should check with their instructor immediately. The Student Service Office can assist students in clearing any missing grades.

*For Medical Students Only:*
Medical students are required to take courses Pass/Fail, but need to keep a record of letter grades they would have received. Students should ask their instructors for an e-mail or letter stating the grade that was awarded, for purposes of computing the GPA.

## *Laboratory Safety Training*

Every person working in a laboratory is required by various agencies to be trained in all aspects of laboratory safety. During Orientation Week, it is mandatory that new graduate students take the on-line University Laboratory Safety Training in Axess via the Training tab. Prior to working in the lab, new graduate students are required to complete 1) General safety and Emergency Preparedness (EHS-4200), 2) Chemical Safety for Laboratories (EHS-1900), Biosafety (EHS-1500), and Compressed Gas Safety (EHS-2200). In addition, everyone residing in Clark must take the on-line HIPAA training and agree to abide by the policies and procedures. To take the on-line training via the Training tab on Axess, type in HIPAA and select HIPAA Fundamentals (HPAA-PRGM-0201).

## *Finances*

Student stipends and financial aid are not shown on a student bill until a student is officially registered through Axess. Once registered for the quarter, aid is activated and reduces the amount owed. If you have any questions regarding your student bill, please contact the Student Service Office in Clark S-166.

**Check Distribution/Information**

Students with research, teaching or course assistantships will be on the regular University payroll. Checks will be available in the department's main office on the 7th and 22nd of each month, or the preceding work day if these dates fall on a weekend or holiday. Your salary is taxable and will be withheld as you request on the W-4 Tax Data form. This form and other payroll forms will be available to complete at orientation.

Students not doing assistantships are paid on a quarterly basis and have their checks mailed to their home address each quarter on the first day of classes. **Please make sure to update your mailing address on Axess.** Students must complete all registration and financial paperwork, pay registration fees, and satisfy all stipulated departmental requirements before receiving stipend checks. No taxes are withheld, but the stipend is reportable and taxable.

Direct Deposit

Stipend Checks and bi-weekly assistantship checks may be direct-deposited in local banks. Students can enroll for direct deposit on Axess. Click on "Enrollment Instructions" for more information.

Holds: Stipend checks will not be issued if University requirements such as submission of the federal employment eligibility form, federal and state tax withholding certificate, and patent agreement form, or if departmental requirements have not been fulfilled. Outstanding bills from the library, University, or Vaden Health Center will also result in holds. Holds must be cleared with the originating office before stipend checks will be issued.

**Loans and External Awards**

Graduate Students who believe they will require loan assistance can apply for federal Stafford Student Loan, Federal Perkins Loan, and University loan programs. Inquiries for publications outlining loan program terms can be directed to the Financial Aid Office, Montag Hall, 355 Galvez Street, Stanford, CA 94305; phone 650-723-3058. International students who are not permanent residents are not eligible for long-term loans.

Graduate Fellowships awarded by external sources (i.e. NSF, NDSEG, Ford) are administered in Montag Hall by Maureen Grey, 725-0868.
Email: mogrey@stanford.edu

**Taxes**
Tax information (limited) is available in:

1. The University Graduate Student Handbook
2. The Bechtel International Center (for international students)
3. Graduate Student Council (GSC)

## ***Health Insurance***

Students are automatically enrolled in Cardinal Care during registered quarters unless health insurance is waived through Axess.
**The health insurance waiver must be in place by the waiver deadlines**.
Fall Quarter: September 15, 2008
Winter Quarter: December 15, 2008
Spring Quarter: March 15, 2009
Summer Quarter: May 15, 2009

To waive out of Cardinal Care a student must enter Axess and follow the health insurance waiver link and complete the steps indicated. A health plan name and group policy number are required to complete the health insurance waiver. A student can waive health insurance for the entire academic year or for a quarter at a time.
Contact Info: 723-2135, Email: healthinsurance@stanford.edu

## *Master's Degree Program Overview*

Students will be expected to enter with a series of core competencies in mathematics, biology, chemistry, physics, computing, and engineering. The backgrounds of students entering the program will be assessed by the examination of their undergraduate transcripts and research experiences. Specifically, we will require 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.

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 a student in consultation with his/her graduate advisor, 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 advisor.

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

Program Proposal

Students are expected to meet with their assigned advisor to construct a coherent program in a specific focus area. To ensure that an appropriate program is pursued, all MS students are required to file a "Program Proposal for a Master's Degree" to the Student Service Office by **October 22, 2008.**

Instructions**:**

1. Obtain the Program Proposal for a Master's Degree Form
2. Type or print neatly. Course Titles and units are to be included.
3. Consult with your advisor and obtain his/her signature.
4. Submit the form to the Student Service Office for review and final approval of the Chair of Graduate Studies.
5. Proposals can take up to 14 working days to be reviewed and processed. Axess will indicate the approval of your proposals.

All programs are subject the approval of the student's advisor and the Chair of Graduate Studies.

Program Proposal Revision:

Students who alter their MS program must submit a new program proposal by the third week of their final quarter.

All program revisions are subject the approval of the student's advisor and the Chair of Graduate Studies.

*Notes to All M.S. Students:*

*All research units applied toward the Masters Degree program requirements must be completed with Stanford faculty.

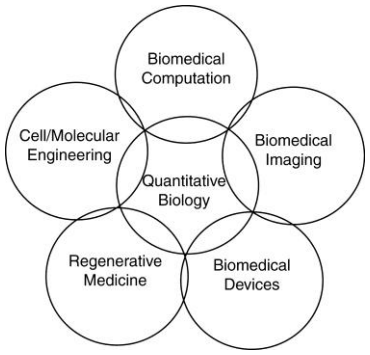
*Special Notes to BS/MS (coterminal) Students:*

*No courses taken more than two quarters before admission to the M.S. program may be used to meet the department's minimum 45-unit requirement for the Master's degree.

*Course units can only apply toward one degree. You may not count course units toward both the B.S. and M.S. program requirements.

***Areas of Research Include:***

* Biomedical Computation
* Tissue Engineering/Regenerative Medicine
* Molecular and Cell Engineering
* Biomedical Devices
* Biomedical Imaging



**Master of Science in Bioengineering**
**Degree Requirements - total 45 units**

1. **Core Bioengineering courses** – 9 units

   BIOE 300A Molecular and Cellular Bioengineering (Fall)
   BIOE 300B Physiology and Tissue Engineering (Winter)
   BIOE 301A Molecular and Cellular Bioengineering Lab (Fall)
   BIOE 301B Clinical Needs and Technology (Winter)

   These courses, together with the Approved Technical Electives, should form a cohesive course of study that provides depth and breadth.

2. **Approved Technical Electives** - 27 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
   BIOE 393 Bioengineering Departmental Research Colloquium
   BIOE 390 Introduction to Bioengineering Research
   MED 255 The Responsible Conduct of Research

4. **Unrestricted Electives** - 6 units

Students must complete a proposed M.S. degree form listing their proposed courses during their first quarter at Stanford to assure that the planned program provides appropriate depth and breadth. The student's faculty advisor and the Associate Chair for Graduate Studies must approve this list of courses.

Sample M.S. programs are provided in the following focus areas:

Biomedical Computation
Regenerative Medicine/Tissue Engineering
Molecular and Cell Bioengineering
Biomedical Imaging
Biomedical Devices

**Working with faculty advisors, students have flexibility to tailor course selections to their areas of interest.** Suggested approved courses are listed after each sample program. For courses not on this list, please consult with your advisor for approval.

**EXAMPLE PROGRAM**
**M.S. in Bioengineering**
**Focus Area - Biomedical Computation**

Core Bioengineering Courses

| | |
|---|---|
| BIOE 300A | Molecular and Cellular Bioengineering - 3 units |
| BIOE 300B | Physiology and Tissue Engineering- 3 units |
| BIOE 301A | Molecular and Cellular Bioengineering Lab – 2 units |
| BIOE 301B | Clinical Needs and Technology- 1 unit |

9 subtotal

Sample Approved Electives

| | |
|---|---|
| BIOE 214 | Representations and Algorithms for Computational Molecular Biology – 3 units |
| BIOC 218 | Computational Molecular Biology - 3 units |
| BIOE 212 | Intro to Biomedical Informatics Research Methodology – 3 units (Taken 2nd YR) |
| BIOE 220 | Imaging Anatomy - 3 units |
| CS 106X | Programming Abstractions (Accelerated) – 5 units |
| CHEMENG 300 | Applied Mathematics in Chemical and Biological Sciences - 3 units |
| BIOE/ME 484 | Computational Methods in Cardiovascular Bioengineering - 3 units |
| BIOE 391 | Directed Study – 4 units |

27 subtotal

Seminars

| | |
|---|---|
| BIOE 393 | Bioengineering Departmental Research Colloquium - 1 unit |
| BIOE 390 | Introduction to Bioengineering Research - 1 unit |
| MED 255 | The Responsible Conduct of Research - 1 unit |

3 subtotal

Sample Unrestricted Electives

| | |
|---|---|
| CS 161 | Design and Analysis of Algorithms - 3 units |
| ARTSTUDI 167 | Introduction to Animation- 3 units |

6 subtotal

TOTAL UNITS 45

## Suggested Approved Courses for Biomedical Computation Theme

### Biochemistry Course

| | | | |
|---|---|---|---|
| BIOC 218 “Same as BIOMEDIN 231” | Computational Molecular Biology | 3 | Aut, Win, Spr |

### Bioengineering Course

| | | | |
|---|---|---|---|
| BIOE 332A, B | Large-scale Neural Modeling | 3 | Win (A), Spr (B) |
| BIOE 334 | Engineering Principles in Molecular Biology | 3 | Aut |

### Biology Courses

| | | | |
|---|---|---|---|
| BIO 141 "Same as Stats 141" | Biostatistics | 4-5 | Aut |
| BIO 214 "Same as BIOC 224" | Advanced Cell Biology | 2-5 | Win |
| BIO 217 | Neuronal Biophysics | 4 | Win |
| SBIO 241 “Same as BIOC 241, BIOPHYS 241” | Biological Macromolecules | 3-5 | Aut |

### Biomedical Informatics Courses

| | | | |
|---|---|---|---|
| BIOMEDIN 200 | Biomedical Informatics Colloquium | 1 | Aut,Win, Spr |
| BIOMEDIN 201 | Biomedical Informatics Student Seminar | 1 | Aut,Win, Spr |
| BIOMEDIN 210 “Same as CS 270” | Introduction to Biomedical Informatics: Fundamental Methods | 3 | Aut |
| BIOMEDIN 211 “Same as CS 271” | Intro to Biomedical Informatics: Principles of System Design | 3 | Win |
| BIOMEDIN 212 “Same as BIOE 212, CS 272, GENE 212” | Introduction to Biomedical Informatics Research Methodology | 3 | Aut |
| BIOMEDIN 214 “Same as BIOE 214, CS 274, GENE 214” | Representations and Algorithms for Computational Molecular Biology | 3-4 | Spr |
| BIOMEDIN 216 | Lectures on Representations and Algorithms for Molecular Biology | 1 | Spr |
| BIOMEDIN 217 “Same as CS 275” | Translational Bioinformatics | 4 | Win |

### Chemical and Systems Biology Course

| | | | |
|---|---|---|---|
| CSB 210 | Signal Transduction Pathways and Networks | 4 | Win |

### Computer Science Courses

| | | | |
|---|---|---|---|
| CS 161 | Design and Analysis of Algorithms | 3-4 | Aut, Win, Sum |
| CS 221 | Artificial Intelligence: Principles and Techniques | 3-4 | Win |
| CS 223A | Introduction to Robotics | 3 | Win |
| CS 224N | Natural Language Processing | 3-4 | Spr |
| CS 227 | Reasoning Methods in Artificial Intelligence | 3 | Spr |
| CS 228 | Structured Probabilistic Models: Principles and Techniques | 3 | Win |

| | | | |
|---|---|---|---|
| CS 248 | Introduction to Computer Graphics | 3-5 | Aut |
| CS 262 "Same as BIOMEDIN 262" | Computational Genomics | 3 | Win |
| CS 273A “Same as BIOMEDIN 273A, DBIO 273A” | A Computational Tour of the Human Genome | 3 | Aut |
| CS 278 “Same as BIOC 278, BIOE 310, CSB 278” | Systems Biology | 3 | Aut |
| CS 279 | Computational Methods for Analysis and Reconstruction of Biological Networks | 3 | Not given this yr |
| CS 346 | Database System Implementation | 3-5 | Spr |
| CS 348A | Computer Graphics: Geometric Modeling | 3-4 | Not given this yr |
| CS 374 | Algorithms in Biology | 2-3 | Spr |
| CS 468 | Topics in Geometric Algorithms | 3 | Aut, Win, Spr |

**Institute for Computational and Mathematical Engineering Courses**

| | | | |
|---|---|---|---|
| CME 200 “Same as ME 300A” | Linear Algebra with Application to Engineering Computations | 3 | Aut |
| CME 204 “Same as ME 300B” | Partial Differential Equations in Engineering | 3 | Win |
| CME 206 “Same as ME 300C” | Introduction to Numerical Methods for Engineering | 3 | Spr |
| CME 302 | Numerical Linear Algebra | 3 | Aut |
| CME 306 | Numerical Solution of Partial Differential Equations | 3 | Spr |
| CME 342 | Parallel Methods in Numerical Analysis | 3 | Spr |

**Electrical Engineering Courses**

| | | | |
|---|---|---|---|
| ENGR 206 | Control System Design | 3-4 | Not given this yr |
| EE 376A, B | Information Theory | 3 | Win (A), Spr (B) |
| EE 418 | Topics in Neuroengineering | 3 | Not given this yr |

**Genetic Courses**

| | | | |
|---|---|---|---|
| GENE 203 "Same as BIO 203, DBIO 203" | Advanced Genetics | 4 | Aut |
| GENE 211 | Genomics | 3 | Win |

**Management Science & Engineering Courses**

| | | | |
|---|---|---|---|
| MS&E 152 | Introduction to Decision Analysis | 3-4 | Spr |
| MS&E 211 | Linear and Nonlinear Optimization | 3-4 | Aut |
| MS&E 269 | Quality Control and Management | 3-4 | Not given this yr |

**Mechanical Engineering Courses**

| | | | |
|---|---|---|---|
| ME 281 "Same as BIOE 281" | Biomechanics of Movement | 3 | Aut |
| ME 331A | Classical Dynamics | 3 | Win |
| ME 331B | Advanced Dynamics | 3 | Spr |

**Neurobiology Courses**

| | | | |
|---|---|---|---|
| NBIO 206 | The Nervous System | 7-8 | Win |

| | | | |
|---|---|---|---|
| NBIO 254 “Same as BIO 154/254” | Molecular and Cellular Neurobiology | 4-5 | Aut |

**Neurology and Neurological Sciences**

| | | | |
|---|---|---|---|
| NENS 220 | Computational Neuroscience | 4 | Win |

**Psychology Course**

| | | | |
|---|---|---|---|
| PSYCH 209A | The Neural Basis of Cognition: A Parallel Distributed Processing Approach | 1-4 | Win |

**Structural Biology Course**

| | | | |
|---|---|---|---|
| SBIO 228 "Same as BIOPHYS 228" | Computational Structural Biology | 3 | Aut, Spr |

**Statistic Course**

| | | | |
|---|---|---|---|
| STATS 366 “Same as 166, BIOMEDIN 366” | Computational Biology | 2-3 | Spr |

**EXAMPLE PROGRAM**
**M.S. in Bioengineering**
**Focus Area - Tissue Engineering/Regenerative Medicine**

Core Bioengineering Courses

| | |
|---|---|
| BIOE 300A | Molecular and Cellular Bioengineering - 3 units |
| BIOE 300B | Physiology and Tissue Engineering- 3 units |
| BIOE 301A | Molecular and Cellular Bioengineering Lab – 2 units |
| BIOE 301B | Clinical Needs and Technology- 1 unit |

9 subtotal

Sample Approved Electives

| | |
|---|---|
| BIOE 261 | Principles and Practice of Stem Cell Engineering – 3 units |
| ME 335A, B | Finite Element Analysis - 6 units |
| DBIO 210 | Developmental Biology - 5 units |
| ME 381 | Orthopaedic Bioengineering - 3 units |
| BIOE/ME 284 | Cardiovascular Bioengineering - 3 units |
| BIOE 220 | Imaging Anatomy – 3 units |
| BIOE 392 | Directed Investigation – 4 units |

27 subtotal

Seminars

| | |
|---|---|
| BIOE 393 | Bioengineering Departmental Research Colloquium - 1 unit |
| BIOE 390 | Introduction to Bioengineering Research - 1 unit |
| MED 255 | The Responsible Conduct of Research - 1 unit |

3 subtotal

Sample Unrestricted Electives

| | |
|---|---|
| CME 200 | Linear Algebra with Application to Engineering Computations – 3 units |
| ARTSTUDI 167 | Introduction to Animation- 3 units |

6 subtotal

TOTAL UNITS 45

## Suggested Approved Courses for Tissue Engineering/Regenerative Medicine Theme

### Bioengineering Courses

| | | | |
|---|---|---|---|
| BIOE 261 "Same as NSUR 261" | Principles and Practice of Stem Cell Engineering | 3 | Aut |
| BIOE 284 A,B | Cardiovascular Bioengineering | 3 | Aut (A), Win (B) |
| BIOE 361 | Biomaterials in Regenerative Medicine | 3 | Alternate yrs, not given this yr |
| ME 385 | Tissue Engineering Lab | 1-2 | Not given this yr |

### Institute for Computational and Mathematical Engineering Courses

| | | | |
|---|---|---|---|
| CME 200 "Same as ME 300A" | Linear Algebra with Application to Engineering Computations | 3 | Aut |
| CME 204 "Same as ME 300B" | Partial Differential Equations in Engineering | 3 | Win |
| CME 206 "Same as ME 300C" | Introduction to Numerical Methods for Engineering | 3 | Spr |

### Biology Course

| | | | |
|---|---|---|---|
| BIO 217 | Neuronal Biophysics | 4 | Win |

### Chemical and Systems Biology Courses

| | | | |
|---|---|---|---|
| CSB 210 | Signal Transduction Pathways and Networks | 4 | Win |
| CSB 260 | Quantitative Chemical Biology | 4 | Alternate yrs, not given this yr |

### Developmental Biology Courses

| | | | |
|---|---|---|---|
| DBIO 201 | Development and Disease Mechanisms | 4 | Aut |
| DBIO 210 | Developmental Biology | 5 | Spr |

### Immunology Course

| | | | |
|---|---|---|---|
| IMMUNOL 205 | Immunology in Health and Disease | 2-4 | Win |

### Material Science Course

| | | | |
|---|---|---|---|
| MATSCI 380 | Nano-Biotechnology | 3 | Aut |

### Mechanical Engineering Courses

| | | | |
|---|---|---|---|
| ME 335 A, B | Finite Element Analysis | 3 | Aut (A), Win (B) |
| ME 338A | Continuum Mechanics | 3 | Win |
| ME 339 | Mechanics of the Cell | 3 | Aut |
| ME 351 A, B | Fluid Mechanics | 3 | Aut (A), Win (B) |
| ME 354 | Experimental Methods in Fluid Mechanics | 4 | Not given this yr |
| ME 381 | Orthopaedic Bioengineering | 3 | Not given this yr |
| ME 382 A, B | Biomedical Device Design | 4 | Win (A), Spr (B) |
| ME 485 | Modeling and Simulation of Human Movement | 3 | Spr |

### Molecular and Cellular Physiology Course

| | | | |
|---|---|---|---|
| MCP 256 | How Cells Work: Energetics, Compartments, and Coupling in Cell Biology | 4 | Spr |

### Neurobiology Course

| | | | |
|---|---|---|---|
| NBIO 206 | The Nervous System | 7-8 | Win |

**EXAMPLE PROGRAM**
**M.S. in Bioengineering**
**Focus Area - Molecular and Cell Engineering**

Core Bioengineering Courses

| | |
|---|---|
| BIOE 300A | Molecular and Cellular Bioengineering - 3 units |
| BIOE 300B | Physiology and Tissue Engineering- 3 units |
| BIOE 301A | Molecular and Cellular Bioengineering Lab – 2 units |
| BIOE 301B | Clinical Needs and Technology- 1 unit |

9 subtotal

Sample Approved Electives

| | |
|---|---|
| BIOE 261 | Principles and Practice of Stem Cell Engineering – 3 units |
| BIOE/CHEMENG 355 | Advanced Biochemical Engineering - 3 units |
| BIOE/CHEMENG 454 | Synthetic Biology and Metabolic Engineering - 3 units |
| BIOE 331 | Protein Engineering - 3 units |
| BIO 230 | Molecular and Cellular Immunology - 4 units |
| CSB 210 | Signal Transduction Pathways and Networks - 4 units |
| BIOE 284 | Cardiovascular Bioengineering– 3 units |
| BIOE 220 | Imaging Anatomy – 3 units |
| BIOE 392 | Directed Investigation – 1 unit |

27 subtotal

Seminars

| | |
|---|---|
| BIOE 393 | Bioengineering Departmental Research Colloquium - 1 unit |
| BIOE 390 | Introduction to Bioengineering Research - 1 unit |
| MED 255 | The Responsible Conduct of Research - 1 unit |

3 subtotal

Sample Unrestricted Electives

| | |
|---|---|
| CHEM 171 | Physical Chemistry - 3 units |
| CHEM 173 | Physical Chemistry - 3 units |

6 subtotal

TOTAL UNITS 45

## Suggested Approved Courses for Molecular and Cell Engineering Theme

### Bioengineering Courses

| | | | |
|---|---|---|---|
| BIOE 261 "Same as NSUR 261" | Principles and Practice of Stem Cell Engineering | 3 | Aut |
| BIOE 284 A,B | Cardiovascular Bioengineering | 3 | Aut (A),Win(B) |
| BIOE 331 | Protein Engineering | 3 | Win, alternate years, not given next yr |
| BIOE 334 | Engineering Principles in Molecular Biology | 3 | Aut |
| BIOE 355 | Advanced Biochemical Engineering | 3 | Spr |
| BIOE 361 | Biomaterials in Regenerative Medicine | 3 | Alternate years, not given this yr |
| BIOE 454 | Synthetic Biology and Metabolic Engineering | 3 | Alternate years, not given this yr |

### Biology Courses

| | | | |
|---|---|---|---|
| BIO 104/200 | Advanced Molecular Biology | 5 | Win |
| BIO 203 | Advanced Genetics | 4 | Aut |
| BIO 217 | Neuronal Biophysics | 4 | Win |
| BIO 230 | Molecular and Cellular Immunology | 4 | Aut |

### Biophysics Course

| | | | |
|---|---|---|---|
| BIOPHYS 228 | Computational Structural Biology | 3 | Aut, Spr |

### Civil and Environmental Engineering Courses

| | | | |
|---|---|---|---|
| CEE 274A "Same as CHEMENG174/274" | Environmental Microbiology I | 3 | Aut, Sum |
| CEE 274B | Metabolic Biochemistry of Microorganisms | 3 | Win, alternate years, not given next yr |

### Chemical Engineering Courses

| | | | |
|---|---|---|---|
| CHEMENG 300 "Same as CME 330" | Applied Mathematics in the Chemical and Biological Sciences | 3 | Aut |

### Chemical and Systems Biology

| | | | |
|---|---|---|---|
| CSB 210 | Signal Transduction Pathways and Networks | 4 | Win |
| CSB 240 | Drug Discovery | 4 | Alternate Yrs, Not Given this year |
| CSB 260 | Quantitative Chemical Biology | 4 | Alternate yrs, not given this year |

### Molecular and Cellular Physiology Course

| | | | |
|---|---|---|---|
| MCP 256 | How Cells Work: Energetics, Compartments, and Coupling in Cell Biology | 4 | Spr |

### Structural Biology Courses

| | | | |
|---|---|---|---|
| SBIO 228 | Computational Structural Biology | 3 | Aut, Spr |
| SBIO 241 "Same as BIOC 241, BIOPHYS 241" | Biological Macromolecules | 3-5 | Aut |

**EXAMPLE PROGRAM**
**M.S. in Bioengineering**
**Concentration Area - Biomedical Devices**

Core Bioengineering Courses

| | |
|---|---|
| BIOE 300A | Molecular and Cellular Bioengineering - 3 units |
| BIOE 300B | Physiology and Tissue Engineering- 3 units |
| BIOE 301A | Molecular and Cellular Bioengineering Lab – 2 units |
| BIOE 301B | Clinical Needs and Technology- 1 unit |

9 subtotal

Sample Approved Electives

| | |
|---|---|
| BIOE 374A,B | Biodesign Innovation – 2, 2 units |
| ME 381 | Orthopaedic Bioengineering - 3 units |
| BIOE/ME 281 | Biomechanics of Movement - 3 units |
| BIOE/ME 284A | Cardiovascular Bioengineering - 3 units |
| EE 312 | Micromachined Sensors and Actuators - 3 units |
| ME 300A | Linear Algebra w/ Applications to Engineering Computations - 3 units |
| BIOE 220 | Imaging Anatomy – 3 units |
| BIOE 392 | Directed Investigation - 5 units |

27 subtotal

Seminars

| | |
|---|---|
| BIOE 393 | Bioengineering Departmental Research Colloquium - 1 unit |
| BIOE 390 | Introduction to Bioengineering Research - 1 unit |
| MED 255 | The Responsible Conduct of Research - 1 unit |

3 subtotal

Sample Unrestricted Electives

| | |
|---|---|
| CS 106X | Programming Abstractions (Accelerated) - 5 units |
| ATHLETIC 52 | Golf: Advanced Beginning - 1 unit |

6 subtotal

TOTAL UNITS 45

## Suggested Approved Courses for Biomedical Device Theme

### Bioengineering Courses

| | | | |
|---|---|---|---|
| BIOE 281 "Same as ME 281" | Biomechanics of Movement | 3 | Aut |
| BIOE 284A, B "Same as ME 284A, B" | Cardiovascular Bioengineering | 3 | Aut (A), Win (B) |
| BIOE 332A, B | Large-Scale Neural Modeling | 3 | Win (A), Spr (B) |
| BIOE 374A, B "Same as ME 368, MED 272, OIT 581/3" | Biodesign Innovation | 2 | Win (A), Spr (B) |
| BIOE 375A, B "Same as ME 369, MED 273, OIT 582/4" | Biodesign Innovation, Project A, B | 2 | Win (A), Spr (B) |
| BIOE 485 | Modeling and Simulation of Human Movement | 3 | Spr |

### Institute for Computational and Mathematical Engineering Courses

| | | | |
|---|---|---|---|
| CME 200 "Same as ME 300A" | Linear Algebra with Application to Engineering Computations | 3 | Aut |
| CME 204 "Same as ME 300B" | Partial Differential Equations in Engineering | 3 | Win |
| CME 206 "Same as ME 300C" | Introduction to Numerical Methods for Engineering | 3 | Spr |

### Electrical Engineering Courses

| | | | |
|---|---|---|---|
| EE 268 | Introduction to Modern Optics | 3 | Aut |
| EE 312 | Micromachined Sensors and Actuators | 3 | Win |
| EE 418 | Topics in Neuroengineering | 3 | Not given this yr |

### Management Science and Engineering Courses

| | | | |
|---|---|---|---|
| MS&E 250A | Engineering Risk Analysis | 2-3 | Win |
| MS&E 256 | Technology Assessment and Regulation of Medical Devices | 1-3 | Spr |
| MS&E 273 | Technology Venture Formation | 3-4 | Aut |
| MS&E 277 | Creativity and Innovation | 4 | Spr |
| MS&E 310 | Linear Programming | 3 | Aut |
| MS&E 380 | Doctoral Research Seminar in Organizations | 3 | Not given this yr |

### Mechanical Engineering Courses

| | | | |
|---|---|---|---|
| ME 208 | Patent Law and Strategy for Inventors and Entrepreneurs | 2-3 | Aut |
| ME 218A | Smart Product Design Fundamentals | 4-5 | Aut |
| ME 218B | Smart Product Design Applications | 4-5 | Win |
| ME 218C | Smart Product Design Practice | 4-5 | Spr |
| ME 220 | Introduction to Sensors | 3-4 | Spr |
| ME 280 | Skeletal Development and Evolution | 3 | Spr |
| ME 294 | Medical Device Design | 3 | Aut |
| ME 309 | Finite Element Analysis in Mechanical Design | 3 | Spr |
| ME 310A, B, C | Project-based Engineering Design, Innovation, and Development | 5 | Aut (A), Win (B), Spr (C) |
| ME 318 | Computer-Aided Product Creation | 4 | Aut, Win, Spr |
| ME 335A,B | Finite Element Analysis | 3 | Aut (A), Win (B) |

| | | | |
|---|---|---|---|
| ME 335C | Introduction to Boundary Element Analysis | 3 | Spr |
| ME 338A | Continuum Mechanics | 3 | Win |
| ME 351A, B | Fluid Mechanics | 3 | Aut (A), Win (B) |
| ME 354 | Experimental Methods in Fluid Mechanics | 4 | Not given this yr |
| ME 381 | Orthopaedic Bioengineering | 3 | Not given this yr |
| ME 382A,B | Medical Device Design | 4 | Win (A), Spr (B) |
| ME 385 | Tissue Engineering Lab | 1-2 | Not given this yr |

**Medicine Courses**

| | | | |
|---|---|---|---|
| MED 217 | Technological Frontiers in Digestive Diseases | 2 | Spr |
| MED 276 | Careers in Medical Technology | 1 | Spr |

**Orthopedic Surgery Course**

| | | | |
|---|---|---|---|
| ORTHO 222 | Anatomy of Movement | 2-4 | Win |

**EXAMPLE PROGRAM**
**M.S. in Bioengineering**
**Concentration Area - Biomedical Imaging**

Core Bioengineering Courses

| | |
|---|---|
| BIOE 300A | Molecular and Cellular Bioengineering - 3 units |
| BIOE 300B | Physiology and Tissue Engineering- 3 units |
| BIOE 301A | Molecular and Cellular Bioengineering Lab – 2 units |
| BIOE 301B | Clinical Needs and Technology- 1 unit |

9 subtotal

Sample Approved Electives

| | |
|---|---|
| EE 261 | The Fourier Transform and its Applications - 3 units |
| BIOE/RAD 220 | Imaging Anatomy - 3 units |
| EE 369A | Medical Imaging Systems I - 3 units |
| EE 369B | Medical Imaging Systems II - 3 units |
| EE 369C | Medical Image Reconstruction - 3 units |
| RAD 226 | In Vivo Magnetic Resonance Spectroscopy and Imaging - 3 units |
| ME 300A | Mathematical and Computational Methods in Engineering- 3 units |
| BIOE 392 | Directed Investigation - 3 units |

27 subtotal

Seminars

| | |
|---|---|
| BIOE 393 | Bioengineering Departmental Research Colloquium - 1 unit |
| BIOE 390 | Introduction to Bioengineering Research - 1 unit |
| MED 255 | The Responsible Conduct of Research - 1 unit |

3 subtotal

Sample Unrestricted Electives

| | |
|---|---|
| EE 268 | Introduction to Modern Optics – 3 units |
| ME 335A | Finite Element Analysis - 3 units |

6 subtotal

TOTAL UNITS 45

## Suggested Approved Courses for Biomedical Imaging Theme

### Bioengineering Courses

| | | | |
|---|---|---|---|
| BIOE 220 "Same as RAD 220" | Imaging Anatomy | 3 | Win |
| BIOE 222A,B | Multi-modality Molecular Imaging in Living Subjects I, II | 4(A) 2(B) | Aut (A), Win (B) |

### Biology Course

| | | | |
|---|---|---|---|
| BIO 212 "Same as HUMBIO 133, BIO 112" | Human Physiology | 4 | Win |

### Institute for Computational and Mathematical Engineering Course

| | | | |
|---|---|---|---|
| CME 200 | Linear Algebra with Application to Engineering Computations | 3 | Aut |

### Electrical Engineering Courses

| | | | |
|---|---|---|---|
| EE 168 | Introduction to Digital Image Processing | 3-4 | Win |
| EE 261 | The Fourier Transform and its Applications | 3 | Aut, Win, Sum |
| EE 262 | Two-Dimensional Imaging | 3 | Alternate years, not given this yr |
| EE 268 | Introduction to Modern Optics | 3 | Aut |
| EE 368 | Digital Image Processing | 3 | Not given this yr |
| EE 369A | Medical Imaging Systems I | 3 | Win |
| EE 369B | Medical Imaging Systems II | 3 | Spr |
| EE 369C | Medical Image Reconstruction | 3 | Not given this yr |
| EE 469B | RF Pulse Design for Magnetic Resonance Imaging | 3 | alternate yrs, not given this yr |

### Molecular and Cellular Physiology Course

| | | | |
|---|---|---|---|
| MCP 222 "Same as BIO 152, NBIO 222) | Imaging: Biological Light Microscopy | 3 | Alternate years, not given this yr |

### Radiology Course

| | | | |
|---|---|---|---|
| RAD 226 | In Vivo Magnetic Resonance Spectroscopy and Imaging | 3 | Win |

## *The Ph.D. Degree Program Overview*

A total of 135 units are required for the Ph.D degree. A student studying for the Ph.D. degree must complete a master's degree (45 units) and must, in essence, fulfill the requirements for the Stanford M.S. degree in Bioengineering. Up to 45 units of master's degree residency units may be counted towards the degree. The maximum number of transfer units is 45. Students admitted to the Ph.D. program with an M.S. degree, must complete at least 90 units of work at Stanford.

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).

The Department of Bioengineering graduate program is designed to bring together in one department, the cadre of faculty who perform bioengineering research and teach bioengineering courses. Our mission is to train students at the intersection of biomedicine and engineering in both academia and the burgeoning biomedical and biotechnology industries.

**Timetable for the Doctoral Degree**

It is expected that the doctoral degree will require five years of full-time study following enrollment into the program.

**First Year:**

Consultation with Advisors
Apply for Predoctoral Fellowships
Coursework (10 units required each quarter)
Involvement in Research
Choose a Research Advisor
First Year Review

**Second Year:**

Continuation of Coursework (10 units required each quarter)
Complete the MS degree Requirements
Complete Initial Research
Pass Qualifying Exam

**Third Year**

Define Dissertation Project
Complete All Courses
Build Momentum and Confidence in Research

**Fourth and Fifth Year**

Complete and Defend your Doctoral Research

## *Combined M.D. /Ph.D. Degree*

Students interested in a career oriented towards bioengineering and medicine can pursue the combined MD/PhD degree program. Stanford has two ways to do an MD /PhD. US citizens and permanent residents can apply to the Medical Scientist Training Program (contact Lori Langdon, 723-6176) and can be accepted with funding from both MD and PhD with stipend/tuition. They can then select a bioengineering laboratory for their PhD. Students not admitted to the Medical Scientist Training Program must apply and be admitted separately to the MD program and the PhD program of their choice.

The PhD degree is administered by the Department of Bioengineering. To be formally admitted as a PhD 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 MS in bioengineering or other engineering discipline at Stanford or another university. The MS requires 45 units of coursework which consists of core bioengineering courses, technical electives, seminars, and 6 unrestricted units. In addition, students will be expected to pass the Department of Bioengineering Ph.D. qualifying examination.

For students fulfilling the full MD requirements who earned their master's level engineering/bioengineering degree at Stanford, the Department of Bioengineering will waive its normal departmental requirement of the 15 units applied towards the PhD degree (beyond the master's degree level) be formal course work. Consistent with the University PhD requirements, the department will instead accept 15 units comprised of courses, research, or seminars that are approved by the student's academic advisor and the department chair. Students not completing their MS engineering/bioengineering degree at Stanford will be required to take 15 units of formal course work in engineering related areas, as determined by their academic advisor.

If you have any further questions, please contact Olgalydia Urbano, Student Services Manager at ourbano@stanford.edu.

## *PhD First Year Advising*

### *Autumn Quarter*

Students will be assigned an initial faculty advisor on the basis of the research interests expressed in their application. Initial faculty advisors will assist students in selecting courses and identifying research opportunities. To ensure that an appropriate program is pursued, students will submit the following advising form by **October 22, 2008:**

1) Students completing the bioengineering master's degree (45 units) and studying for the Ph.D. degree will **only** submit the **Program Proposal for a Master's Degree Form**. (See the Master's Degree Program Overview on page 7 for instructions).

2) Students admitted to the Ph.D. program with an M.S. degree, will submit the **PhD First Year Advising Form** to be signed by the student's advisor and submitted to the Student Service Office, Clark Center S-166.

### *Spring Quarter*

In spring quarter of the first year, the assigned advisor will again meet with the student to evaluate his or her progress. **The First-Year Evaluation Report** must be submitted to the Student Services Office by June 16th of the student's first year in the Ph.D. program. A faculty meeting is scheduled to review Graduate student progress.

## *PhD First Year Requirements*

### *Lab Rotations*

The department will not require formal lab rotations, but students will be encouraged to explore research activities in two or three labs during their first academic year.

### *Choosing a Research Advisor*

Students must choose a research or thesis advisor prior to the end of summer quarter. The research supervisor assumes primary responsibility for future direction of the student and will ultimately direct the student's dissertation. Please notify the Student Service Office and your first-year advisor as soon as a research advisor is chosen.

### *Applying for Predoctoral Fellowship Applications*

All first-year Ph.D. students who are eligible to apply for outside predoctoral fellowships such as NSF, and NASA are strongly encouraged to do so. Applications for both are generally available in October and are due in November. Check with Student Services and Financial Aid for further details and any questions concerning eligibility. Students are encouraged to consult with their faculty advisers when preparing fellowship applications.

***Yearly Evaluations***

At the end of each academic year (usually in early June) the bioengineering faculty will evaluate the progress of all PhD students.

## *Qualifying Exam Process*

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.

During the first year of post-master's study, a student is expected to take and pass the PhD qualifying examination.

***Purpose of the Exam***

The PhD qualification exam has several goals.

1) To motivate students to review and synthesize course work and research material
2) To determine the student's ability to understand and apply fundamental concepts
3) To develop and test the student's ability to communicate orally and to respond to questions and comments
4) To evaluate the student's potential to pursue doctoral research
5) To identify areas that need to be strengthened for the student to be successful as a PhD student, independent scholar, and teacher.
6) To provide a mechanism for a range of faculty to come to know the student's capabilities

***Procedure for the Exam***

The procedure for the exam consists of six steps.

1) An Academic Council Member must be willing to supervise the student's PhD program and dissertation. The decision by the faculty member to supervise the student's program and dissertation is based on the potential of the student to become an independent scholar, and is based on many factors, such as the student's undergraduate and graduate course record, graduate record exam scores, and research, teaching and professional experience. The most important factor is the direct knowledge the faculty sponsor has obtained of the student's capabilities (e.g., as acquired through supervising the student in a multi-quarter project course, independent study, or as Research Assistant). The student must have a graduate Stanford GPA of 3.25 to be eligible for the exam. Students typically have a GPA of 3.50. Students are encouraged to take the exam during the academic year and to work together to prepare for the exam. Typically the exam is taken shortly after the student earns the masters degree.

2) Once a faculty member agrees to be the "faculty sponsor," the student must submit an application folder containing the items listed below (a-f) to initiate the PhD Qualification Exam. The faculty sponsor will notify the department faculty that the application has been submitted and is on file for perusal by the faculty at the Student Services Office. Normally, the application will be discussed at the next faculty meeting (but no sooner than one week). The application should contain the following:

   a) Updated transcripts of all undergraduate and graduate course work
   b) Curriculum vitae
   c) Calculation showing the student's GPA for courses taken at Stanford (Please exclude research and activity courses). http://registrar.stanford.edu/students/grades/gpa_calc.htm?id=1
   d) Research project abstract (<300words). This abstract should be written by the student and represent the topic on which the student would lecture if asked (see below)
   e) Preliminary dissertation proposal (one page). Knowledge and work of the student, and/or others, should be synthesized to present a rationale for the proposed dissertation topic (e.g., theory to be developed, hypotheses to be tested) as well as proposed methodology to fulfill the dissertation objective.
   f) A list of four independent areas in which the student feels he/she has depth. One of these areas must come from a fundamental engineering topic (e.g., thermodynamics, fluid mechanics, control systems, signal processing, mathematics). A second area must be from a biological or medical specialty (e.g., molecular biology, cell biology, neuromuscular physiology, cardiovascular medicine). The other two areas may come from any medical, biological, bioengineering, or other engineering topics that lead to a cohesive program of graduate study (e.g., genetics, developmental biology, biotechnology, neurology, medical imaging, computer graphics, mathematics, robotics, polymer physics). The student should discuss these areas with their advisor in the process of planning their graduate program and prior to preparation of their application folder.

3) The student, in absentia, will be evaluated by the faculty at one of their meetings (other faculty may be requested to be present to participate in the evaluation). The evaluation will be based on the student's potential to become an independent scholar (see #1). The faculty will determine if the student should be allowed to proceed to the next step in the PhD Qualifying Examination. If the student is not allowed to proceed, the faculty sponsor will convey to the student the reasons for the faculty's decision. Otherwise, the faculty will appoint a subcommittee consisting of three or four faculty, at least two of whom will be Academic Council Members of the Bioengineering Department.

4) The subcommittee is to obtain additional information regarding the student's potential to become an independent scholar. To accomplish this objective, the student will present to the subcommittee a 15-minute technical lecture on the topic contained in the abstract (see #2d). (One week prior to the lecture, the student will give each subcommittee member a one page "reminder" containing the short abstract of the lecture, and the time and place of the lecture.) This lecture, followed by a short question/answer session, will be open to all faculty and students. Afterwards, in a closed session (up to 1.5 hrs.) with the subcommittee, the student will answer additional questions regarding the topic presented at the lecture, the four areas chosen by the student (see #2f), the preliminary dissertation proposal (see #2e), or other related topics. (The two-hour time-slot and the place of the lecture and questioning will be arranged by the student and the faculty sponsor with consent of all subcommittee members.) The subcommittee will deliberate on all the information it has acquired (from the preliminary evaluation by the faculty [see #3], and from the lecture and the question/answer session) and will decide on a recommendation of pass, conditional pass, or fail (see #5). This recommendation will be communicated to the student.

5) Possible outcomes are that the student:

a) passes unconditionally;
b) passes conditionally;
In this case, the faculty will outline the weaknesses and how the conditions the student could (or must) fulfill before reconsideration (e.g., specific courses must be taken with performance at a specified level; communication skills need to be improved as evidenced by ….). With the faculty sponsors' endorsement, the student will later request a change from "conditional pass" to "pass" after he/she believes that the conditions have been fulfilled. The student will outline in this request the reasons for this belief. The faculty will meet again to act on the request.
c) fails, with or without option to retake.

6) The student's sponsor will notify the student and the Student Services Office of the results of the examination.

## *University PhD Requirements*

### *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.

Students must have at least three faculty members: the principal dissertation advisor and two other readers serve on their Doctoral Dissertation Reading Committee who read and certify their dissertation. At least two members must be on the Stanford Academic Council. It is expected that at least one member of the Bioengineering faculty be on each reading committee.

The Doctoral Dissertation Reading Committee Form is to be completed and filed with the Student Service Office ***before*** scheduling a University oral examination that is a defense of the dissertation. On occasion, the department chair, may in some cases, approve the appointment of a reader who is not on the Academic Council, if that person is particularly well-qualified to consult on the dissertation topic and holds a Ph.D. or equivalent foreign degree. Approval is requested on a Petition for Doctoral Committee Form.

### *PhD Candidacy*

Students must be admitted to candidacy by the 6th quarter of the student's post-master's registration. Being admitted to candidacy signifies that the department considers the student capable of completing the requirements necessary for earning a Ph.D. degree. Candidacy is valid for five calendar years (through the end of the quarter in which candidacy expires), unless terminated by the department for unsatisfactory progress. An extension of candidacy may be obtained for a maximum of one additional year. In order to receive candidacy status, the student must file the PhD candidacy form to the Student Service Office. This form is to be approved and signed by the advisor, reading committee and the Associate Chair of Graduate Curriculum, Dennis Carter.

### *Terminal Graduate Registration (TGR)*

TGR status is reached when Ph.D. students have been admitted to candidacy, completed 135 units of coursework, and submitted the Doctoral Dissertation Reading Committee form. Student Services will contact students when they are approaching TGR eligibility. Students must complete the following paperwork and submit it to the Student Service Office ***before the beginning of the quarter*** in which they first become eligible for TGR status:

a) Request for TGR Status

Students should then register for TGR Dissertation, **BIOE 802 (TGR Dissertation for zero units) each quarter** through AXESS. TGR Grading is as follows: "S" for satisfactory progress, "N-" for unsatisfactory progress, and "P" for a final grade when everything has been finished. A hold on registration is placed for a student who receives an "N-" grade for more than two consecutive quarters.

Students register at a special tuition rate, $2760/qtr in 2008-2009. As course work is no longer considered necessary during this advanced stage of study, units are no longer counted towards residency. Within certain restrictions and after tuition adjustment to the appropriate unit rate, TGR students may enroll in additional courses at their own expense. This year the TGR tuition rate will cover 3 units of tuition.

***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. Forms for the University oral scheduling and a one-page dissertation abstract should be submitted to the department student services office at least three weeks prior to the date of the oral for departmental review and approval.

Please consult with the Registrar's Office Publications and Forms page for the most current specifications for formatting of dissertations and procedures for completing and delivering dissertations. It is the student's responsibility to obtain all required signatures on all forms and on the dissertation. Dissertation Copies are distributed to the University Library, Archives, and the department. Students are responsible for purchasing bound copies for personal use.

***Graduation Quarter***

Registration is required for the term in which a student submits a dissertation or has a degree conferred. Students who meet the following conditions are eligible to be assessed a special tuition rate for the quarter in which they are receiving a degree.

All course work, degree requirements, and residency requirements have been completed; Graduate students must have enrolled in the applicable 801 or 802 section relevant to their degree during the Graduation Quarter. Master students should enroll in SPEC 801.

1. The student has formally applied to graduate via Axess.

2. The student has filed all necessary forms regarding Graduation Quarter before the first day of the term chosen as the Graduation Quarter.
3. A graduate student must have an active program status, which may include an approved leave of absence, in the term immediately preceding the term chosen as the Graduation Quarter (not applicable for undergraduates).
4. A graduate must have passed the oral examinations and successfully defended the dissertation/thesis. The graduate student has only to submit the dissertation/project or Master's thesis by the deadline for submission in the term designated as the Graduation Quarter (not applicable for undergraduates).

Students on Graduation Quarter are registered at Stanford and, therefore, have the rights and privileges of registered students. There is a registration fee of $100 for the Graduation Quarter; students will be assessed University health insurance (unless waived) and ASSU fees. Only **one** Graduation Quarter may be requested for each degree program. Students who, for whatever reason, are not graduated during the Graduation Quarter will be assessed a higher, standard tuition rate in subsequent terms. Requests should be directed to the Student Service Office.

***Commencement***

Commencement is held once a year in June. There are two ceremonies. The first one is the University ceremony (main event) and the department ceremony (diploma distribution) follows. Information about commencement is typically available around mid to late April.

***Personal Leave for Graduate Students***

If a break in continuous formal study is needed, graduate students must request a leave of absence from the department Chair. The maximum period of leave granted is one year. The Leave of Absence petition should explain the request and include a proposed schedule for completion of the Ph.D. degree, taking into account the requested leave period. A letter of support from the major adviser and the official University Leave of Absence form should also be submitted to the department Chair.

If the student is not able to resume studies by the quarter originally approved by the department Chair, a one-time extension may be granted. If she or he wishes to return after an approved leave of absence has expired, the student must apply for reinstatement. Financial support from the department cannot be guaranteed in the event of an extended leave of absence.

***Honor Code***

Stanford examinations are not proctored. This is not the tradition at many other universities. We do deal firmly with honor code violations. Students have been suspended, and have had degree conferral delayed, following convictions for honor code violations. Please read the Stanford University Honor Code.

## Bioengineering Faculty Directory
## (The Prefix For All Campus Numbers is 72*)*

| **Professors** | **Email** | **Research** | **Phone/Location** |
|---|---|---|---|
| Russ Altman<br>Chair, Professor | Russ.Altman@stanford.edu | Biomedical Computation | 5-3394, Clark S170 |
| Annelise Barron<br>Associate Professor | aebarron@stanford.edu | Polymer and Colloidal Science and Biotechnology | 1-1151, Clark W300B |
| Kwabena Boahen<br>Associate Professor | boahen@stanford.edu | Neural Systems in Silicon | 4-5633, Clark W125 |
| Zev Bryant<br>Assistant Professor | zevry@stanford.edu | Molecular Biophysics | 4-3090, Clark E302 |
| Dennis Carter<br>Professor | dcarter@stanford.edu | Skeletal Mechanobiology | 3-4784, Durant 215 |
| Jennifer Cochran<br>Assistant Professor | cochran1@stanford.edu | Cell and Molecular Engineering | 4-7808, Clark W250 |
| Markus Covert<br>Assistant Professor | mcovert@stanford.edu | Systems Biology | 5-6615, Clark W153 |
| Karl Deisseroth<br>Assistant Professor | deissero@stanford.edu | Neuroscience Cell and Tissue | 6-4325, Clark W083 |
| Scott Delp<br>Professor | delp@stanford.edu | Neuromuscular Biomechanics | 5-4009, Clark S321 |
| Drew Endy<br>Assistant Professor | endy@stanford.edu | Synthetic Biology | Y2E2Bldg, Rm. 269B |
| KC Huang<br>Assistant Professor | kchuang@stanford.edu | Molecular Biophysics | 1-2483, Clark S325 |
| Norbert Pelc<br>Professor | pelc@stanford.edu | Biomedical Imaging | 3-0435, Lucas P263 |
| Stephen Quake<br>Co-Chair, Professor | quake@stanford.edu | Biofluidics | 4-8891, Clark E300 |
| Matthew Scott<br>Professor | mscott@stanford.edu | Developmental Biology | 5-7680, Clark 200B |
| Christina Smolke<br>Assistant Professor | csmolke@stanford.edu | Synthetic Biology | Arriving Wtr Qtr, Y2E2 269A |
| James Schwartz<br>Professor | jswartz@stanford.edu | Cell and Molecular Engineering | 3-5398, Keck 185 |
| Charles Taylor<br>Associate Professor | taylorca@stanford.edu | Cardiovascular Biomechanics | 5-6128, Clark E350B |
| Paul Yock<br>Professor | yock@stanford.edu | Biomedical Devices | 6-1160, Clark E100 |

## *Bioengineering Administration*

| | |
|---|---|
| Raul Felipa, Director of Finance and Administration | felipa@stanford.edu |
| Jennifer Su, Grants Manager | jsul@stanford.edu |
| Tiffany Murray, Faculty Affairs Coordinator | tiffany.murray@stanford.edu |
| Olgalydia Urbano-Winegar, Student Services Manager | ourbano@stanford.edu |
| Lisa Lambeth, Student Services Specialist | llambeth@stanford.edu |
| Christina Fan, Student Coordinator | chfan@stanford.edu |
| Craig Goergen, Student Coordinator | cgoergen@stanford.edu |

### *Facilities*

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 James H. Clark Center, Allen Center for Integrated Systems, William F. Durand Building for Space Engineering and Science, William M. Keck Science Building, and the Richard M. Lucas Center for Magnetic Resonance Spectroscopy and Imaging.

### *Responsibility of Living in Clark*

- Bike Parking is on the east and west side of the building. Please do not park bikes in the courtyard, or along the handrails, as this creates a hazard.
- The seminar rooms and auditorium are available for general use, but must be reserved ahead of time through the online reservation system. Please contact Lisa Lambeth, Student Services Specialist for assistance. Conference rooms located on each floor are available to Clark residents only.
- Requests for IT support are made directly online at https://helpsu.stanford.edu When submitting your help ticket, select "Clark Center" for the department in the drop down box on the web form. You may also phone 650-725-HELP and mention Clark Center to the consultant.

### *Staying Connected*

Never hesitate to call security. They are here to help you feel safe and be secure in your work place. If you see something suspicious, if you are in harm's way, or if you are alone here at night and want an escort to your car, please call them. Security: 723-7222

Everyone working in Clark should subscribe to the Clark Center e-mail distribution list. This is the Clark center's primary means of disseminating information to all occupants of the building. Please send an e-mail to majordomo@lists.stanford.edu, and put "subscribe clark_center" in the body of the message.

Student email lists are as follows:
bioengphd@lists.stanford.edu (PhD students)
bioengmasters@lists.stanford.edu (MS students)
bioecoterm@lists.stanford.edu (Coterm students)
bioesocial@lists.stanford.edu (Everyone)

### *Student Lounges*

The bioengineering student lounge, located next to the Student Service Office is a great place to take a break. The Clark building is wireless so you can take your computer anywhere. NeXus restaurant is open until 7:00pm. Feel free to gather there before or after lunch time. The most obvious places are Peet's Coffee (on the third floor) and the many tables and chairs scattered throughout the exterior terraces, and the courtyard. In case you are looking for a calming walk, Clark has close to one mile of exterior walkways with fabulous views.

### *Mail*

Graduate students will have shared mailboxes located in the Student Service Office in Clark Center S-166. Please check your mail periodically.

### *Student Organizations*

***Stanford Student Biodesign (SSB)***

This group aims to prepare students for careers in biotech, biomedical technology, bioengineering, and other fields at the intersection of life sciences and engineering. They offer career seminars, lectures, dinners with industry and faculty, community service opportunities, and hands-on innovation experience.

***BioMass***

BioMedically Affiliated Stanford Students (BioMASS) provides useful career resources and information, arranges fun social events, and imparts a political voice to the approximately 600 students enrolled in biological science graduate programs in 14 research departments here at Stanford University.

**BioNeXus**

BioNeXus is a student group on campus aiming to promote collaboration and a greater sense of community among Bio-X graduate students and post-docs, for both research and recreation.

### *Places to Get Help*

Problems and conflicts can arise over the course of your graduate career. If you are having a conflict, let the other person know as they might be unaware of the situation. However, realize that you are not alone in the process. Here is just a sample of individual/offices that you can turn to. They are not listed in any particular order, so feel free to chat with whomever you feel most comfortable with.
CAPS-Counseling Services (completely confidential) 723-3785
Bridge Peer Counseling Center, (completely confidential) 723-3392
Olgalydia Urbano, Student Services Manager

## *Campus Computer Resources*

There are a numerous facilities and options for computer resources at Stanford. Most students have their own computers, but there are many places on campus for non-owners to use computers.

**Meyer Computer Cluster/Multimedia Studio** 723-9407
The second floor of Meyer Library is home to a state-of-the-art multimedia production facility available to anyone with an e-mail account. It includes digital-film video workstations, video editing stations, flat bed and 35mm slide scanners, MIDI keyboards, and removable media disc drives. Meyer also possesses a large bank of PCs and Macs. Connection stations in the cluster allow you to hook your laptop into SUNet.

**Tresidder LAIR Computer Cluster** 723-1315
The LAIR on the second floor of Tresidder offers a self-serve cluster of PCs and Macs that are accessible 24 hours a day!

**Sweet Hall UNIX Cluster** 725-2101
For those who are UNIX savvy and in need of real computational power, the 24-hour Sweet Hall UNIX cluster should provide relief. It houses 150 HP, SGI and Sun workstations and free printing.

**Visual Arts Services** 723-6813
If you need to produce high quality slides, posters, or color handouts, visit Visual Arts Services on the first floor of the Medical School Office Building (MSOB).

**Lane Medical Library's Medical Informatics Training Lab (MITL):** The MITL is a facility where students, faculty, and staff can explore computer-based medical resources, work with multimedia software, and conduct small classes for Medical Center affiliates. When not in use as a classroom, the MITL is available for general computing use. The MITL houses both Windows XP and Macintosh G4 workstations. A graphics workstation with flat-bed and slide scanners allows scanning of paper, X-rays, slides and file. Both color and black and white, duplex printers are also available. Medical center personnel who require after-hours access to computing equipment may request to use the MITL 24-hour access room. The MITL is located in M202 and offers substantial consulting support for School of Medicine and Medical Center personnel. Wireless network access is available in the 24 hour study/computer rooms.

**Residential Computer Consultants (on-campus housing)**
If you live on campus and have a personal computer, you can hook up to the network from your room. Ask you Residential Computer Consultant (RCC) for more details about PhoneNet and Ethernet connections or visit their web site at http://rescomp.stanford.edu. Each residence hall also has its own computer cluster.

**Microdisc Department** (at the Stanford bookstore)
When purchasing a computer or software, try the Microdisc Department in the main campus Stanford bookstore. Microdisc offers educational discounts on personal computers, peripherals and software. They have a demonstration area where you can try the merchandise and an on-site service center.