Bioengineering Related Graduate Courses
Spring 2019

ENGR 220A, Molecular Bioengineering  This course introduces students to molecular components of biology with application of engineering principles for analysis. Topics include: molecular components of cells, DNA/RNA structure and function, protein structure/function/folding, gene and protein regulation, DNA replication, and experimental and computational research methods. 3 units. T R 9:30 am - 10:45 am

ENGR 220B, Molecular Bioengineering  introduces students to structural components of cells with application of engineering principles for analysis. Topics include: biomembrane structure and function, membrane proteins, membrane transport, intracellular compartments, intracellular trafficking, chemotaxis, cell cycle, apoptosis, and stem cells. 4 units. T R 9:30 am - 10:45 am

ENGR 220C, Tissue/Systems Bioengineering  This course introduces students to tissue and organism-level organization with application of engineering principles for analysis. Topics include: cardiovascular, respiratory, digestive, and central nervous systems, structural components of organisms (bones and muscles), immune system, and of pharmacology. 3 units. T R 9:30 am - 10:45 am

ENGR 225, Current Topics in Bioengineering  Seminar series highlighting current topics and advances in bioengineering presented by UCSB faculty or visiting scientists providing context and motivation for bioengineering learning, introducing students to concepts outside of their primary research specialty, and promoting interdisciplinary thinking and research collaboration. 1 unit. R 2:00 pm - 3:15 pm

ENGR 230, Bioengineering Student Seminar  Seminar series where students present their original thesis research and also review journal articles that critically analyze contemporary bioengineering research. Three quarters of ENGR 230 are required for the optional BioE graduate emphasis. Presentations will be evaluated and feedback provided. 1 unit. T 2:00 pm - 3:15 pm
**BMSE 201A, Protein Structure and Function** Traces the physical interactions by which sequence-specific polypeptides attain a unique, functional native state. Fold design, fold prediction, and protein folding kinetics are also discussed. 2 units. T R 9:30 am - 10:45 am

**BMSE 204, MCDB 245, Post-translational Protein Processing**
Structure/function relationships in interesting macromolecules isolated from marine organisms. Focus is on well-characterized pathways from horseshoe crabs, abalones, mussels, and fish as well as others. 4 units. T R 11:00 am - 12:15 pm, F 9:00 am - 9:50 pm

**BMSE 215, Biophysical Thermodynamics** An overview of those parts of chemical thermodynamics relevant to the study of biomolecules and biological systems. Topics include fundamental biopolymer structure formation. 2 units. T R 9:30 am - 10:45 am

**BMSE 219, Microscopy for Quantitative Biology** Fluorescence live imaging is a powerful tool to study dynamics of living matter. This course provides an overview on geometric and frontier optics, bright field microscopy fluorescence and absorption spectroscopy. Practicing these concepts students will construct a light-sheet microscope. Goals: Fluorescence: Basic components of the microscope for manipulating light; Diffraction and interference for image formation; Complex microscope systems, e.g. EPI, Confocal, 2 photon, Light sheet. 2 units. T R 12:30 pm - 1:45 pm

**BMSE 223, Chem 223, MCDB 223, Signal Transduction** A cell’s growth is controlled by positive and negative cues from its surroundings. A discussion of the cell’s signaling mechanisms that recognize these cues and initiate an intracellular set of events that generates a response. 3 units. M W F 9:00 am - 9:50 am

**BMSE 265, BMSE Seminar Discussion Group** A weekly seminar discussion group to review, in advance, relevant literature of participating BMSE seminar guests. 1 unit. T 3:00 pm - 4:00 pm

**BMSE 272, MATRL 272, Mechanical Force and Biomolecules**
Explores single-molecule biophysics and the role of mechanical force
in biomolecular behavior. Emphasis is placed on modern experimental techniques and the effects of mechanical stress on DNA conformation, protein unfolding, and force-generation by motor proteins. Recent literature is used throughout. 

### BMSE 290BP, Group Studies: Bacterial Pathogenesis
Presentation and discussion of current research, to be selected from the following list: BP. Bacterial Pathogenesis. 

**2 units. TBA**

### BMSE 290CE, Group Studies: C. elegans Development
Presentation and discussion of current research, to be selected from the following list: CE. C. elegans Development. 

**2 units. TBA**

### BMSE 290DN, Group Studies: Development Neurobiology
Presentation and discussion of current research, to be selected from the following list: DN. Developmental Neurobiology. 

**2 units. TBA**

### BMSE 294B, MCDB 294B, Bioengineering: Career and Development Opportunities
Based on presentations by experts from the bioengineering industry. Presenters describe their companies’ technologies and developments, including biosensors, therapeutics, tissue engineering, quantum dots and advanced instrumentation. Training and educational requirements for different career tracks are discussed. 

**2 units. M 10:00 am - 12:00 pm**

### BMSE 595, Biochemistry/Molecular Biology Literature Seminar
A critical review of research in selected areas of biochemistry-molecular biology. 

**2 units. TBA**

### BMSE 595BG, Biochemistry/Molecular Biology Literature Seminar
A critical review of research in selected areas of biochemistry-molecular biology. 

**2 units. TBA**

### CH E 272, Omics-enabled Biotechnology
Integrates genomic, transcriptomic, metabolomic, and proteomic approaches to quantify and understand intricate biological systems. Complementary bioinformatics approaches to curate the large datasets associated with these experiments are also discussed. Recent examples from the literature reinforce core concepts, ranging from applications to human health to
the environment. By the end of the course, students should be able
to design an integrated experiment that capitalizes on these “omics”-
based approaches to enhance the scope of their research. 3 units. M
W 12:30 pm - 1:45 pm

CH E 294B, Bioengineering Based on presentations by experts from
the bioengineering industry. Presenters describe their companies’
technologies and developments, including biosensors, therapeutics,
tissue engineering, quantum dots and advanced instrumentation.
Training and educational requirements for different career tracks are
discussed. 2 units. T R 12:00 pm - 1:50 pm

CHEM 223, BMSE 223, MCDB 223, Current Events Organic Chemistry
Faculty and students present and critically discuss current chemical
literature.

CHEM 239, Selected Topics in Organic Chemistry Selected top-
ics from organic chemistry the contents of this course will vary. 1-4
units. T R 2:00 pm - 3:15 pm

CHEM 242C, Chemical Aspects of Biological Systems Macromolecular
biosynthesis and specialized cellular processes. A survey of nucleic
acid and protein biosynthesis, characterization of lipids and mem-
branes; function of membranes in transport, energy transduction, and
cellular control; mechanisms of muscle contraction and cell motility;
neurochemistry. 3 units. T R 2:00 pm - 3:15 pm

CHEM 245, Computational Biochemistry Introduction to molecular
modeling and molecular dynamics. Discussion of practical considera-
tions of energy minimization, solvent modeling, structure-based drug
design. Practical computer graphics experience. 3 units. T R 3:30
pm - 4:45 pm

CHEM 262A, Drug Design Sources for new drugs. Biochemistry of
diseases. Target validation techniques. Mechanism of action of en-
zymes and receptors. Enzyme inhibition and receptor binding stud-
ies. Structure base drug design: conformational analysis, docking and
binding affinity calculations. Course also teaches proposal writing
skills. 3 units. M W F 11:00 am - 11:50am
CHEM 290, Seminar in Chemistry and Biochemistry  Presentation of seminar required of all departmental graduate students.  2 units. F 10:00 am - 11:50 am

CMPSC 281B, Advanced Topics in Computer Vision  Advanced topics in computer vision: image sequence analysis, spatio-temporal filtering, camera calibration and hand-eye coordination, robot navigation, shape representation, physically-based modeling, regularization theory, multi-sensory fusion, biological models, expert vision systems, and other topics selected from recent research papers.  4 units. M W 1:00 pm - 2:00 pm

DYNS 592, DYNS Seminar  Research seminar for special interest groups in dynamical neuroscience.  1 unit. TBA

ECE 281B, Advanced Topics in Computer Vision  Advanced topics in computer vision: image sequence analysis, spatio-temporal filtering, camera calibration and hand-eye coordination, robot navigation, shape representation, physically-based modeling, multi-sensory fusion, biological models, expert vision systems, and other topics selected from recent research papers.  4 units. T R 1:00 pm - 2:00 pm

ECE 594Q, Nanotechnology  Instruction in these variable unit courses may be carried out by lecture, by laboratory, or by a combination of these. These courses provide a study of topics of current interest in various areas of electrical and computer engineering.  1-5 units. M W 12:00 pm - 1:50 pm

ECE 595E, Group Studies in Electrical and Computer Engineering  Instruction in research group meetings carried out by lecture, by laboratory, or by a combination of the two. Courses provide a critical review of research in various areas of electrical and computer engineering. E. signal processing.  1 unit. TBA

EEMB 511, Writing Science-EEMB Colloquium  A hands-on workshop to polish writing skills. Modules focus on “story telling” to make ideas compelling, streamlining to make writing compact and effective, and developing flow of ideas and paragraphs. Students work on a chapter, paper, or proposal.  2 units. R 12:00 pm - 2:50 pm
**EEMB 595EV, Evolutionary Biology** A critical review of research in selected fields of biology. 2 units. R 3:00 pm - 4:50 pm

**EEMB 595TE, Theoretical Ecology and Evolution** Focus on Bayesian Methods, featuring special guest instructor Grace DiRenzo. 2 units. TBA

**MATRL 200C, Structure Evolution** Study of phenomena underlying the evolution of structure across the relevant length and time scales in Materials. Structural defects. Driving forces, mechanisms and kinetics of structural change. Diffusional transport. Fundamentals of phase transformations. Crystallization. Evolution of microstructural features and patterns. 4 units. M W 9:00 am - 10:50 am, F 9:00 am - 10:50 am

**MATRL 222A, Structure Evolution** Study of phenomena underlying the evolution of structure across the relevant length and time scales in Materials. Structural defects. Driving forces, mechanisms and kinetics of structural change. Diffusional transport. Fundamentals of phase transformations. Crystallization. Evolution of microstructural features and patterns. 4 units. M W 9:00 am - 10:50 am, F 9:00 am - 10:50 am

**MATRL 226, Symmetry and Tensor Properties of Materials** Description of the principles of crystal symmetry, functional materials, and their properties, including dielectrics, piezoelectrics, and magnetic and transport phenomena. Fundamental concepts, tensorial and mathematical description of functional behavior. 3 units. T R 9:30 am - 10:45 am

**MATRL 228, Computational Materials** Basic computational techniques and their application to simulating the behavior of materials. Techniques include: finite difference methods, MonteCarlo, molecular dynamics, cellular automata, and simulated annealing. 3 units. T R 2:00 pm - 3:15 pm

**MATRL 271C, Properties of Macromolecules** Fundamentals of the properties of macromolecular solutions, melts, and solids. Viscosity, diffusion and light scattering from dilute solutions. Elements of
macromolecular solid state structure. Thermal properties and processes. Mechanical and transport properties. Introduction to electrical and optical properties of macromolecules. 3 units. T R 9:30 am - 10:45 am

MATRL 272, BMSE 272, Mechanical Forces and Biomolecules
See BMSE 272 for course description.

MATRL 278, Interaction in Biomolecular Complexes Focuses on the interactions, structures, and functional properties of complexes comprised of supramolecular assemblies of biological molecules. Systems addressed include lipid molecules. Systems addressed include lipid membranes, lipid-DNA complexes, and assemblies of proteins of the cell cytoskeleton. 3 units. T R 11:00 am - 12:15 pm

MCDB 223, Ch E 223, BMSE 223, Signal Transduction See BMSE 223 for course description.

MCDB 225, Development The molecular mechanisms of pattern formation and cellular differentiation that underlie developmental processes in a variety of important model systems. 2 units. M W F 9:00 am - 9:50 am, T R 8:00 am - 9:15 am

MCDB 226C, Basic Pharmacology: Principles and Chemotherapy Fundamental principles of pharmacology, drug-receptor theory, biochemical mechanisms of action of drugs. 4 units. M W F 10:00 am - 10:50 am, F 9:00 am - 9:50 am, W 8:00 am - 8:50 am

MCDB 245, BMSE 204, Post-Translational Protein Processing See BMSE 204 for Course Description.

MCDB 246, Stem Cell Biology in Health and Disease Basic biology of embryonic and adult stem cells and nuclear transfer, with emphasis on latest findings from the current literature. 4 units. M W 2:00 pm - 3:15 pm

MCDB 253, Neurobiology III: Developmental Neurobiology This course begins with fertilization and moves through sequential stages in the development of the nervous system, including cell migration and differentiation, axon outgrowth and pathfinding, programmed
cell death, synaptogenesis, learning, memory, neurodegenerative conditions and current strategies for neuronal regeneration. 4 units. T R 9:30 am - 10:45 am

**MCDB 263, Progress in Biochemistry and Molecular Biology**
Research seminars presented by invited speakers on current research topics. 1 unit. R 11:00 am - 12:15 pm

**MCDB 294B, BMSE 294B, Bioengineering: Career and Development Opportunities**
Based on presentations by experts from the bioengineering industry. Presenters describe their companies’ technologies and developments, including biosensors, therapeutics, tissue engineering, quantum dots and advanced instrumentation. Training and educational requirements for different career tracks are discussed. 2 units. M 10:00 am - 12:00 pm

**ME 225BP, Methods in Mechanobiology and Biofabrication**
Cell mechanobiology topics including cell structure, mechanical models, and chemo-mechanical signaling. Review and apply methods for controlling and analyzing the biomechanics of cells using traction force microscopy, AFM, micropatterning and cell stimulation. Practice and theory for the design and application of methods for quantitative cell mechanobiology. Weekly lecture and hands-on laboratory sessions. 3 units. T R 12:30 pm - 1:45 pm

**ME 292, Design Transducer**
Design issues associated with microscale transduction. Electrodynamics, linear and nonlinear mechanical behavior, sensing methods, MEMS-specific fabrication rules, and layout are all covered. Modeling techniques for electromechanical systems are also discussed. 3 units. M W 8:00 am - 9:15 am

**PSTAT 231, Data Mining**
Introduction to data mining techniques. Model assessment and performance evaluation. Data preparation. Programming techniques for transforming raw data into a form suitable for predictive modeling. Extracting data to a form that predictive models can utilize. Incorporating non-numeric data in predictive models. Techniques for managing exceptional and extreme data. Building predictive models using SAS Enterprise Miner 5 in SAS 9, including Decision Trees, Neural Networks, and Bayesian Networks. 4 units. T R 5:00 pm - 6:15 pm
PSTAT 274, Time Series Stationary and non-stationary models, seasonal time series, ARMA models: calculation of ACF, PACF, mean and ACF estimation. Barlett’s formula, model estimation: Yule-Walker estimates, ML method. Identification techniques, diagnostic checking, forecasting, spectral analysis, the periodogram. Current software and applications. 4 units. M W 11:00 am - 12:15 pm

PSY 221C, Multivariate Analysis in Psychology and Related Social Sciences The use in psychology of the general linear model, multiple regression, discriminant function analysis, factor-analysis, and principal components analysis 4 units. T R 9:30 am - 11:00 am; F 9:00 am-10:50 am

PSY 269, Neuroanatomy An examination of the organization of the vertebrate nervous system. Topics include neurohistological techniques; neurology and neuropsychology; comparative neuroanatomy; neural degeneration; developmental neuroscience. 4 units. W 9:00 am - 11:50 am