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## Bioengineering Graduate Courses and Technical Electives Fall 2019

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**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*

**Now offered in Winter 2020: 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*

**Technical Electives** The optional Bioengineering Emphasis course requirement includes 1 (or more) technical elective(s). *Technical Electives for emphasis must equal 4 units.*

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**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 11:00 am - 12:15 pm*

**BMSE 201B, Chemistry and Structure of Nucleic Acids** Primary, secondary, and higher-order structures of DNA and RNA, thermodynamic stability and folding, protein-nucleic acid interactions, ribozymes, applications to gene regulation, RNA world evolution. *2 units. T R 12:00 pm - 1:45 pm*

**BMSE 205A, Biochemical Techniques** Practical theory and application of basic biochemical techniques. Topics include SDS-PAGE,

buffers, centrifugation, antibody methods, spectroscopy and fluorescence techniques. *1 unit. T R 8:00 am - 9:50 am*

**BMSE 229, Protein Biochemistry** Discussion topics relevant to structure-function relationships in proteins including the chemical reactivity of amino acid side chains, posttranslational modifications, and the covalent and noncovalent interactions of multimeric structures. Case studies involve recent advances in structure-function relationships of mechanoproteins. *2 units. M W F 10:00 am - 10:50 am*

**BMSE 235, Experimental Strategies in Molecular Genetics** Discussion of experimental strategies used to purify, analyze, and manipulate nucleic acids, isolate molecular clones from complex genomes, physically map genomes, analyze gene expression, and perform reverse genetics. *1 unit. M W F 10:00 am - 10:50 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 290A, Group Studies: Biomolecular Materials Synthesis** Presentation and discussion of current research, to be selected from the following list: A. Biomolecular Materials Synthesis. *2 units. TBA*

**BMSE 290B, Group Studies: Biomineralization** Presentation and discussion of current research, to be selected from the following list: B. Biomineralization. *2 units. TBA*

**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: Developmental Neurobiology** Presentation and discussion of current research, to be selected from the following list: DN. Developmental Neurobiology. *2 units. TBA*

**BMSE 290HW, Group Studies: Marine Structural Proteins** Presentation and discussion of current research, to be selected from the following list: HW. Marine Structural Proteins. *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 226, Computational Chemistry** Introduction to computational chemistry and molecular modeling. Applications of molecular mechanics, quantum mechanics, and computer graphical interfaces to problems in chemistry, biochemistry, drug design, and pharmacology. *3 units. M W F 1:00 pm - 1:50 pm*

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

**CHEM 242A, Chemical Aspects of Biological Systems** Macromolecular biosynthesis and specialized cellular processes. A survey of nucleic acid and protein biosynthesis, characterization of lipids and membranes; function of membranes in transport, energy transduction, and cellular control; mechanisms of muscle contraction and cell motility; neurochemistry. *3 units. M W F 10:00 am - 10:50 am*

**CHEM 243, The RNA World** Introduction to RNA structure and thermodynamics. Biological roles of RNA in contemporary organisms. Implications for the origins of life. *3 units. T R 9:30 am - 10:45 am*

**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*

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

**ECE 235, Stochastic Processes in Engineering** A first-year graduate course in Stochastic processes, including: review of basic probability; gaussian, poisson, and Wiener processes; wide-sense stationary processes; covariance function and power spectral density; linear systems driven by random inputs; basic Wiener and Kalman filter theory. *4 units. M W 4:00 pm - 5:50 pm*

**ECE 277, Pattern Recognition** Principles and design of pattern recognition systems. Statistical classifiers: discriminant functions; bayes,

minimum risk, k-nearest neighbors, perceptrons. Clustering and estimation; criteria; k-means, fuzzy, hierarchical, graph-theoretic, simulated and deterministic annealing; maximum likelihood and bayesian methods: nonparametric methods. Overview of applications. *4 units. T R 12:00 pm - 1:50 pm*

**ECE 594Z, Special Topics in Electrical and Computer Engineering: Imaging Systems**

Instruction in these 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. *4 units. T R 10:00 am - 11:50 am*

**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 595T, Parasitology**

A critical review of research in selected fields of biology. *2 units. M 2:30 pm - 3:30 pm*

**EEMB 595TE, Theoretical Ecology and Evolution**

Focus on Bayesian Methods, featuring special guest instructor Grace DiRenzo. *2 units. TBA*

**MATRL 276A, Biomolecular Materials I: Structure and Function**

Survey of classes of biomolecules (lipids, carbohydrates, proteins, nucleic acids). Structure and function of molecular machines (enzymes for biosynthesis, motors, pumps). *3 units. T R 11:00 am - 12:15 pm*

**MCDB 226A, Basic Pharmacology**

History and scope of pharmacology as a basic science; principles of drug action and relationship of

pharmacology to physiology, chemistry, biochemistry emphasized. *4 units. M W F 9:00 am - 9:50 am*

**MCDB 226A, Basic Pharmacology** History and scope of pharmacology as a basic science; principles of drug action and relationship of pharmacology to physiology, chemistry, biochemistry emphasized. *4 units. T 8:00 am - 9:15 am, 9:30 am - 5:00 pm; T 8:00 am - 9:15 am, R 9:30 am - 5:00 pm*

**MCDB 226AL, Basic Pharmacology Lab** Analysis of drug sites and mechanisms of action using isolated tissues, organs, and intact animal preparations.. *4 units. T 9:30 - 5:00 pm*

**MCDB 229, Protein Biochemistry** Discussion topics relevant to structure-function relationships in proteins including the chemical reactivity of amino acid side chains, posttranslational modifications, and the covalent and noncovalent interactions of multimeric structures. Case studies involve recent advances in structure-function relationships of mechanoproteins. *2 units. M W F 10:00 am - 10:50 am*

**MCDB 231, General Microbiology** Introduction to biological properties of microorganisms historical foundations of the field of microbiology; a study of major groups of microorganisms, their structure, physiology, cultivation, and pathogenicity. *4 units. M W F 10:00 am - 10:50 am*

**MCDB 251, Neurobiology I: Cellular Organization and Biophysics of the Nervous System** Nervous system properties ranging from single cells to whole organisms, using examples from vertebrates/invertebrates studied in terms of morphology, physiology, behavior. *4 units. M W 3:30 pm - 4:45 pm*

**MCDB 263, Progress in Biochemistry and Molecular Biology** Research seminars presented by invited speakers on current research topics. *1 unit. W 3:00 pm - 4:00 pm*

**MCDB 266, Optogenetics and Functional Imaging** Class is a journal club based on primary literature with rotating presenters and active discussion. This quarter we will focus on Channelrhodopsin and GCaMP, covering the original papers, new variants, and best use

cases. Optogenetics is ten years old now and has proven to be a powerful technique to identify behaviorally critical brain regions and map neural circuit connections. Imaging neuronal activity, in the the whole brain of behaving animals, is now possible. Come learn about the development, potential and caveats of these tools. *1 unit. TBD*

**ME 219, Mechanics of Materials** Matrices and tensors, stress deformation and flow, compatibility conditions, constitutive equations, field equations and boundary conditions in fluids and solids, applications in solid and fluid mechanics. *3 units. T R 12:30 pm - 1:45 pm*

**ME 220A, Fundamentals of Fluid Mechanics** Introductory course in fluid mechanics. Basic equations of motion (continuity, momentum, energy, vorticity), coordinate transformations, "potential" flow, thin airfoil theory, conformal mapping, vortex dynamics, boundary layers, stability theory, laminar/turbulent transition, turbulence. Inviscid/viscid, irrotational/rotational, incompressible/ compressible flow examples. *3 units. T R 11:00 am - 12:30 pm*

**PSTAT 231, Introduction** 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. Bartlett'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 2:00 pm - 3:15 pm*

**PSY 211, Basic Concepts in Behavioral Neuroscience** Intended to provide fundamental understanding of neuroscience and behavior for graduate students at the beginning of their studies. Provides a broad

overview of brain function with focus on the molecular, cellular, system, and behavioral level of analysis in order to instill a comprehensive appreciation of the biological mechanisms important to behavior. *4 units. M W 3:30 pm - 4:45 pm*

**PSY 265, Computational Neuroscience** Survey of methods in computational neuroscience; single cell methods including Hodgkin-Huxley models, occupation theory, integrate-and-fire models; neural network modeling including linear system theory, nonlinear dynamics, connectionism, Hodgkin-Huxley-like network models, models of synaptic plasticity, methods for generating predicted BOLD signals. *4 units. M W 11:30 am - 12:45 pm*

**PSY 268, Brain Development** An examination of the major developmental events producing the organization and connectivity of the nervous system. offered concurrently with Psychology 168, but graduate students will be required to complete additional reading and writing assignments.. *4 units. M W 5:00 pm - 6:15 pm*