

# Biomedical Sciences

OFFICE: 5008 Basic Science Building,  
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<http://biomedsci.ucsd.edu>

## Professors

Kim E. Barrett, Ph.D., *Medicine*  
Timothy D. Bigby, M.D., *Clinical Medicine*  
Roland C. Blantz, M.D., *Medicine*  
Gerry R. Boss, M.D., *Medicine*  
Philip Bourne, Ph.D., *Pharmacology*  
Joan Heller Brown, Ph.D., *Pharmacology (Chair)*  
Laurence L. Brunton, Ph.D., *Pharmacology/*  
*Medicine*  
John M. Carethers, M.D., *Medicine*  
Dennis A. Carson, M.D., *Medicine*  
Webster K. Cavenee, Ph.D., *Medicine*  
Shu Chien, M.D., Ph.D., *Bioengineering/Medicine*  
Mario Chojkier, M.D., *Medicine*  
Jerold J. M. Chun, Ph.D., *Pharmacology (Adjunct)*  
Don W. Cleveland, Ph.D., *Medicine*  
James W. Covell, M.D., *Medicine (Emeritus)*  
Edward Dennis, Ph.D., *Pharmacology/Chemistry*  
*and Biochemistry*  
Wolfgang H. Dillmann, M.D., *Medicine*  
Jack E. Dixon, Ph.D., *Pharmacology/Cellular and*  
*Molecular Medicine/Chemistry and*  
*Biochemistry (Dean, Scientific Affairs)*  
Daniel Donoghue, Ph.D., *Chemistry and*  
*Biochemistry*  
Steven F. Dowdy, M.D., *Cellular and Molecular*  
*Medicine*  
Mark H. Ellisman, Ph.D., *Neurosciences*  
Scott D. Emr, Ph.D., *Cellular and Molecular*  
*Medicine*  
Gregory F. Erickson, Ph.D., *Reproductive Medicine*  
Jeffrey Esko, Ph.D., *Cellular and Molecular*  
*Medicine*  
Ronald M. Evans, Ph.D., *Biology (Adjunct)*  
Sylvia Evans, Ph.D., *Pharmacy/Pharmacology*  
Marilyn G. Farquhar, Ph.D., *Cellular and*  
*Molecular Medicine (Chair)*  
James R. Feraisco, Ph.D., *Medicine/*  
*Pharmacology*  
Theodore Friedmann, M.D., *Pediatrics*  
Xiang-Dong Fu, Ph.D., *Cellular and Molecular*  
*Medicine*  
Wayne Giles, Ph.D., *Bioengineering/Medicine*  
Gordon N. Gill, M.D., *Medicine*  
Mark Ginsberg, M.D., *Medicine*

Christopher K. Glass, M.D., Ph.D., *Cellular and*  
*Molecular Medicine/Medicine*  
Lawrence S. B. Goldstein, Ph.D., *Cellular and*  
*Molecular Medicine*  
Tracy Handel, Ph.D., *Pharmacy*  
Stephen Hedrick, Ph.D., *Cellular and Molecular*  
*Medicine*  
Michael C. Hogan, Ph.D., *Medicine (Adjunct)*  
Vivian Hook, Ph.D., *Pharmacology*  
Stephen B. Howell, M.D., *Medicine*  
Paul A. Insel, M.D., *Pharmacology/ Medicine*  
Wolfgang Junger, Ph.D., *Surgery (Adjunct)*  
Martin F. Kagnoff, M.D., *Medicine*  
Michael Karin, Ph.D., *Pharmacology*  
Kenneth Kaushansky, M.D., *Medicine (Chair)*  
Carolyn J. Kelly, M.D., *Medicine (In-Residence)*  
John Kelsoe, M.D., *Psychiatry*  
Thomas J. Kipps, M.D., Ph.D., *Medicine*  
Theo Kirkland, M.D., *Pathology/Medicine*  
*(In-Residence)*  
Richard Kolodner, Ph.D., *Medicine*  
Elizabeth A. Komives, Ph.D., *Chemistry and*  
*Biochemistry*  
Ronald Kuczenski, Ph.D., *Psychiatry (In-Residence)*  
Hyam L. Leffert, M.D., *Pharmacology*  
Fred Levine, M.D., Ph.D., *Pediatrics (In-Residence)*  
Richard Lieber, Ph.D., *Orthopaedics*  
Jamey D. Marth, Ph.D., *Cellular and Molecular*  
*Medicine*  
James Andrew McCammon, Ph.D., *Chemistry and*  
*Biochemistry/Pharmacology*  
Odile Mathieu-Costello, Ph.D., *Medicine*  
*(In-Residence)*  
Pamela L. Mellon, Ph.D., *Reproductive Medicine/*  
*Neurosciences*  
Marc Montminy, M.D., Ph.D., *Biological Sciences*  
*(Adjunct)*  
Alexandra Newton, Ph.D., *Pharmacology*  
Sanjay Nigam, M.D., *Cellular and Molecular*  
*Medicine/Pediatrics*  
Daniel T. O'Connor, M.D., *Medicine (In-Residence)*  
Jerrold M. Olefsky, M.D., *Medicine*  
Renate B. Pilz, M.D., *Medicine (In-Residence)*  
Frank L. Powell Jr., Ph.D., *Medicine*  
Morton P. Printz, Ph.D., *Pharmacology*  
Eyal Raz, M.D., *Medicine (In-Residence)*  
Douglas D. Richman, M.D., *Pathology/Medicine*  
*(In-Residence)*  
Michael G. Rosenfeld, M.D., *Medicine*  
Geert Schmid-Schoenbein, Ph.D., *Bioengineering*  
Nicholas Schork, M.D., *Psychiatry*  
Shunichi Shimasaki, Ph.D., *Reproductive Medicine*  
Gregg J. Silverman, M.D., *Medicine (In-Residence)*

Deborah Spector, Ph.D., *Cellular and Molecular*  
*Medicine*  
Stephen A. Spector, M.D., *Pediatrics*  
Charles F. Stevens, Ph.D., *Pharmacology (Adjunct)*  
Palmer W. Taylor, Ph.D., *Pharmacy and*  
*Pharmaceutical Sciences (Dean)*  
Susan S. Taylor, Ph.D., *Chemistry and Biochemistry*  
Lynn F. TenEyck, Ph.D., *Pharmacology (Adjunct)*  
Roger Y. Tsien, Ph.D., *Pharmacology/*  
*Chemistry and Biochemistry*  
Robert H. Tukey, Ph.D., *Pharmacology /*  
*Chemistry and Biochemistry*  
Eric Turner, M.D., Ph.D., *Psychiatry*  
Wylie W. Vale, Ph.D., *Medicine (Adjunct)*  
Ajit P. Varki, M.D., *Medicine*  
Peter D. Wagner, M.D., *Medicine*  
Jean Wang, Ph.D., *Medicine*  
Nicholas J.G. Webster, Ph.D., *Medicine*  
John B. West, M.D., Ph.D., *Medicine*  
David S. Williams, Ph.D., *Pharmacology/*  
*Neurosciences (Adjunct)*  
Joseph L. Witzum, M.D., *Medicine*  
Virgil L. Woods, Jr., M.D., Ph.D., *Medicine*  
Anthony Wynshaw-Boris, M.D., Ph.D., *Pediatrics/*  
*Medicine*  
Tony L. Yaksh, Ph.D., *Anesthesiology/*  
*Pharmacology*  
Jason X. Yuan, M.D., Ph.D., *Medicine*  
Maurizio Zanetti, M.D., *Medicine (In-Residence)*

## Associate Professors

Joseph A. Adams, Ph.D., *Pharmacology*  
Ju Chen, Ph.D., *Medicine*  
Nazneen Dewji, Ph.D., *Medicine (Adjunct)*  
Richard Gallo, M.D., Ph.D., *Medicine*  
Joseph G. Gleeson, M.D., *Neurosciences*  
John C. Guatelli, M.D. *Medicine*  
Bruce Hamilton, Ph.D., *Medicine*  
Victor Nizet, M.D., *Pediatrics*  
Oswald Quehenberger, Ph.D., *Medicine (Adjunct)*  
Judith A. Varner, Ph.D., *Medicine (Adjunct)*  
Francisco Villarreal, M.D., Ph.D., *Medicine (Adjunct)*  
Joseph Vinetz, M.D., *Medicine*

## Assistant Professors

Arshad Desai, Ph.D., *Cellular and Molecular*  
*Medicine*  
Seth Field, M.D., Ph.D., *Medicine*  
Mark A. Lawson, Ph.D., *Reproductive Medicine*  
*(In-Residence)*  
Karen Oegema, Ph.D., *Cellular and Molecular*  
*Medicine*  
Bing Ren, Ph.D., *Cellular and Molecular Medicine*

Peter Van der Geer, Ph.D., *Chemistry and Biochemistry*

Binhai Zheng, Ph.D., *Neurosciences*

Huilin Zhou, Ph.D., *Chemistry and Biochemistry*

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## The Graduate Program

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The graduate program offered by the Group in Biomedical Sciences is designed to lead to the Ph.D. degree through a combination of didactic study, laboratory rotations, and thesis research in basic biomedical sciences. Research experiences are wide and varied, permitting students the options of selecting molecular, cellular, or organ and integrated systems approaches in their research programs. Students are encouraged to design and execute investigation in a self-critical and independent manner. Undergraduate preparation must include courses in mathematics (through calculus), chemistry (including organic, physical, and biochemistry), and if possible, participation in undergraduate research. Students whose undergraduate backgrounds are significantly different will be considered provided there is sufficient evidence of interest in cell and molecular biology, physiology, pharmacology, or eukaryotic regulatory biology, and a desire to enter a field of active research and academic excellence.

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## Doctoral Degree Program

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During the first year, the students take basic courses in cell biology, molecular biology, pharmacology, physiology, genetics, and microbiology/immunology. In a required laboratory rotation program, students develop laboratory skills and the ability to formulate scientific hypotheses and become familiar with the research activities of the faculty. Students may differentiate into one of five advanced training tracks: genetics, microbiology/immunology, molecular cell biology, molecular pharmacology, or physiology. Required advanced courses and electives in subsequent years are chosen to develop the students' interest and specialized knowledge in the thesis research area and chosen training tracks. The thesis laboratory is usually selected by the end of the first year of graduate study.

The graduate program is interdepartmental and interdisciplinary; it involves faculty of the Departments of Medicine, Pharmacology, Neurosciences, Reproductive Medicine, Chemistry, Pathology, Bioengineering, Cellular and Molecular

Medicine, Psychiatry, Orthopedics, Anesthesiology, and the Cancer Center.

Pharmacologic studies of drug action at the molecular and biochemical levels include studies of receptor structure and function, genetic and recombinant DNA methods to analyze ligand-receptor interactions, regulation of gene expression and signal transduction, and biophysical approaches to defining neurotransmitter and hormone action. Molecular and cell biological approaches are being applied to the study of major issues in cell biology, including the regulation of protein targeting and intracellular membrane traffic, hormone and growth factor receptors, endothelial cell biology, molecular motors, RNA splicing, and mitosis, among others. Physiological studies include molecular to whole animal approaches to cardiovascular, microcirculatory, respiratory, renal, gastrointestinal and fetal physiology and their neural and hormonal control. Genetic and genomic studies include experimental and statistical approaches to existing variations in both human and model organism populations as well as mutagenesis, gene targeting, gene silencing, gene profiling, and gene therapy approaches to manipulating genomes. Studies in microbiology and immunology are focused on the fundamental basis of innate and adaptive immunity, elucidation of inflammatory response pathways, and understanding those virulence mechanisms of pathogenic bacteria, viruses, and parasites that can subvert host and contribute to infectious disease pathogenesis. Faculty within the program are the directors of four specialized centers of research at the university focusing on cancer, myocardial ischemia, hypertension, and atherosclerosis. Other faculty are directors of training grants for programs in pulmonary physiology, oncogenes, cardiovascular physiology, cellular and molecular pharmacology, hypertension, metabolic diseases, cell and molecular biology, genetics, digestive diseases, and cancer cell biology.

The graduate program in biomedical sciences is also designed to educate physician-scientists through the School of Medicine's Medical Scientist Training Program. Students already admitted to the School of Medicine are eligible for admission to our program for Ph.D. training. Such students generally apply in the first or second year of their medical studies and enter graduate studies following completion of their second year of medical

school. Normative time for M.D./Ph.D. students is seven years.

## Examinations

Students obtain letter grades in the program's basic courses. Candidacy for the Ph.D. degree is determined by a two-part examination. The first part, the minor proposition examination, tests the student's competence and ability to design the approach to a pertinent research problem in an area unrelated to his or her major interest. The second part, the major proposition examination, deals with the dissertation problem and should be completed during the third year of residence in the program. After the preparation of the dissertation, an oral defense of the thesis completes the requirement for the Ph.D. degree.

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## COURSES

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*For course descriptions not found in the 2006–2007 General Catalog, please contact the department for more information.*

### 200A. Molecules to Organisms: Concepts (6)

This course provides a systematic approach to current biomedical research, using analysis of selected topics to focus on the process of research discovery and its critical evaluation. The course progresses through five thematic modules that cover genes, building a cell, cellular responses, organogenesis, and the processes that allow survival in the world. *Prerequisite: limited to BMS graduate students except by consent of instructor.*

### 200B. Molecules to Organisms: Approaches (2)

Students will critically evaluate classic and current research papers in biomedical research, in addition to being exposed to state-of-the-art technologies in research. *Prerequisite: limited to BMS graduate students except by consent of instructor.*

### 201. Seminars in Biomedical Research (4)

This course includes attendance at seminars in the biomedical sciences and is designed to provoke critical discussion of the presented findings and scientific approaches in a small-group setting. *Prerequisite: limited to BMS graduate students except by consent of instructor.*

### 202. Carcinogenesis and Drug Metabolism (3)

This elective will explore relationships between drug metabolism and carcinogenesis at cellular, molecular and etiological levels. Guided by faculty, students will research and present key papers and principles underlying the biochemistry, genetics, biophysics, and computer-assisted aspects of several assigned topics. *Prerequisites: biology and chemistry. Cell biology, biochemistry, and molecular biology may be taken concurrently.*

**204. Evolution of Modern Concepts in Pharmacology (2)**

This course details the evolution of modern principles of pharmacology from first evidences to the present level of knowledge. The course will be independent of but compliment general principles of pharmacology courses for medical and graduate students. *Prerequisite: prior or concurrent Principles of Pharmacology, or equivalent course.*

**207. Using Internet Resources in Molecular Biology (2)**

Increasing the Internet is a source both of data and analysis tools in molecular biology. A hands-on series of instructional lectures is proposed that uses these resources to work through problems found in many molecular biology research situations. Topics include: DNA and protein sequence analysis, genome analysis, constructing and using phylogenetic trees, RNA structure prediction, protein structure analysis, classification and prediction. *Prerequisite: consent of instructor.*

**219. Ethics in Scientific Research (1)**

Overview of ethical issues in scientific research, conflicts of interest; national, statewide and campus issues and requirement; ethical issues in publications; authorship; retention of research records; tracing of research records; attribution; plagiarism; copyright considerations; primary, archival and meeting summary publications; ethical procedures and policies; NIH, NSF, California and UCSD; case studies and precedents in ethics. *Prerequisite: consent of instructor.*

**222. Essentials of Glycobiology (2)**

Advanced elective for graduate/medical students who have had core courses in cell biology or biochemistry. Expert faculty will present a coordinated overview of the field of glycobiology, which explores the structure, synthesis and functions of sugar chains in biological systems.

**223. Genetics, Metabolism, and Inherited Disease (2)**

Detailed discussions of the molecular aspects of certain inborn errors of intermediary metabolism selected to illustrate principles of biochemical genetics applicable to a wider variety of clinically important genetic diseases. Individual sessions will include faculty presentations followed by student-led discussions of the particular principles illustrated by the disorders reviewed. (S)

**224. Topics in Cancer Research (2)**

Each quarter will focus on an important area of cancer research such as immunology (fall), growth regulation (winter), and cancer genetics (spring). One-hour lecture coordinated with a one-hour seminar with the opportunity to meet with the invited speaker. *Prerequisites: limited to senior undergraduates, graduate students, and medical students. (W,S)*

**229. Methods in Pharmacology (3)**

A combination of lecture and lab exercises presented by the faculty of the Group in Biomedical Sciences, designed to introduce biomedical science graduate students to the essential techniques employed in molecular and cellular pharmacology. *Prerequisites: BMS 212, OP, CBB, biochemistry, molecular biology, biomedical sciences or consent of instructor. (S)*

**230. Receptors and Signal Transduction (3)**

An examination of the molecular and biochemical bases of drug and neurotransmitter action. Topics include molecular basis of drug specificity, receptor mechanisms, neuropharmacology, signal transduction

from the cell surface to the nucleus, and drug action on excitable tissues. *Prerequisite: course in biochemistry. (F)*

**231. Contemporary Topics in Pharmacology (2)**

A selection of short courses in the biomedical and pharmacological sciences offered by resident experts. Topics will vary annually. Each short course will last one to two weeks, meeting five hours a week. *Prerequisite: consent of instructor. (F,W,S)*

**232. In vivo Cellular and Molecular Imaging (1)**

Strategies such as positron emission tomography, magnetic resonance imaging, and ultrasound for non-destructively imaging molecular and cell biological events inside living animals and eventually human patients. Emphasis on detecting angiogenesis, apoptosis, and expression of tumor-specific genes. *Prerequisites: upper-division or graduate courses in molecular and cell biology.*

**233. Molecular Biology of Human Retroviruses (3)**

Replication cycle and gene regulation of HIV. Molecular approaches to therapy and vaccines. *Prerequisites: undergraduates lower-division courses in BIMM 100.*

**234. Practical Histopathology and Mouse Models of Human Diseases (2)**

The course is designed to introduce or reintroduce histology and histopathology of the various organ systems to those who need to analyze mouse tissues as an essential part of their research. *Prerequisites: standard undergraduate biology courses.*

**235. Pharmacogenomics (3)**

The pharmacogenetics course is designed to introduce graduate students, medical students, and pharmacy students to this emerging area of interest, indicating how hereditary mechanisms influence drug responses in humans. The lectures, examples, discussions, and journal presentations will provide the students with a working knowledge of the domains of pharmacology, how heredity influences any response traits, and the ways that advances in genome technologies support our emerging understanding of how polymorphic genetic variants determine inter-individual differences in drug responses. The course will include lectures, discussions, and journal article presentations by students. *Prerequisite: admission to a UCSD graduate program, School of Medicine, or School of Pharmacy and Pharmaceutical Sciences.*

**240. Critical Reading in Cell Biology (3)**

This course will focus on critical reading and understanding current areas in Cell and Molecular Biology. The exact topic will vary, but will include such topics as Protein Trafficking, Cell Division, Intracellular Movement, Cell Interaction, and Cell Cycle.

**242. Seminar in Genetics (1)**

Intended for graduate students interested in principles of classical and molecular genetics. Will attend weekly genetics seminar and participate in didactic/discussion preparatory session. *Prerequisite: consent of instructor.*

**243. Human Genetics (3)**

Advanced aspects of human genetics and human genetics disease, including principles of Mendelian and non-Mendelian inheritance, monogenic and polygenic traits, anticipation, penetrance, and genomics. Course will consist of alternating didactic sessions and seminars in which students will present papers.

**245. Cancer Genetics (3)**

Intended for graduate students interested in genetics. Course will cover genetic basis for cancer related diseases. *Prerequisites: graduate-level course in cell biology and molecular biology.*

**246. Current Literature in Glycobiology (1)**

Informal presentations on topics of current interest in glycobiology as represented in the current scientific literature. *Prerequisite: consent of instructor.*

**250. Molecular and Modern Methodologies in Physiological Sciences (2)**

This course emphasizes modern approaches and methodologies for investigating physiological processes in normal and pathological conditions. This includes the application of transgenic, knockout, adenovirus gene therapy, antisense, and cellular imaging technologies in animal models.

**260. Immune Regulation (3)**

This course will cover most of today's key aspects in the organization and dynamics of the immune system and its regulation. It will provide students with a basis for understanding the physiology and functioning of the immune system in normal and pathological states. *Prerequisites: core courses in Biomedical Sciences Ph.D. Program, or permission of instructor.*

**262. Neurophysiology (4)**

An overview of neurophysiological systems, emphasizing mammalian neurophysiology and related model vertebrate systems and concepts. (W)

**264. Molecular and Cellular Basis of Disease (2)**

Lectures on the molecular and cellular mechanisms of pathogenesis. Topics will include Alzheimer's disease, cell surface and unclear receptors in disease, signal transduction by oncogenes in cancer cells, AIDS, human diseases affecting glycosylation pathways, rheumatoid arthritis, and arteriosclerosis. *Prerequisite: graduate students. (W)*

**282. Microbial Pathogenesis (3)**

Topics covered in this course include molecular and cellular mechanisms of viral, bacterial, and protozoan pathogenesis. Host response and microbial mechanisms of evasion of host defense will also be discussed. Sessions will consist of faculty and student presentations of current literature. *Prerequisite: graduate standing or consent of instructor. (S)*

**285. Statistical Inference in the Medical Sciences (2)**

An introduction to basic techniques used in biomedical literature: t tests, ANOVA, chi-square, linear and nonlinear regression. Emphasis will be on understanding the appropriate use and interpretation of the tests, rather than on the calculations.

**294. Pharmacology and Molecular Biology Journal Club (0-1)**

Current literature in molecular pharmacology and molecular biology is reviewed. Two papers are chosen per week for oral presentation by students. Faculty critique the student presentations. *Prerequisite: enrollment in Ph.D. program at year two and above. (F,W,S)*

**295. Pharmacology Research Discussions (0-1)**

Student, faculty, and fellow discussion groups on research projects. Students are expected to present research findings to fellows, other Ph.D. students, and faculty. Written critiques are provided by the faculty. *Prerequisites: completion of minor proposition examination and two years of graduate work. (F,W,S)*

**296. Directed Reading (1-4)**

Reading of special topics under the direction of a faculty member. Exact subject matter to be arranged in individual cases. *Prerequisite: consent of instructor.*

**297. Progress in Signal Transduction (1)**

Papers describing recent progress in signal transduction from the cell-surface to the nucleus will be chosen from recent research literature. Two papers will be discussed and criticized in detail each week for one hour. *Prerequisites: graduate-level Biochemistry, Cell Biology, and Molecular Biology; registered as second-year and above graduate student in Biomedical Sciences, Biology, or Chemistry.* (F,W,S)

**298. Directed Study (1-12)**

Reading and laboratory study of special topics under the direction of a faculty member. Exact subject matter to be arranged in individual cases. (F,W,S)

**299. Independent Study or Research (1-12)**

Independent study or research. *Prerequisite: consent of instructor.* (F,W,S)