

Chemical and Systems Biology

Courses offered by the Department of Chemical and Systems Biology are listed under the subject code CSB on the (<https://explorecourses.stanford.edu/search?q=CSB&view=catalog&page=0&catalog=71&filter-term-Autumn=on&filter-term-Winter=on&filter-term-Spring=on&filter-term-Summer=on&filter-coursestatus-Active=on&collapse=&filter-catalognumber-CSB=on&filter-catalognumber-CSB=on>) Stanford Bulletin's (<http://explorecourses.stanford.edu/CourseSearch/search?view=catalog&catalog=&page=0&q=CSB&filter-catalognumber-CSB=on>) ExploreCourses web site. (<http://explorecourses.stanford.edu/CourseSearch/search?view=catalog&catalog=&page=0&q=CSB&filter-catalognumber-CSB=on>)

The department emphasizes individualized training at the interface of physical science and biomedical science. The program encourages students to draw upon a variety of modern scientific techniques, ranging from recent advances in molecular biology and protein biochemistry to synthetic organic chemistry and single cell imaging. Graduate students in the department take courses in signal transduction networks, chemical biology, and other areas of importance to their research goals.

Master of Science in Chemical and Systems Biology

Students in the Ph.D. program may apply for an M.S. degree after having satisfactorily completed the course and laboratory requirements of the first two years. The degree also requires a written thesis based on literature or laboratory research. Postdoctoral research training is available to graduates having the Ph.D. or M.D. degree.

Doctor of Philosophy in Chemical and Systems Biology

University requirements for the Ph.D. are described in the "Graduate Degrees (<http://exploreddegrees.stanford.edu/schoolofmedicine/chemicalandsystemsbiology/%20/graduatedegrees/>)" section of this bulletin.

The Department of Chemical and Systems Biology offers interdisciplinary training to prepare students for independent careers in biomedical science. The main focus of the program is cell signaling, chemical biology, and systems biology.

The program leading to the Ph.D. degree includes formal and informal study in chemical biology, systems biology, drug discovery, biochemistry, and other areas of relevance to the interests of particular students. First-year students spend one quarter in each of three different laboratories, working closely with other graduate students, a professor, and postdoctoral fellows on various research projects. During the fourth quarter, the student chooses a faculty mentor with whom to undertake thesis research, based on available positions and the student's interest. During or before the eighth quarter of study, students must pass a qualifying exam which consists of an oral exam on general knowledge and a defense of a research proposal. Course requirements are fulfilled during the first two years of study; the later years of the four- to six-year program are devoted to full-time dissertation research. Close tutorial contact between students and faculty is stressed throughout the program.

Research opportunities also exist for medical students and undergraduates. The limited size of the labs in the department allows for close tutorial contact between students, postdoctoral fellows, and faculty.

The department participates in the four quarter Health and Human Disease and Practice of Medicine sequence which provides medical students with a comprehensive, systems-based education in physiology, pathology, microbiology, and pharmacology.

Emeriti: (Professors) Robert H. Dreisbach, Avram Goldstein, Dora B. Goldstein, Tag E. Mansour, Oleg Jardetzky, Richard A. Roth, James P. Whitlock

Chair: Tobias Meyer

Professors: Karlene A. Cimprich, James E. Ferrell, Jr., Tobias Meyer, Daria Mochly-Rosen, Thomas J. Wandless

Associate Professors: James K. Chen, Joanna K. Wysocka

Associate Professor (Teaching): Kevin Grimes

Assistant Professors: Joshua Elias, Daniel F. Jarosz, Lei Stanley Qi, Mary Teruel

Courtesy Professors: Carolyn Bertozzi, Matthew Bogoy, Stuart Kim, Brian Kobilka, Beverly S. Mitchell, Paul A. Wender

Courtesy Associate Professors: Markus W. Covert, Justin Du Bois, Aaron F. Straight, Marius Wernig

Courtesy Assistant Professors: Michael Z. Lin, Jan M. Skotheim

Courses

CSB 199. Undergraduate Research. 1-18 Unit.

Students undertake investigations sponsored by individual faculty members. Prerequisite: consent of instructor.

CSB 201. Chemical and Systems Biology Bootcamp. 1 Unit.

In this "boot camp" students perform hands-on original research in small groups, combining chemical biology systems-level approaches to investigate current biological problems. This year's course will investigate the function and regulation of uncharacterized genes. Students will acquire conceptual and methodological training in a wide range of modern techniques, including "omics" approaches, fluorescence microscopy, genome editing, computational approaches, and quantitative data analysis.

CSB 210. Cell Signaling. 4 Units.

The molecular mechanisms through which cells receive and respond to external signals. Emphasis is on principles of cell signaling, the systems-level properties of signal transduction modules, and experimental strategies through which cell signaling pathways are being studied. Prerequisite: working knowledge of biochemistry and genetics.

CSB 220. Chemistry of Biological Processes. 3 Units.

The principles of organic and physical chemistry as applied to biomolecules. The goal is a working knowledge of chemical principles that underlie biological processes, and chemical tools used to study and manipulate biological systems. Current topics may include chemical genetics, activity-based probes, DNA/RNA chemistry and molecular evolution, protein labeling, carbohydrate engineering, fluorescent proteins and sensors, optochemical/optogenetic methods, mass spectrometry, and genome-editing technologies. Prerequisites: organic chemistry and biochemistry, or consent of instructor. Same as: BIOC 220

CSB 240A. A Practical Approach to Drug Discovery and Development. 3-4 Units.

Advancing a drug from discovery of a therapeutic target to human trials and commercialization. Topics include: high throughput assay development, compound screening, lead optimization, protecting intellectual property, toxicology testing, regulatory issues, assessment of clinical need, defining the market, conducting clinical trials, project management, and commercialization issues, including approach to licensing and raising capital. Maximum units are available by taking an additional contact hour.

CSB 240B. A Practical Approach to Drug Discover and Development. 3-4 Units.

(Continuation of 240A) Advancing a drug from discovery of a therapeutic target to human trials and commercialization. Topics include: high throughput assay development, compound screening, lead optimization, protecting intellectual property, toxicology testing, regulatory issues, assessment of clinical need, defining the market, conducting clinical trials, project management, and commercialization issues, including approach to licensing and raising capital. Maximum units are available by taking an additional contact hour. Prerequisite: 240A.

CSB 242. Drug Discovery and Development Seminar Series. 1 Unit.

The scientific principles and technologies involved in making the transition from a basic biological observation to the creation of a new drug emphasizing molecular and genetic issues. Prerequisite: biochemistry, chemistry, or bioengineering.

CSB 244. Drug Discovery and Development: A Case-based Approach. 2 Units.

Provides an overview of the drug discovery and development process through use of case examples--successful and unsuccessful attempts to integrate the scientific, clinical, regulatory, and commercial requirements to bring a new drug to patients. Focus on the complex array of independent tasks that must be accomplished to bring a new drug to the clinic. Specific cases discussed in a seminar format.

CSB 245. Economics of Biotechnology. 2 Units.

Focuses on translation of promising research discovery into marketed drugs and the integration of scientific method, clinical needs assessment, clinical and regulatory strategy, market analysis, economic considerations, and the influence of the healthcare economic ecosystem necessary for successful translation. Explores the economic perspectives of various stakeholders--patients, providers, payers, biotechnology and pharmaceutical companies, FDA, and financial markets--and how they influence drug development.

CSB 250. The Biology of Chromatin Templated Processes. 3 Units.

Topics include mechanisms of DNA replication; gene expressions regulation; DNA damage sensing and DNA repair; chromatin structure and function; and epigenetics and nuclear reprogramming. Prerequisite: working knowledge of molecular biology, biochemistry and genetics, or instructor consent.

CSB 260. Concepts and Applications in Chemical Biology. 3 Units.

Current topics include chemical genetics, activity-based probes, inducible protein degradation, DNA/RNA chemistry and molecular evolution, protein labeling, carbohydrate engineering, fluorescent proteins and sensors, optochemical/optogenetic methods, mass spectrometry, and genome-editing technologies.

CSB 270. Research Seminar. 1 Unit.

Guest speakers and discussion on current research in pharmacology.

CSB 299. Directed Reading in Chemical and Systems Biology. 1-18 Unit.

Prerequisite: consent of instructor.

CSB 370. Medical Scholars Research. 4-18 Units.

Provides an opportunity for student and faculty interaction, as well as academic credit and financial support, to medical students who undertake original research. Enrollment is limited to students with approved projects.

CSB 399. Graduate Research. 1-18 Unit.

Students undertake investigations sponsored by individual faculty members. Prerequisite: consent of instructor.

CSB 801. TGR Project. 0 Units.

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CSB 802. TGR Dissertation. 0 Units.

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