

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" 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.

COVID-19 Policies

On July 30, the Academic Senate adopted grading policies effective for all undergraduate and graduate programs, excepting the professional Graduate School of Business, School of Law, and the School of Medicine M.D. Program. For a complete list of those and other academic policies relating to the pandemic, see the "COVID-19 and Academic Continuity (<http://exploreddegrees.stanford.edu/covid-19-policy-changes/#tempdeptemplatetabtext>)" section of this bulletin.

The Senate decided that all undergraduate and graduate courses offered for a letter grade must also offer students the option of taking the course for a "credit" or "no credit" grade and recommended that deans, departments, and programs consider adopting local policies to count courses taken for a "credit" or "satisfactory" grade toward the fulfillment of degree-program requirements and/or alter program requirements as appropriate.

Graduate Degree Requirements

Grading

Chemical and Systems Biology counts all courses taken in academic year 2020-21 with a grade of 'CR' (credit) or 'S' (satisfactory) towards satisfaction of graduate degree requirements that otherwise require a letter grade provided that the instructor affirms that the work was done at a 'B' or better level.

Graduate Advising Expectations

The Department of Chemical and Systems Biology is committed to providing academic advising in support of graduate student scholarly and professional development. When most effective, this advising relationship entails collaborative and sustained engagement by both the advisor and the advisee. As a best practice, advising expectations should be periodically discussed and reviewed to ensure mutual understanding. Both the advisor and the advisee are expected to maintain professionalism and integrity.

Faculty advisors guide students in key areas such as selecting courses, designing and conducting research, developing of teaching pedagogy, navigating policies and degree requirements, and exploring academic opportunities and professional pathways.

Graduate students are active contributors to the advising relationship, proactively seeking academic and professional guidance and taking responsibility for informing themselves of policies and degree requirements for their graduate program.

For a statement of University policy on graduate advising, see the "Graduate Advising (<http://exploreddegrees.stanford.edu/graduatedegrees/#advisingandcredentialstext>)" section of this bulletin.

What is the overall purpose of faculty advising in this program?

The Department of Chemical and Systems Biology is committed to providing advising to ensure graduate student personal, academic, and professional development. Both the advisor and advisee are key players in sustaining a collaborative relationship with integrity and professionalism.

How are advisors initially assigned to or selected by incoming graduate students?

Graduate students select a thesis advisor generally at the end of Spring Quarter of their first year. Before selecting an advisor, students rotate in one lab per quarter during Autumn through Spring quarters of their first academic year. Students may opt for a fourth lab rotation and select an advisor in the Summer Quarter before their second year. After each rotation, students meet with the CSB Advisory Committee to discuss how the rotation went and whether the next rotation is a good match for the student's educational and professional goals. With the guidance of the CSB Advisory Committee and assistance from the student services staff, if needed, the student and thesis advisor mutually agree to work together.

What is the process by which students can change advisors and when should this happen?

The student should approach the CSB student services office and the CSB Advisory Committee to discuss the reasoning and proposal to change advisors. The student should work with the student services office and CSB Advisory Committee to try to find a suitable advisor. This process should happen as soon as issues start to arise and/or as soon as the student would like to change advisors.

How frequently should students meet with their advisors and how are those meetings set up? How does meeting frequency change as the student progresses?

As mentioned above, at the end of each quarter, first-year students meet with the CSB Advisory Committee to discuss potential issues with the program, issues with host laboratories, classes, the qualifying exam, and career planning. The topics that are discussed include ideas about student activities as well as additions or changes to the program. Students are also encouraged to meet with the CSB Advisory Committee members or the Department Chair individually if any issues come up throughout the year.

Committee meetings are held once a year after the qualifying exam. When a student is in their fifth year, the committee meetings should be held twice a year. From the sixth year and on, the meetings should be held every quarter.

What topics might be discussed at advising or committee meetings?

Committee meetings are the best opportunity for the student to get feedback about the progress and to get second opinions about which types of experiments should be pursued to help answer the questions being addressed in the student's thesis. The committee should include four faculty members counting the thesis advisor (faculty on the committee do not need to be tenure track). At least one of the four faculty members has to be a primary faculty in the CSB department, but the composition can be different from that in the qualifying exam and can also change during the student's thesis work as they may need to pursue different directions. The structure and format of the meetings are listed below. The committee should provide advice on future directions, attendance of conferences, career plans and more personal laboratory issues. Each meeting should include a time plan to ensure that the thesis project can be completed within five-and-a-half years.

At the beginning of each meeting, the student exits the room to allow for a discussion between the advisor and the rest of the committee. A few minutes before the end of the meeting, the advisor is asked to leave the room to allow for the student and the rest of the committee to discuss issues about the lab, potential personal issues, training opportunities and to discuss possible differences in research goals or issues relating to authorship.

If a committee meeting is not completed by the end of Summer Quarter, an enrollment hold is placed on the student's account and may delay graduate funding.

Are there any forms to complete or deliverables associated with any of those meetings?

Following the committee meeting, the student is required to summarize the discussion and formulate a revised plan for subsequent work. This summary should be discussed with the advisor and sent to the committee members within one week for comment. A final copy of the report must be submitted to the CSB Student Services Manager.

How and when does a student select and convene their dissertation reading or thesis committee? What is the purpose of the committee? And, how often should the committee meet?

Students select their reading committee when they go TGR, which is usually towards the end of their fourth year in Spring Quarter. The purpose of the committee is to further discuss the student's thesis and provide feedback. As mentioned above, committee meetings are held once a year after the qualifying exam. When a student is in their fifth year, the committee meetings should be held twice a year. From the sixth year and on, the meetings should be held every quarter.

How does the department or program, advisor, and student decide when a student is ready to graduate?

The decision to schedule an oral defense requires the support of each member on the committee including the thesis advisor. The department also expects that each student complete for the thesis at least one peer-reviewed, first-author paper that is accepted for publication by the time the oral thesis exam is being scheduled.

Who else might a student consult for help or guidance, e.g., department chair, DGS, student services staff?

At any time, students may consult with CSB student services staff, the Director of Graduate Studies and the Department Chair. Students may reach out to any of these parties by email to set up a meeting and/or stop by the student services office.

Emeriti (Professors) Robert H. Dreisbach, Stuart Kim, Richard A. Roth, James P. Whitlock

Chair: James K. Chen

Director of Graduate Studies: Daniel F. Jarosz

Professors: James K. Chen, Karlene A. Cimprich, James E. Ferrell, Jr., Nathanael Gray (effective Winter Quarter), Tobias Meyer, Daria Mochly-Rosen, Thomas J. Wandless, Joanna K. Wysocka

Professor (Teaching): Kevin Grimes

Associate Professor: Daniel F. Jarosz

Assistant Professors: Gheorghe Chistol, Lei Stanley Qi

Courtesy Professors: Philip Beachy, Carolyn Bertozzi, Matthew Bogoy, Justin Du Bois, Beverly S. Mitchell, Paul A. Wender

Courtesy Associate Professors: Markus W. Covert, Michael Z. Lin, Jan M. Skotheim, Aaron F. Straight, Marius Wernig

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 applied to biomolecules. The goal is a working knowledge of chemical principles that underlie biological processes. Chemical tools and techniques used to study and manipulate biological systems may be used to illustrate these principles. Prerequisites: organic chemistry and biochemistry, or consent of instructor.

CSB 221. Methods and Logic in Chemical and Systems Biology. 3 Units.

This course covers logic, experimental design and methods in Chemical and Systems Biology, using discussions of classic and modern literature to discern the principles of biological investigation in making discoveries and testing hypotheses. In collaboration with faculty, students also apply those principles to generate a potential research project, presented in both written and oral form.

CSB 224. Chemical and Systems Biology Pizza Talks. 1 Unit.

Required of and limited to all graduate students and postdoctoral scholars in the Department of Chemical and Systems Biology. Students and postdocs are required to give in-depth presentations about their current projects within the academic year.

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 243. Biotechnology and Development of Therapeutics. 1-2 Unit.

This course will introduce students to the applications of biotechnology to the discovery and development of novel drugs and therapeutics. Students will learn about the process of drug discovery and development from target discovery, through drug optimization, preclinical testing, clinical testing, and commercialization. The course also offers a basic understanding of functions that work in parallel with discovery research and drug development, including business strategy, portfolio decision-making and program management. Finally, the course allows the opportunity to learn from, and connect with leaders from companies within the Biotechnology sector.

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 261. Quantitative Principles in Cell Differentiation. 3 Units.

Explores the common principles controlling cell differentiation from stem cells to terminally differentiated cells. Focus is on becoming familiar with the computational and single-cell experimental approaches that are needed to identify, probe, and dissect the dynamic decision to differentiate or de-differentiate in different cell systems including stem cells, adipocytes, neurons, pancreatic beta cells, cardiomyocytes, and hematopoietic cells. Topics include exploring how feedback mechanisms can be exploited to enable and precisely control tissue regeneration.

CSB 270. Research Seminar. 1 Unit.

Students discuss readings focused on chemical and systems biology assigned by corresponding faculty host. Course held before corresponding Friday Cutting Lecture Series speaker. Please contact Student Services with any questions regarding the course administration. Required for CSB first and second year students. Open to all CSB students.

CSB 271. Principles of Cell Cycle Control. 3 Units.

Genetic analysis of the key regulatory circuits governing the control of cell division. Illustration of key principles that can be generalized to other synthetic and natural biological circuits. Focus on tractable model organisms; growth control; irreversible biochemical switches; chromosome duplication; mitosis; DNA damage checkpoints; MAPK pathway-cell cycle interface; oncogenesis. Analysis of classic and current primary literature.

Same as: BIO 171, BIO 271

CSB 272. Responsible conduct, rigor, and reproducibility in research. 1 Unit.

Focus is on responsible conduct of research, rigor, and reproducibility in research. Students and postdocs discuss scientific ethics and best practices for experimental design and interpretation. Invited lecturers participate as well.

CSB 290. Curricular Practical Training. 1 Unit.

CPT Course required for international students completing degree requirements.

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

Prerequisite: consent of instructor.

CSB 346. Advanced Seminar in Microbial Molecular Biology. 1 Unit.

Enrollment limited to PhD students associated with departmental research groups in genetics or molecular biology.
Same as: BIO 346, GENE 346

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.

CSB 802. TGR Dissertation. 0 Units.