Stanford MEDICINE | Biochemistry

2024-2025

GRADUATE STUDENT HANDBOOK

biochemistry.stanford.edu

Stanford MEDICINE | Biochemistry

SUMMARY OF DEPARTMENT REQUIREMENTS FOR THE PH.D.

Requirements for the Ph.D. degree are summarized on this page and serve as a clickable table of contents.

Goals of the Curriculum

MORE INFO ON PAGE 3

Research Rotations

- First rotation in the Biochemistry Department. Length of rotation is flexible. Choose a lab at the end of first year, preferably by the end of spring quarter.

MORE INFO ON PAGE 4

Courses

- Required 1st Year Courses
  - BIOS 200 – Foundations in Experimental Biology
  - BIOC 202 – Biochemistry Mini-Course (Bootcamp)
  - BIOC 215 – Frontiers in Biological Research (2 Quarters, Autumn & Winter)
  - BIOC 257 – Currents in Biochemistry
  - MED 255 – Responsible Conduct of Research (intensive one-day class)
- Three Core Courses P 5
- Electives P 7

Presentations

- 1st proposal (2nd Year) P 10
- 2nd proposal (3rd Year) P 13
- Journal Club (3rd - 4th Year) P 15
- Annual Retreat Presentation P 16
- Thesis Defense (target graduation by year 5) P 19

Thesis Committee

- Choosing a Thesis Committee P 17
- Annual Meetings P 18

Other Requirements

- Advancement to Candidacy (by the summer quarter of your 2nd year) P 23
- Teaching P 20
- Fellowship Applications (1st Year) P 20
- Individual Development Plan (required within 30 days of joining a lab and then annually) P 21
- Participation in Department Programs P 16
- University Requirements P 21

THE CURRICULUM

The overall goal of the biochemistry curriculum is to help students develop the ability to acquire and use scientific knowledge, to identify important problems and opportunities, to develop effective research strategies and creative tools to address them. These goals will help students develop as scientists and, more broadly, across a wide range of future careers that involve approaching complex problems with creativity and rigor. Specific goals are as follows:

1. Help students tackle scientific questions at the level of molecules, cells, and organisms. Courses in Biological chemistry and Biophysics (molecular), Cell Biology (cellular), and Genetics (organismal) cover the diversity of conceptual and experimental approaches required to understand a biological process or pathway at these varying scales.

2. Help students critically evaluate scientific data and read the published literature so they can make good decisions about the validity of scientific models or claims and launch successful scientific or therapeutic research projects.

3. Help students use quantitative and computational approaches in their research.

4. Help students effectively communicate scientific concepts, discoveries, and hypotheses in persuasive, engaging and clear proposals and talks.

5. Provide students with the skills and the confidence to identify important challenges and opportunities in science and in society and to recognize that these skills are transferable to many careers and life goals.

We encourage each student to develop a personalized curriculum based on discussions with the graduate and thesis advisor, their own scientific background, and their scientific interests. Our philosophy is to be flexible so that the curriculum supports each student during their thesis research and in their future career.

RESEARCH ROTATIONS

Research rotations are critical for students in choosing their thesis lab. In addition, rotations broaden a student's research experience and familiarize students with ongoing research projects.

Rotation possibilities and experiences are discussed quarterly with the Graduate Advisor, or more frequently if desired. Rotations are set up by discussion of the student directly with the faculty member of interest. The first rotation must be carried out in the Biochemistry Home Program Subsequent rotations can be carried out with faculty in any Home Program throughout the Biosciences. Rotations are typically one quarter in length, but the student can arrange more, shorter rotations. Rotations longer than one quarter are strongly discouraged, as the primary purpose of the rotation is to find a suitable thesis lab, not to carry out scientific endeavors to completion.

Students can choose their thesis lab any time after the end of the second quarter. Some students carry out an additional rotation in the third quarter and then choose their thesis lab. Although students have on occasion carried out a rotation over the summer quarter, this is discouraged, as it is typically in the student's best interests to initiate their thesis research to maximize the period that can be devoted to advancement toward the thesis research.

- Your Individual Development Plan (IDP) is due within 30 days of joining your lab.

CORE COURSES

- Take three full quarter courses in one of the following areas:
  - **Biochemistry and Biophysics**
  - **Quantitative and Computational Techniques**
  - **Genetics**
  - **Cell Biology**
- Each quarter course can be replaced by two mini-courses (which run 1-3 weeks). We enthusiastically recommend additional elective courses based on scientific interests.

Biochemistry and Biophysics

RECOMMENDED

- BIOC 241 – Biological Macromolecules
- BIOS 202 – Understanding Kinetics for Biologists and Biology (mini-course; recommended in combination with BIOC 241)
- BIOS 294 – Chemistry for Biologists and Others (BIOC 294, mini-course)

Additional courses of interest:

- CHEM 283 – Therapeutic Science at the Chemistry- Biology Interface
- BIOE 102 – Physical Biology of Macromolecules
- SBIO 242 – Methods in Molecular Biophysics
- BIO 294 – Cellular Biophysics
- BIOE 335 – Molecular Motors

Quantitative and Computational Techniques

CODING

- CS 106A and CS106B – Programming Methodology and Abstractions
- STATS 101 – Data Science 101
- Mini-courses in R from the Department of Biomedical Data Sciences

GENOMICS

- DBIO 173A – Foundations of Computational Human Genomics
- GENE 214 – Representations and Algorithms for Computational Molecular Biology
- BIOE 279 – Computational Biology: Structure and Organization of Biomolecules and Cells
- BIOS 253 – Primary concepts in Bioinformatics- To Make Sense Of large scale Biological and Biomedical Data (mini-course)

STATISTICS

- STATS 101 – Data Science 101
- STATS 116 – Theory of Probability

MATHEMATICAL MODELING

- BIOE 209 – Mathematical Modeling of Biological Systems
- BIOS 204 – Modeling Cell Signaling (mini-course)

Genetics

- GENE 205 – Advanced Genetics RECOMMENDED
- GENE 211 – Genomics
- DBIO 210 – Developmental Biology

Cell Biology

- BIOC224 – Advanced Cell Biology RECOMMENDED
- MCP 256 – How Cells Work: Energetics, Compartments, and Coupling in Cell Biology
- CSB 210 – Cell Signaling

YEAR 2

BIOC 350 - Development of Thesis Research

Students will develop a specific aims page for their thesis proposal based on small group discussion with faculty. The goals are to critically evaluate the scientific importance, potential impact, novelty and feasibility of the students' chosen research question and then to communicate these clearly in a proposal, to learn about others' research, and to give and receive actionable feedback. The deliverable at the end of this course is the equivalent of a Specific Aims page of an NIH proposal, which will function as the basis of their first proposal (5-page limit). Students take this as a group during the first quarter of their second year.

YEAR 3-4

BIOC 360 - Developing an Original Research Proposal

A key skill in academic research and in the biotechnology/pharmaceutical industry is the ability to identify unexplored questions, targets or pathways. This comes from critically reading and evaluating a new area of the scientific literature, identifying important gaps or untapped therapeutic opportunities and developing a methodical, feasible and rigorous experimental approach. Students develop skills in these areas by carrying out their specific research projects; the goals of this workshop are to build on and generalize these skills. This workshop will discuss the importance of these skills from both academic and industry perspectives. Working closely in a small group with faculty and alumni, students will identify an important question, technological challenge or therapeutic opportunity in an area outside their thesis research and develop an investigative proposal. The final deliverable will be a presentation and a one page specific aims page, analogous to one you might give in a company to persuade colleagues to pursue a drug target or submit to an agency to obtain funding for a project.

Elective Courses

The elective component of the Ph.D. curriculum is designed to allow students to tailor their coursework to align with their scientific interests. Electives are not mandatory and are intended to provide flexibility in each student's academic journey, allowing for additional study in areas of particular interest.

While many students choose to take several elective courses to gain both breadth and depth, there is no required minimum number of electives. Students are encouraged to consult with their advisors to select courses that complement their research focus and long-term goals. Electives may be chosen from any graduate-level courses across science, engineering, or mathematics disciplines at Stanford, with advisor approval for undergraduate courses if needed.

Students may wish to consider choosing a few elective courses that will expose them to areas of biological research that lie outside the core proficiency areas most relevant to biochemistry but are nevertheless extremely important in 21st century biology. Examples of such areas include: organismal-level biology and physiology, human health and disease, ecology and evolution, systems-level analysis of biological systems, bioinformatics, physical biology and biological chemistry. Various Stanford departments offer graduate-level courses in all these areas, and new courses are constantly being developed. The graduate advisor and other departmental faculty, as well as other graduate students, can provide valuable input and advice on elective course opportunities.

21st century research will continue to rely heavily on computation in all areas. Incoming Ph.D. students who do not already have some experience in computer programming and computer algorithms are strongly encouraged to acquire familiarity with basic programming approaches during their time here. Several classes focused on biological topics use basic programming within the course for problem sets and projects. Examples that are accessible to all students, including those lacking any programming experience, include: GENE 211 Genomics (Python), BIOS 205 Introduction to R for Data Analysis (R), GENE 218 Computational Analysis of Biological Images (Python), and BIOC 230 Biomedical Data Analysis in MATLAB (MATLAB). For students who already have some programming skills, several more advanced computation-based classes have been highly recommended by Biochemistry Ph.D. students in recent years, including BIOPHYS 279 Computational Biology: Structure and Organization of Biomolecules and Cells, CS 248 Computer Graphics, CS 221 Artificial Intelligence, and BIOMEDIN 214 Representations and Algorithms for Computational Molecular Biology.

Many students find that small, in-depth, literature-based courses that focus closely on a narrowly defined topic are among their most rewarding intellectual experiences in graduate school, providing an important opportunity to think very deeply about the literature and discuss it at a sophisticated level.

Format of Committee and Proposal Meetings Goals

The goal of the committee meeting is to help the student, specifically in their research, broadly in their development as a scientist, and for faculty to serve as advisors and mentors in their career aspirations and personal growth. While the purpose of these meetings is not for faculty evaluation, faculty do need to evaluate students to discover what advice will be most useful and empowering for the student. Both faculty and students are asked to embrace a growth mindset and allow critical comments to be made and received in a positive, constructive light.

Students can aid the effectiveness of committee meetings by:

- Communicating their agenda and goals to the committee before and at the beginning of each meeting. Never go into a meeting without goals; they may change during the meeting but students should think through what they want to get out of any meeting they lead/ attend beforehand.
- Including a timeline to communicate what has happened during the last year as a strategy to inform your committee what you have done without getting caught up in feeling you have to account for your time or prove you have worked hard/been productive.
- Approaching committee meetings as conversations.
- Thinking of faculty as facilitators rather than judges.

Scheduling Committee and Proposal Meetings

All meetings will be scheduled by your advisor's Administrative Assistant (AA), after receiving notice from the Student Services Administrator. While this removes the burden of arranging meetings from the student, the student maintains the responsibility to rapidly communicate information about their course schedule and other commitments to the AA. The committee meeting should be 90 minutes in length. For students in their fourth year and beyond, an additional 15 minutes should be used to discuss future plans.

Prior to the beginning of the meeting the student is to leave the room to provide an opportunity for the advisor and committee to discuss the student. After the meeting if the advisor or a committee member feels it important to discuss the outcome of the meeting the student may be asked to leave the room again for further discussion. At the end of the meeting the advisor must leave the room to give the student the opportunity to discuss any issues regarding the advisor, laboratory environment, personal issues or training goals.

Research Proposal & Committee Meeting Timeline

2nd Year

- 1st Proposal Course Meetings (BIOC 350, Autumn quarter)
- 1st Proposal Defense/Committee Meeting (Jan)

3rd Year

- Committee Meeting (Winter)
- 2nd Proposal Course Meetings (BIOC 360, Spring quarter)
- 2nd Proposal Presentation (Aug/Sept)

4th Year

- Committee Meeting (Autumn or Winter quarter)
- Journal Club Presentation (Autumn - Spring quarters)

5th Year

- Committee Meeting (Winter, Summer quarters)

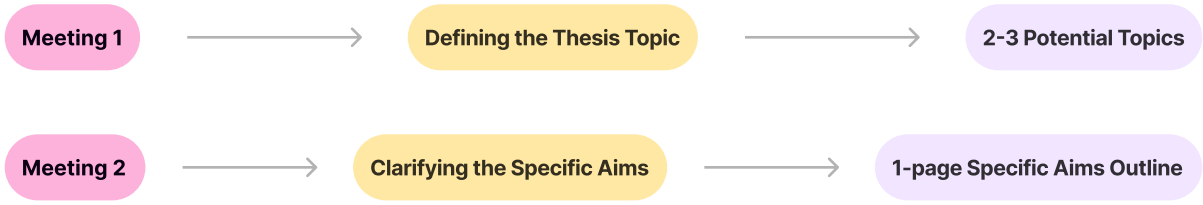
6th Year

- Committee Meeting (Quarterly)

- Any proposal can be completed at an earlier date.
- The 1st proposal must be completed within 8 months of joining a lab.
- Any exceptions to the above timeline must be discussed with the graduate advisor.
- See below for description of the format and expectations for each proposal.

Research Proposal Format

- All Proposal Defense meetings will be scheduled for 90 minutes and will not extend longer. This includes the time for faculty consultation and post-meeting discussion.
- At the end of each Proposal Defense meeting, the student and faculty committee members will together decide whether feedback will be given as a group or individually. Students are encouraged to take advantage of their committee members for feedback directly following proposal and committee meetings as well as at any other time. It may be useful in these discussions to articulate clear goals for the upcoming year.
- Meetings leading up to the Proposal Defense (as detailed below) emphasize the importance of working out research ideas through discussion before any writing begins:



1st Proposal

In the first proposal the student describes and discusses their planned thesis research.

The goal of the first proposal, and the process leading up to it, is for the student to take ownership of their project. The distinguishing characteristic of the PhD is the intellectual component. This component consists of the following:

i. Knowledge of the background and intellectual history of a field; ii. Critical appraisal of the experiments, models, and directions of that field; iii. An ability to pose important questions in the field; iv. An ability to derive an experimental plan to address one or more important questions in the field.

Experiments can be carried out by technicians without the requirement of a doctoral degree. In contrast, the intellectual aspect of one's project is here emphasized while recognizing that executing experiments is also critical. Further, a corollary of the above is that knowledge of multiple fields will render one a more powerful scientist. While the preparation time before the first proposal is limited, such broadening will greatly enhance one's ability to identify and solve scientific questions and is thus expected to develop throughout one's graduate experience.

There is no expectation at this meeting for a given amount of initial data to be presented. Rather, the following is expected:

A thorough (deep and broad) understanding of the literature that provides the background directly leading to the student's thesis project and the literature pertinent to framing the thesis question and carrying out the proposed research.

- A clear and compelling description of why the proposed research question is interesting and important.
- A clear experimental plan, with contingencies, for carrying out the research. A crude estimated timeline should be presented.
- Most generally, the student should demonstrate the intellectual skills required to articulate the question being addressed, its importance, and how it will be addressed in a thoughtful, well- directed, and logical manner.

How to prepare

Preparation for the 1st proposal starts as soon as one joins a lab.

You should have regular meetings with your advisor and discuss your ideas and possible thesis projects, with project ideas coming from both you and your advisor.

- You should read the literature in your area, broadly and deeply. Your advisor may give you references to read, but you should not rely on nor limit yourself to those.
- You should become familiar with other projects in the lab and how they relate to your project. This typically is accomplished by talking with lab mates (typically best when specific times are set aside to talk) and by reading the prior literature from your lab.
- Read multiple papers each week. Over time you will then accumulate a comprehensive background. On the other hand, if you read only when you are forced to, you will have to rely on others for insights and directions in your research.
- It is not possible to prepare for the first proposal simply by taking one week or even one month off from research prior to the 1st proposal and reading all pertinent literature in this compressed period. Such a strategy is counter to the development of a thesis project and the necessary depth of understanding.
- Students should take approximately 1-2 weeks prior to the proposal meeting to prepare the written and oral presentations and to reflect on preliminary data, if any relevant data has been obtained.

Class Leading Up to the 1st Proposal

Second year graduate students will enroll in BIOC 350, Development of Thesis Research, during the Autumn quarter. The class will meet once a week to prepare you for writing and presenting your proposal. Three instructors (the Proposal Steering Committee) will teach the class. A syllabus for the class will be available on its coursework site.

Second year graduate students will defend their proposals before their Thesis Committee by the end of Winter quarter. For the proposal defense the student will designate one member of the thesis committee (not the student's PI) to act as Chairperson for the proposal defense. The responsibilities of the chair includes: 1) ensuring that the examination proceeds according to the Department's procedures, 2) moderating the discussion to ensure that all faculty have an opportunity to discuss the proposal with the student 3) ensuring that the student is the primary respondent to questions and that no member of the Committee dominates the discussion and 4) writing a summary and evaluation of the exam once complete. See below for guidelines for the written and oral presentation.

Students will adapt their 1st Proposal into fellowship applications for submission in Autumn quarter of their 3rd year. It is strongly recommended that all rising 3rd year students take BIOS 242, Writing Successful NIH Fellowships and K Awards, in Autumn quarter of their 3rd year in order to help with this process.

Specific Guidelines for Written Proposals

Proposal Summary

This should be handed out to your committee at least one day prior to the committee meeting. The first and second proposals are no more than 5 pages in length (single spaced, including figures, excluding references). Suggested lengths for the sections are: Title, maximum 80 characters -- the title is important and defines the point of your project; Specific Aims, 1/2 page preferred, 1 page maximum; Background and Significance, 1 page preferred, 2 pages maximum; Research Design and Methods, 2 pages; and Progress Report, 1/2 page, but remember that the point of the proposal is not to emphasize preliminary results.

Some may approach the outline above for the first and second proposals. Another example is as follows:

i. Specific aims: Present a small number of experiments (less than five) that you view as most important to the model or to discriminate between models. What specific experimental goals do you actually plan to accomplish over the period of the proposal (34 years)?

OR

i*. Specific aims for novel experimental approach: Describe a sequence of intermediate controls that will validate the full experimental approach in a stepwise fashion. In addition, describe one biochemical experiment that you view as the most important application of the novel experimental approach. What would be learned that cannot be learned with existing methods?

ii. Background: This should be limited to one page, if at all possible. The background should not be covered encyclopedically. Rather, the background relevant to points ii and iii below should be concisely covered.

iii*. Novel experimental approach: Describe the conceptual basis of the experimental approach and the means to implement it. Justify each technically challenging step by a direct precedent from the experimental literature. The proposal should include at least one central figure that describes the approach pictorially.

iv. Long term goals: What are the broad, important questions, and why are they important? Often the hardest part of a project is figuring out what question, if answered, would lead to significant insights.

The Oral Proposal

A critical feature of the oral presentation is planning and time management. There is a tendency to present too much background information. This should be kept to a minimum, with presentation only of those prior results that provide the intellectual underpinning and are directly relevant to the proposed thesis research.

- The major question to be asked and/or hypothesis to be addressed should be clearly and simply stated, right in the beginning. This should take only a minute or two. Then the background and the proposed experiments should center around this statement.
- The general background should take <5 minutes. With a comprehensive understanding of the area, you should be able to pick out the critical background and field questions on directly and distally related points that your committee may raise.
- The student should be prepared to describe the importance of the proposed research and its relevance beyond the stated project.
- Presenting an estimated timeline for the proposed research can be very helpful in prioritizing experiments.
- It is critical to have considered details of the experimental plan. It is not necessary to present all of this, but very often it is the details of an experiment that provide the greatest challenges or prevent an experiment from working.
- When a proposal is satisfactorily completed, the student should have the written proposal (including the title and date of completion) approved and signed by the faculty advisor and members of the committee and placed in the student's file (see Student Services Administrator).

2nd Proposal

Students enroll in BIOC 360 for Spring Quarter of the 3rd Year. This course will meet using an agreed-upon schedule with the 3rd year students and the faculty on the Proposal Steering Committee.

The aim of the 2nd Proposal is for students to explore their interests and develop their ability to find scientific questions. These questions should meet the following criteria: i. Interesting; ii. Important; iii. Understudied; and iv. Tractable. Since the 2nd proposal is to aid students and their development. Students are encouraged to voice ideas about how to improve their and others' experiences.

In addition to identifying the topic, the student's goals should be to convey to their audience (in a 1-page Specific Aims and in their oral presentation) why the question is interesting and important and give an overview or synopsis of the experimental approaches and design to address it. This latter should be in the form of a brief outline of an experimental plan, with models (or hypotheses), tests, potential outcomes, and interpretations, next steps, and implications. These skills entailed are important across essentially the full range of career directions for students.

The development of proposals will take place in a group format, with input from faculty advisors and other students. Students are also encouraged to seek out other faculty and student experts for advice. This format is viewed as ideal: it allows an exchange of ideas and feedback, and participants often note that they get the most out of hearing advice on others' proposals, perhaps because they can be more objective. In addition, this format allows students to address the frequent challenge of considering, integrating, and sifting through multiple forms of feedback, and determining how to respond.

Any student not wanting to participate in the group activity should petition in writing to the Graduate Advisor, with an outline of their plan and timeline for completing the Proposal in time to present in one of the group presentations.

Each student will provide:

- A 1-page Specific Aims (okay if it goes slightly over); this will be reviewed in meetings and will be handed out to the presentation audience.
- A ~10 minute presentation to the department, with ample time for questions and discussion.

Presentation times: Students will present in groups (August/September), based on student preferences. The exact timing determined during the BIOC 360 course.

Feedback: Feedback throughout and at the conclusion of this process is key for students getting the most out of this process. To obtain the broadest feedback, students will bring notecards and pens that can be used to provide feedback. Students emphasized that positive feedback is highly welcome—as while they also want critical constructive feedback, hearing about good things done after putting a lot of work into a project is helpful. More specifics guidelines will be developed with the student group.

BIOCHEMISTRY JOURNAL CLUB

Our Biochemistry Department Journal Club is designed to bring together students, post-docs and faculty to discuss interesting, exciting and important topics from the literature. Every 4-6 weeks, one 4th year student and one Faculty member will present a research discussion based on recent papers or developing scientific topics of general interest.

The Journal Club, and each student requirement, is in place solely to aid students and their development, and so should be optimized to do so and students should voice ideas about how to improve their and others' experiences. In particular, the Journal Club provides a unique opportunity for students to hone their presentation skills and to bring the department up to date regarding recent scientific developments. It is designed to help advanced students as they begin to present at scientific conferences and apply for post-doctoral and professional positions. Journal club presentations fulfill the third presentation requirement for the PhD degree.

Guidelines. Each student will present on a topic outside their thesis research. This allows students to continue to develop the ability to identify interesting questions and research findings as well as present that research. While the topic should be outside of current thesis topic, being too prescriptive about format or topic can be counterproductive. The guiding principle should be to clearly communicate to the audience why that paper was chosen and to define and articulate the goals the presenter has for their presentation.

Preparation Guidelines:

- Each student will choose a faculty journal club mentor. Send the name of your mentor to the Student Services Administrator a minimum of 2 months in advance of the assigned presentation date.
- Each student, in consultation with journal club mentor, will chose what to get help with and how to get that help (i.e. topic & paper choice, scientific content, presentation). Student may also seek input from multiple faculty.
- Each student will ask 3 (or more) faculty to give feedback following their presentation, and they may specify particular areas that they are interested in receiving feedback. Email these selected faculty at least 1 month prior to the assigned presentation date and cc the Student Services Administrator. Faculty are expected to respond promptly whether they are willing to serve in this role.

Students may prefer to request feedback in different ways, but in general students have indicated preference for immediate feedback, directly following the presentation, either verbally or in writing. To obtain the broadest feedback, students will bring notecards and pens that can be used to provide feedback. Positive feedback (hearing about good things done after dedicating a lot of work to the project) as well as critical constructive feedback are emphasized.

Alternative Presentation: **Research-in-Progress Talk**: Students will work with a faculty member other than their thesis advisor and present an update on their thesis research.

ANNUAL RETREAT

The Department holds its annual scientific research conference in October. All laboratory groups present talks or posters on current research, and attendance is mandatory. This year's conference is scheduled for October 21-23, 2024 at Stanford Sierra Camp.

All students in the department are expected to attend the conference for its entire duration.

REGISTER NOW

OTHER MEETINGS

Graduate students are expected to attend all the Biochemistry Department-sponsored seminars. This ensures broad training within our graduate program.

Lectures by Students and Postdoctoral Trainees

An important aspect of the training of every graduate student is the development of speaking skills. Opportunities are offered for trainees to speak about their ongoing research in a seminar setting at group meetings, conferences, monthly **postdoc/student research talks**, **Wednesday Science Disco**, and the **annual departmental research conference** each fall.

Seminar Programs

The Department of Biochemistry hosts a biweekly seminar series (autumn-spring quarters) entitled **Frontiers in Biology**. Seminars are at 4 PM on Wednesdays in the Clark Center Auditorium, alternating with the Developmental Biology and Genetics seminar programs. Graduate students and postdoctoral fellows select and sponsor several of the seminar speakers.

Listings of other seminars in various disciplines can be found at:

BIOLOGY BIO-X BIOENGINEERING

Group Meetings

Each faculty member in the department has weekly group meetings in which the students and postdoctoral fellows take turns presenting their experiments and/or discussing papers from the literature.

THESIS COMMITTEE

The thesis committee is chosen by the student, in consultation with their advisor. It is made up of at least three faculty members, including the the student's advisor. At least three members of the committee should be affiliated with the Biochemistry department. Students are encouraged to include an additional faculty member from outside of the Biochemistry department whose expertise and perspective the student believes will be valuable. Students can petition the Graduate Advisor for exceptions to these guidelines.

A Committee Chair is selected from the assembled committee members (NOT the advisor) by the student to serve in an additional role at committee and proposal meetings to moderate the discussion.

One thesis committee meeting is required per year in years 2-4, two in year 5, and one per quarter in year 6 and beyond. The first committee meeting is covered by the 1st proposal, as this is a presentation of the student's proposed thesis research. However, in the years in which the student has their 2nd Proposal or Journal Club Presentation, additional thesis committee meetings are required. Individual Development Plan (IDP) meetings are a requirement for all Biosciences PhD students and are in addition to the thesis committee meeting requirements.

General Philosophy on Meetings

Students can best explore their creative potential and develop their intellectual and analytical skills through frequent collegial interactions with faculty. In this spirit, committee and proposal meetings are designed to allow an open exchange of scientific ideas and results. Through this, students learn to develop, organize, and present their ideas and results while benefiting from the experience and insights of committee members. These meetings also provide an opportunity to identify areas for students to focus on as they develop as independent scientists.

Thesis Committee Meeting Format

- Committee meetings will be scheduled for 90 minutes and will not extend longer. This includes the time for faculty consultation and post-meeting discussion.

- Students are encouraged to take advantage of their committee members for feedback during the committee meetings as well as any other time. It may be useful in these discussions to articulate clear goals for the upcoming year.

THESIS COMMITTEE MEETING & INDIVIDUAL DEVELOPMENT PLAN (IDP) DEADLINES

Year 1

- Within 30 days of joining thesis lab: IDP Meeting

Year 2

- Winter Quarter: Thesis Committee Meeting (1st Proposal)
- June 1: Schedule a planning and mentoring meeting with your advisor
- August 1: IDP Meeting

Year 3

- Winter Quarter: Thesis Committee Meeting
- June 1: Schedule a planning and mentoring meeting with your advisor
- August 1: IDP Meeting

Year 4

- Autumn OR Winter Quarter: Thesis Committee Meeting
- June 1: Schedule a planning and mentoring meeting with your advisor
- August 1: IDP Meeting | Requires a 1-page written progress report)

Year 5

- Autumn AND Summer Quarters: Thesis Committee Meeting | Requires a "5th Year and Beyond Degree-Progress Petition)
- June 1: Schedule a planning and mentoring meeting with your advisor
- August 1: IDP Meeting .

Years 6+

- Quarterly: Thesis Committee Meeting | Requires a "5th Year and Beyond Degree-Progress Petition)
- August 1: IDP Meeting .

- Students can request scheduling of an additional committee meeting at any time.
- Any exceptions to the above timeline must be discussed with the graduate advisor.
- To receive a committee meeting waiver, written approval must be sent to the Student Services Administrator by both the student's advisor and the graduate advisor.
- It is the expectation of the Biochemistry faculty that the Ph.D. project should be carried out and defended in five years or less (see policy 1.e.). Students enrolling for a sixth year must petition to the Graduate Advisor with a timeline for graduation and a statement of post-graduation plans. This petition will be required for registration.

PH.D. THESIS & ORAL EXAMINATION

a. Students must complete a draft of the Ph.D. thesis that is acceptable to the reading committee, which is typically, but not necessarily, the same as the proposal committee. Students must also have completed their two departmental research proposals and their Journal Club presentation before the Ph.D. oral examination can be scheduled.

b. Reprints of a student's published work may be included in the thesis. However, if a publication is jointly authored, the student must describe in the thesis their role in that work. In addition, the thesis should contain a general introduction and a general conclusion.

c. At the oral examination, a student will first present to an open audience a seminar on the thesis, after which there is an open question period. Then, the examining committee meets in private with the candidate for further discussion of the general area of the research work and to test the candidate's command of biochemistry and fitness for scholarly pursuits.

d. Please see the Student Services Administrator for the appropriate instructions and forms before establishing a Dissertation Reading Committee and Oral Examination. Your committee must consist of at least five members: four examiners (your thesis committee plus one) and one University chair (chair cannot have appointment in same department as you or your advisor). Approval to deviate from this assemblage requires approval by the graduate advisor and your thesis advisor.

e. Graduate student funding will end with the thesis defense and only on special conditions, on a case by case basis, will a postdoc position be offered.

f. Deadlines for submitting your thesis to the Registrar's Office and applying to graduate can be found on the Registrar's website at: https://registrar.stanford.edu/students/dissertation-andthesis-submission. You must be registered in the quarter in which you will turn in your thesis. Tuition can be reduced in your final quarter by completing a "Petition for Graduation Quarter."

Please see the Student Services Administrator for this form. Other graduation information can be found on the Registrar's website under the Academics tab at: https://registrar.stanford.edu/students.

Notes on thesis preparation

University regulations specify the composition of the examination committee and the format of the dissertation defense. Students should refer to the booklet Directions for Preparing Doctoral Dissertations, available from the Registrar's Office, for specific information. You can also obtain this information at: https://registrar.stanford.edu/students/dissertation-and-thesis-submission.

OTHER REQUIREMENTS

Teaching

Students are required to gain experience in mentoring, instruction or teaching for one quarter. Possibilities for formal teaching assistantships include: BIOC 205 (Aut), BIOC 241 (Aut), BIO 42 (Win), BIO109a/209a (Win), BIO 109b/209b (Spr), CHEM 181 (Aut), CHEM 183 (Win), HUMBIO 200 (Aut, Win, Spr) and others as approved by your advisor.

Students receive academic credit as teaching assistants in these by enrolling in BIOC 221 (The Teaching of Biochemistry) and notifying the Student Services Administrator of the TA course selected. Teaching involves attending all lectures, holding office hours to answer questions from students in the courses, compiling problem sets and answers, helping compile, supervise and grade exams, and assisting with organizational matters including distribution of handouts.

More detailed descriptions of TA responsibilities will be provided by the course instructor. Other mentoring and instruction opportunities in local community programs are also encouraged as routes to fulfill this requirement. In addition, direct supervision and mentoring of undergraduate or junior students in the laboratory can also suffice to fulfill this requirement.

Fellowship Applications

All first year students are expected to submit predoctoral fellowship applications to the National Science Foundation. Additional information regarding deadlines can be found on-line at: https://www.fastlane.nsf.gov/grfp/.

Students should schedule a meeting with the Graduate Advisor by October 14 to discuss their areas of research for these applications, and each student will choose a faculty member to develop, read and critique their proposals.

All third year students are required to adapt their 1st Proposals into fellowship applications. For US Citizens and Permanent Residents, we expect that you will submit an application for the NIH F31 NRSA Individual Predoctoral Fellowship (due in early December). For international students on visas, we expect that you will submit an application to other opportunies such as the internal Bio-X Predoctoral Fellowship if appropriate (due in January). All students are encouraged to seek out other fellowship opportunities for which they might be eligible. Please https://med.stanford.edu/rmg/funding.html

Individual Development Plan (IDP) and Annual Planning Meetings

Your Individual Development Plan (IDP) and annual planning meeting with your advisor are intended to help you:

- Take ownership of your training and professional development.
- Pause and reflect! Amidst daily research activities, it is easy to lose sight of longer-term goals.
- Think intentionally about your short-, mid- and long-term training and development goals.
- Identify and use resources to help you achieve your goals.
- Have open and direct dialogue with your mentor(s).
- Establish clear expectations/steps.

All Biosciences Ph.D. candidates and their mentors in the Schools of Medicine and H&S are required to create and discuss their Individual Development Plans (IDPs) on an annual basis. This annual IDP meeting is in addition to any required Committee Meetings.

Students and their advisors share responsibility for completing the IDP, as well as the consequences of not completing the IDP by the deadlines. Failure to comply with IDP requirements will negatively impact Stanford's ability to receive NIH funding; and incur a hold on student registration that prevents stipends from being funded.

See https://biosciences.stanford.edu/current-students/idp/ for more information and IDP forms, including extensive FAQs and resources for both faculty and students.

Questions? Please email bioscicareers@stanford.edu

UNIVERSITY REQUIREMENTS

1. a student must be admitted to candidacy for the Ph.D. degree no later than the end of the second year,
2. the Ph.D. degree must be completed within 6 years, and
3. a student must be registered continuously to the end of the Ph.D. degree, unless he or she obtains an approved leave of absence.

STUDENT SERVICES

Registration

Graduate students are required by the University to register for Autumn, Winter, Spring and Summer quarters either for 10 units, or TGR until the degree is received. Students receiving stipend checks must register for 10 units or TGR in order to receive a check. Leaves of absence require department approval before departure.

TGR P 23

Registration Process

Find enrollment policies and deadlines, Stanford's schedule of classes, enrollment how-to and troubleshooting, and details about special registration statuses.

ENROLL IN CLASSES

Graduate Student Tracking (GST) System

The Biosciences Graduate Student Tracking System (GST) is a secure online resource for Ph.D. students, faculty, and student services officers (SSOs); its ultimate goal is to provide support in the related areas of student academic progress, alumni tracking, admissions and training grant application/renewal.

ACCESS GST

Students are asked to enter their Lab Rotations as well as IDP and Thesis Committee Meetings into this system.

Academic Policies

The Stanford Bulletin provides a central source for policies – both academic and non-academic – that are applicable to all Stanford students.

STANFORD BULLETIN

Forms & Processes (eForms)

Navigate the university's forms, petitions, and request processes.

ACCESS FORMS

Terminal Graduate Registration (TGR)

Students who have:
1) been admitted to candidacy,
2) completed all required course work, and
3) have satisfied the residency requirement of 135 units are required to register for TGR status. Under TGR, tuition fees are substantially reduced.

Students registered in TGR status must enroll each quarter in BIOC 802 - TGR Dissertation, with their advisor as the instructor, and for 0 units.

Units and Residency

The University's minimum unit requirement for the Ph.D. degree is satisfactory completion of 135 units of course work, reading, and/or research at Stanford. At least three units must be taken with each of four different Stanford faculty members.

Candidacy

Admission to candidacy is a judgment by the faculty in the department of the student's potential to successfully complete the requirements of the degree program. Students are expected to complete department qualifying procedures and apply for candidacy by the summer quarter of their second year in the Ph.D. program. This form is forwarded to the Registrar's Office and indicates that the student is formally qualified for the Ph.D. degree and is in good academic standing. The form requires listing completed Stanford course work with at least 3 units of course work taken with each of four Stanford faculty members.

Once a student is admitted to candidacy, the status is valid for five years; subject to termination by the department if progress is unsatisfactory. In special circumstances, it may be renewed by the submission and approval of a new application or extended upon the chairman's recommendation.

Department Channels & Events Calendar

Stay connected! Subscribe to the department listserv (subiochem) and join our Slack channel (biochemistry.department) for the latest updates. To keep track of department events and programming, don't forget to add biochemistrynews@stanford.edu to your Outlook calendar.

subiochem SLACK biochemistrynews@stanford.edu

Vaden Student Health Center

The Vaden Student Health Center provides medical care, including a range of counseling and mental health services, to regularly enrolled Stanford students. The center is located at 866 Campus Drive and has a full-time staff of physicians, mental health professionals and nurses. It provides, for free or for modest fees, a program of medical and psychological services to students holding current student I.D. cards. Visit Vaden Health Services for more info.

Stanford University requires all new students to have completed an Entrance Medical Record.

COMPLETE ENTRANCE MEDICAL RECORD

Health Insurance

Stanford students are required to enroll in the Stanford health insurance plan, Cardinal Care, paid along with registration or tuition fees, or provide evidence of satisfactory coverage with an external carrier. Cardinal Care is the comprehensive student health insurance plan sponsored by Stanford University featuring access to Stanford Medical Center. Coverage information for the current academic year can be found here.

Students are automatically enrolled in Cardinal Care unless they waive coverage and have other health insurance. Students must waive coverage before the first quarter in which they are enrolled each academic year (normally this is Autumn quarter).

Cardinal Care is waived in Axess by the deadlines listed at https://vaden.stanford.edu/insurance/choosing-your-insurance/important-deadlines. Stanford health insurance charges appear on quarterly University bills (autumn, winter, spring quarters).

Dental benefits are now available through the Cardinal Care insurance plan. Benefits are administered by Delta Dental of California. Coverage includes diagnostic and preventive services at 100% with no deductible when an in-network Delta Dental PPO dentist is used. Consult your Cardinal Care insurance plan for more information. Information is available on the Vaden website at https://vaden.stanford.edu/insurance/dental-and-vision-insurance-options.

Campus Health Service Fee

This is a mandatory fee that applies to all undergraduate and graduate students enrolled on the Stanford campus ($261/qtr, 2024-25). It covers many services provided by Vaden Health Center, including primary care medical visits, psychological evaluation, and short-term therapy at Counseling and Psychological Services (CAPS), and access to health and wellness programs.

MORE INFO

Stipends

Entering students are offered a stipend and tuition. Students are required to apply for predoctoral fellowships from the National Science Foundation during their first year in residence. Applications are available on the Web and are due in October. Students are also encouraged to apply for other outside fellowships. Departmental funds are used to supplement support from all sources to an annual minimum level of $53,400 (2024-25). ASSU fees, late fees, etc. are the responsibility of each student. Additionally, a one-time document fee of $250 must be paid by the student. Health insurance will be paid by the department if not covered by fellowship institutional allowances. Students may receive stipends quarterly or salary semi-monthly (based on funding source). A U.S. Social Security number is required to receive any funds disbursed by Stanford.

For those students on fellowships who are paid quarterly, the stipend checks are issued approximately two weeks before the quarter begins (provided you are enrolled in classes for the quarter) and are mailed by the Student Financial Services Office to the student's address in Axess. Fellowship stipends are taxable but are not subject to withholding or reporting by Stanford.

Students receiving stipends are responsible for making any necessary estimated tax payments. Federal Form 1040-EZ and California Form 540-ES are available at https://sfs.stanford.edu/taxes/resources. These forms are also available on the IRS' website.

Students who are paid semi-monthly will be paid on the 7th and the 22nd of the month (or on the preceding work day if these dates fall on a weekend or holiday). Salary assistantships are taxable and subject to withholding and are reported by Stanford on a W-2 form. International students may qualify for federal "tax treaty exemption" - if one exists between the US and their country. Direct-deposit is also available, apply through AXESS.

Tuition

Tuition (10 units) is fully covered by research assistantships or traineeships. Tuition paid by the department is paid directly to the University. Students will receive tuition credit on their University bill.

Tax

Stipends are subject to income tax, but not withholding, so the student must pay estimated taxes (form 1040ES). Please view information found at https://sfs.stanford.edu/taxes should you have a question regarding tax status or payments.

I-9 Requirement

Any individual receiving salaried compensation must have on file a correctly completed I-9 form (Employment Eligibility) prior to commencement of work. International students who are not U.S. permanent residents must have a valid passport and visa with either an I-94 card or an I-20 ID card carrying an employment authorization stamp in order to file an I-9. See the Student Services Administrator for completion of this form.

Students in the Department of Biochemistry (including MSTP students who declare biochemistry as their home program), will be provided a $1,500 Biochemistry stipend allowance to utilize throughout their thesis program for books and other incidentals relevant to their training.

The stipend must be utilized while actively enrolled in the Biochemistry program. Requests to use department funding should be submitted in writing to the Graduate Student Advisor and the Student Services Administrator. See the Student Services Administrator for additional information.

Academic Standing Policy

Enthusiasm, intellectual growth, and the ability for bench research are essential elements for success in the Biochemistry Graduate Training Program. In cases where a Ph.D. candidate may find these elements to be lacking, the faculty urge the candidate to consider alternate – and likely more rewarding – career development paths at an early stage, with time to explore and excel in another field during their prime years. A graduate committee may also judge that a candidate is not making sufficient progress to complete the Ph.D. degree in a timely fashion, in which case the committee will increase its level of mentoring through quarterly meetings with the candidate and the establishment of concrete, short-term research goals. Continued lack of progress can lead to dismissal from the program. For more information, see the University's policy at: (http://exploredegrees.stanford.edu/graduatedegrees/#degreeprogresstext).

Vacation Policy

Graduate student quarter breaks are not like that of undergraduates because of the continuous nature of research progress. Students have a finite time in graduate school to complete their thesis work. Their success/failure will depend on the choices they make and their dedication to their research. Graduate students are allowed to be away 15 days per year (not including Christmas Day and New Year's Day).

Generally, only a portion is used at winter break. All vacation time is to be scheduled as to minimize disruption to their research.

Patent Policy

Stanford's patent and copyright policies apply to any student working on a research project, regardless of the source of aid. You must agree to this policy by completing the form "SU Patent Agreement (SU-18)" located in the AXESS system. The policies allow inventors/creators to retain all rights to inventions and copyrightable materials unless certain exceptions apply. The most important exception is that Stanford claims title to inventions and copyrightable materials (including computer software) made under sponsored research in order to grant sponsors the licensing or other rights required under the agreement. Stanford also claims title to copyrighted material under the following circumstances:

- The work is created for University purposes in the course of employment;
- The work is commissioned by the University;
- The work is supported by a direct allocation of funds through the University pursuit of a specific project;
- Other arrangements are required as agreed in writing

HOUSING & TRANSPORTATION

On Campus

Graduate Housing at Stanford accommodates single students as well as those coming to Stanford with a spouse, same-gender or opposite-gender domestic partner, and/or children. Graduate residences include studios and apartments with up to four bedrooms.

All Stanford student housing is smoke-free, and pets are not allowed. All housing assignments are made through a lottery system. If you are new to Stanford and enrolled in a graduate degree program, you are guaranteed housing for your first year of study if you apply by the Lottery deadline and indicate as the final choice on your application that you are willing to live in any residence for which you are eligible.

VISIT STANFORD HOUSING

Off Campus

Many students live off-campus. Community Housing Services provides helpful information on their website, including listings of rentals available in the local area.

WARNING! Please be aware of potential scams as you search for housing. A general rule is that if it sounds too good to be true, it probably is. Any landlord that wants you to send them a wire transfer or a check and does not let you see the location of the rental could very well be trying to scam you. If you are renting sight-unseen from a private landlord, try to FaceTime with them to see the place. Use the street view feature of Google Maps to see if the location shown in a listing matches up with what is actually there.

Stanford Transportation

Comprehensive information on shuttle times, ridesharing options, parking permits and other Stanford transportation related topics.

VISIT STANFORD TRANSPORTATION

HEALTH & SAFETY

Department of Environmental Health and Safety (EH&S)

EH&S is the principal health and safety office at Stanford University. They support and advance the teaching, learning and research activities at Stanford by promoting a safe and healthy campus environment. They also provide and coordinate programs and services that minimize safety, health, environmental, and regulatory risks in a manner consistent with fiscal and environmental stewardship.

LEARN ABOUT HEALTH AND SAFETY TOPICS

FACILITIES | BECKMAN CENTER

The Department of Biochemistry, housed on the fourth floor of the Beckman Center, is part of the Medical Center complex. Most laboratory space and equipment is shared and members of different laboratory groups are intermingled. This is a popular and efficient way to promote collaboration and intellectual interaction.

Facilities include numerous state-of-the art microscope imaging units, darkrooms, computer stations, glassware and media preparation rooms, a conference room and a library. The Beckman Center houses a Protein and Nucleic Acid (PAN) core facility equipped for the synthesis and characterization of macromolecules. The Fluorescence Activated Cell Sorter Facility is located on the ground floor along with Munzer Auditorium, PAN Facility, Cell Sciences Imagining Facility and the cafeteria.

Card Key Security System

A card key security system has been installed in the Beckman Center and other external buildings within the Medical Center. The Beckman Center has six ground floor doors plus the RAF tunnel door keyed. These doors are also equipped with closed circuit cameras.

There is a telephone outside the main front doors to accommodate visitors without card keys. If needed, see Marc Perez in Room B483 to obtain a card key as well as keys to the lab and shared rooms.

Stockroom (B432) & Glassware Facilities (B431)

A stockroom with common lab supplies is available in Room B432. All ordering of supplies and small equipment is handled through the stockroom.

The glassware facilities are located in room B431. The staff in this facility are responsible for picking up, washing, wrapping and sterilizing the department's glassware. Your stockroom and glassware contacts are:

- Marc Perez, Lab Manager
- Jennifer Leder, Biochemistry Lab Services Coordinator
- Laura Tan, Lab Assistant

Department Library (B402) & Conference Room (B475)

The department library is located in B402 and is used for study, seminars, and group meetings. Audiovisual equipment is available for use in the library. The department's conference room is located in B475. It is used for group meetings and study. Audiovisual equipment is available for use in the room.

To reserve a room, contact your advisor's administrator or the Biochemistry admin team.

Department Mailboxes

Department mailboxes are arranged in the lobby across from the business office (room B400). They are arranged by lab group. Please check your mailbox regularly. Mail moves between departments and offices at Stanford by interdepartmental (ID) mail. All ID mail should include the four-digit Stanford mail code. Biochemistry is mail code 5307. There is a complete list of mail codes in the Stanford Directory. Stanford mail codes are the same as ZIP+4 codes used by the U.S. Postal Service.

Bulletin Boards

Bulletin boards located throughout the department display departmental and University information and announcements as well as job opportunities. Upcoming seminars are also displayed on a weekly basis outside B400 and can also be checked via the computer network.

Computer Resources

Stanford University enjoys an extensive and varied computing environment. Connection to the network is through a self registration mechanism available to all users at Stanford through the University Information Technology group. The Beckman Computational Services and Bioinformatics Resource provides licensed software to laboratories for many applications in bioinformatics, molecular biology, computation and analysis. For supercomputing resources and access to CPU and GPU clusters the Stanford Sherlock Cluster provides free of charge access and compute time for computation.

OUTREACH & MENTORING ACTIVITIES

The Biochemistry Department recognizes the societal need for community involvement and outreach, and the value of these activities for the individuals who engage in them for their development as scientists, as citizens and as individuals.

While a dichotomy is sometimes drawn between time spent in lab and "outside activities", we believe there is a synergy between them. Lessons learned as a scientist can help one more effectively contribute to society beyond the bench and contributing to one's community can make one a more effective and impactful scientist:

Development as a scientist is stimulated by seeing problems from different perspectives and learning how to apply scientific approaches more broadly. The approaches taken as scientists, observing carefully—listening without prior judgment, developing models to explore all possible origins and solutions—help one contribute to challenging community and societal problems on the individual and broader scale.

In addition, activities beyond the day-to-day are often reinvigorating, allowing one to be more effective in lab research and even at times allowing one to spend more time directly involved in research.

Thus, all members of the department are encouraged to participate in community service activities, such as those aimed at improving access to higher education especially for historically underserved communities. Outreach and mentoring activities that members of the department have participated in/are currently participating in are listed below:

- Stanford Science PenPals
- Stanford Summer Research Program
- Stanford at the Tech
- East Palo Alto Tennis and Tutoring
- FAST
- BioAIMS
- MSTP Boost
- Green Scholars Program
- BioPeers
- ADVANCE
- Stanford Prison Education Program
- Stanford Splash
- BioAIMS
- Stanford Japanese Association
- Community College Outreach Program

Student Engagement

Discover student organizations at Stanford, learn how to create a new group, become a class president, and find out more about the Fraternity and Sorority experience.

GET INVOLVED

To encourage interaction among the various labs, the department provides cookies and fruit every weekday at 4 PM in the 4th floor lobby. Everyone is welcome to attend. Additionally, department socials, sponsored by the labs, are held approximately every three weeks on Fridays at 5 PM, either in the lobby or on a nearby lawn.

THE DEPARTMENT OF BIOCHEMISTRY

The Department of Biochemistry explores the molecular basis of life by studying the structures and functions of proteins and nucleic acids, the control of development, molecular motors and the cytoskeleton, trafficking of proteins between organelles, regulation of gene expression, protein homeostasis, structure and design, genetic and epigenetic control of chromosome function, and the application of genomics. These efforts have led to transformative advances in our understanding of health and disease. Advanced courses in more specialized areas emphasize the most recent developments in biochemistry, biophysics, cell biology, and molecular biology. These courses include the physical chemistry of proteins and nucleic acids, membrane biology and biochemistry, the cytoskeleton, mechanisms and regulation of nucleic acid replication and recombination, the biochemistry of bacterial and animal viruses, the molecular basis of morphogenesis, and the structure and function of both eukaryotic and prokaryotic chromosomes. Laboratories are located throughout the Stanford campus and affiliated institutes.

- **Emeritus Professors:** Patrick O. Brown, Douglas Brutlag, I. Robert Lehman, James A. Spudich
- **Chairman:** Aaron Straight
- **Associate Professors:** Onn Brandman, Pehr Harbury, Lingyin Li, Julia Salzman
- **Assistant Professors:** Alex Gao, Silvana Konermann, Florentine Rutaganira, Haopeng Xiao
- **Courtesy Professors:** Karlene Cimprich, Chaitan Khosla, Sharon Long
- **Director of Graduate Studies:** Onn Brandman

 **Steven Artandi**

 **Onn Brandman**

 **Patrick O. Brown**

 **Gilbert Chu**

 **Karlene Cimprich**

 **Rhiju Das**

 **Ron Davis**

 **James Ferrell**

 **Alex Gao**

 **Pehr Harbury**

 **Daniel Herschlag**

 **Chaitan Khosla**

 **Peter Kim**

 **Silvana Konermann**

 **Mark Krasnow**

 **Lingyin Li**

 **Sharon Long**

 **Suzanne Pfeffer**

 **Rajat Rohatgi**

 **Florentine Rutaganira**

 **Julia Salzman**

 **James Spudich**

 **Aaron Straight**

 **Haopeng Xiao**

199. Undergraduate Research

Investigations sponsored by individual faculty members. Prerequisite: consent of instructor.
1-18 units, Aut, Win, Spr, Sum (Staff)

200. Applied Biochemistry

(Enrollment limited to MD candidates) Fundamental concepts sessions.
2 units, Aut (Harbury, Cowan)

202. Biochemistry Mini-Course

(Open to first year Biochemistry students or consent of instructor) Hands-on, four or five-day immersion in biochemical methods and practice, theory and application of light microscopy, nucleic acid sequencing, and computational approaches to modern biological problems.
1 unit, Aut (Das)

205. Biochemistry Mini-Course

(For medical students) Topics include DNA structure, replication, repair, and recombination; gene expression, including mechanisms for regulating transcription and translation; chromosome structure and function; gene cloning, protein engineering, and genomics. Patient presentations and journal clubs illustrate how molecular biology affects the practice of medicine.
3 units, Aut (Chu, Gomez-Ospina)

215. Frontiers in Biological Research

(Same as DBIO 215, GENE 215) Literature discussion in conjunction with the Frontiers in Biological Research seminar series hosted by Biochemistry, Developmental Biology, and Genetics in which distinguished investigators present current work. Students and faculty meet beforehand to discuss papers from the speaker's primary research literature. Students meet with the speaker after the seminar to discuss their research and future direction, commonly used techniques to study problems in biology, and comparison between the genetic and biochemical approaches in biological research.
1 unit, Aut, Win (Harbury, Villeneuve, Pringle)

221. The Teaching of Biochemistry

Required for teaching assistants in Biochemistry. Practical experience in teaching on a one-to-one basis, and problem set design and analysis. Familiarization with current lecture and text materials; evaluations of class papers and examinations. Prerequisite: enrollment in the Biochemistry Ph.D. program or consent of instructor. 3 units, Aut, Win, Spr, Sum (Staff)

224. Advanced Cell Biology

(Same as BIO 214, MCP 221) For PhD students. Current research on cell structure, function, and dynamics. Topics include complex cell phenomena such as cell division, apoptosis, compartmentalization, transport and trafficking, motility and adhesion, differentiation, and multicellularity. Current papers from the primary literature. Prerequisite for undergraduates: BIO 129A,B, and consent of instructor.
3 units, Win (Pfeffer, Ehrhardt, Jarosz, Kopito, Svensson)

241. Biological Macromolecules

(Same as BIOE 241, BIOPHYS 241, SBIO 241) The physical and chemical basis of macromolecular function. Forces that stabilize biopolymers with three-dimensional structures and their functional implications. Thermodynamics, molecular forces, structure and kinetics of enzymatic and diffusional processes, and relationship to their practical application in experimental design and interpretation. Biological function and the level of individual molecular interactions and at the level of complex processes. Case studies in lecture and discussion of classic and current literature. Enrollment limited to 30. Prerequisites: None; background in biochemistry and physical chemistry preferred but material available for those with deficiency; undergraduates with consent of instructor only.
3-5 units, Aut (Das)

257. Currents in Biochemistry

Seminars by Biochemistry faculty on their ongoing research. Background, current advances and retreats, general significance, and tactical and strategic research directions.
1 unit, Aut (Straight)

299. Directed Reading

Prerequisite: consent of instructor. 1-18 units, Aut, Win, Spr, Sum (Staff)

350. Development of Thesis Research

Biochemistry 2nd year PhD students with permission of instructor only. Students place their thesis research into a broader scientific perspective, identify important questions to ask, and learn to communicate these clearly. Series of roundtable discussions with students and faculty about the proposed research topics. Initial focus on developing the equivalent of specific aims for research grants.
2 units, Aut, (Harbury, Rohatgi)

360. Developing an Original Research Proposal

Biochemistry 3rd year PhD students with permission of instructor only. Students foster broad familiarity with the biomedical literature and learn to develop new research directions. Topics well outside of each student's research topic are chosen for regular informal journal club presentations. Students work with faculty to hone skills for identifying important open scientific questions, formulating hypotheses, and refining experimental logic. Students work collectively to create a "model" research proposal on a topic of general interest to the group, and then individually to develop an original proposal on a topic of each student's choice.
1 unit, Spr (Herschlag, Krasnow)

370. Medical Scholars Research

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.
4-18 units Aut, Win, Spr, Sum (Staff)

390. Curricular Practical Training

CPT Course required for international students completing degree requirements.
1-10 units, Win, Spr, Sum (Brandman)

399. Graduate Research and Special Advanced Work

Investigations sponsored by individual faculty members. Prerequisite: consent of instructor.
1-18 units, Aut, Win, Spr, Sum (Staff)

459. Frontiers in Interdisciplinary Biosciences

(Same as BIOE 459, BIO 459, CHEMENG 459, CHEM 459, PSYCH 459. Students register through their affiliated department.) For specialists and non-specialists. Sponsored by the Stanford BioX Program. Three seminars per quarter address scientific and technical themes related to interdisciplinary approaches in bioengineering, medicine, and the chemical, physical, and biological sciences. Leading investigators from Stanford and the world present breakthroughs and endeavors that cut across core disciplines. Pre-seminars introduce basic concepts and background for non-experts. Registered students attend all pre-seminars; others welcome. See http://biox.stanford.edu/courses/459.html. Recommended: basic mathematics, biology, chemistry, and physics.
1 unit, Aut, Win, Spr (Robertson)

802. TGR Dissertation

Terminal Graduate Registration course for doctoral programs. Work on the thesis dissertation must be evaluated.
0 units, Aut, Win, Spr, Sum (Staff)

This information, together with the latest Stanford University time schedule, is also available through Axess at: http://axess.stanford.edu/

There are excellent graduate level courses taught by faculty in other departments in the Medical School as well as by faculty in Biology and Chemistry. These courses enhance the breadth and depth of graduate education, providing students with an understanding of the multidisciplinary nature of modern biochemistry. Students are also encouraged to come up with areas for courses, which can then be organized in conjunction with one or more members of the faculty.

FREEDOM OF EXPRESSION AND ACADEMIC FREEDOM AT STANFORD

Stanford is committed to freedom of expression, free inquiry, and the open exchange of ideas as fundamental values for the university's academic mission. This website furnishes interim guidance on the application of freedom of expression principles in different contexts around campus. While the guidance is intended to provide greater clarity about current policies and procedures, some of these policies will continue to be evaluated by university administration as well as the Faculty Senate's Ad Hoc Committee on University Speech, with input and consultation across our community.

LEARN MORE

OFFICE OF THE VICE PROVOST FOR GRADUATE EDUCATION (VPGE)

VPGE works collaboratively across the university to ensure that every graduate student receives the best possible educational experience. VPGE's initiatives and resources enrich students' academic experiences at Stanford by advancing diversity, preparing leaders, and positioning Stanford at the forefront of innovation in graduate education.

LEARN MORE