

STRUCTURAL BIOLOGY & BIOCHEMISTRY (PHD)

Overview

The Structural Biology and Biochemistry (STBB) PhD Program is an interdepartmental graduate training program offered within the School of Medicine at the University of Colorado Anschutz Medical Campus in Aurora, Colorado. Student training places a major emphasis on research experiences, both in lab rotations and thesis projects, and includes a range of coursework in biochemistry, biophysics, drug design, pharmacology, and cellular, molecular, and structural biology.

The STBB Program encourages students to engage in collaborative projects and provides shared mentoring that can include faculty from outside The Program. Such interactions are geared towards fostering interdisciplinary training.

Faculty research activities cover a range of structural and computational techniques including NMR Spectroscopy, X-Ray

Crystallography, Cryo-EM, Mass Spectrometry and Proteomics, Biophysics, and Peptide/Protein Chemistry that are focused on a diversity of biological targets such as signaling molecules, transmembrane proteins, RNA, genome bioinformatics, lipids, and oligosaccharides.

Admission Requirements

Admission Philosophy

Students are considered and selected on the basis of past academic performance, previous research experience, recommendations, and individual interviews. While previous experience in structural biology and biochemistry coursework and research is helpful, the STBB program welcomes applicants with varied backgrounds. Students most likely to succeed have traditionally been those with intellectual achievement and creativity, first-hand understanding of laboratory research, and a strong personal desire and motivation to progress in their scientific training.

Entrance Requirements

Students are selected on the basis of past academic performance and, where possible, individual interviews. We select students who show intellectual vigor, independence, and strong motivation to become creative and successful scientists. The faculty recognizes that students who are attracted to a career in Structural Biology and Biochemistry come from highly varied backgrounds. Although there are no specific undergraduate course requirements, students with a good undergraduate foundation in math and the biological and chemical sciences have performed best in the Program. It is suggested that applicants have completed courses in biology, chemistry, biochemistry, and cell and molecular biology before entering the Program.

The Structural Biology and Biochemistry Program requires that applicants achieve a minimum cumulative undergraduate GPA of 3.00, and recommends that applicants complete the Graduate Record Examination (GRE). Foreign applicants must demonstrate proficiency in English.

How to Apply

DEADLINE FOR APPLICATIONS IS DECEMBER 1st.

PRIORITY DEADLINE FOR INTERNATIONAL APPLICANTS IS NOVEMBER 1.

To apply for admission applicants must submit the following:

- Online Graduate School application (<https://graduateschool.ucdenver.edu/admissions/>).
- A \$50.00 domestic and \$75.00 international non-refundable application fee [credit card (on-line only), check, or money order]. No application will be processed unless this fee is paid.
- Three (3) letters of recommendation. The most informative letters will come from Professors who have mentored you in your research experiences. Professors who have taught science classes you have been enrolled in, or whom you have worked with in an advisory capacity, are also good choices. We do not recommend that you ask postdocs, technicians or fellow students for letters. Likewise, members of the community are generally not good choices, as typically their understanding of biomedical PhD training, and hence their ability to evaluate your potential, is limited.
- GRE test scores are optional but recommended. Use GRE code 4875.
- TOEFL or IELTS scores and financial support verification (international students only).
- One (1) official transcript of all academic work completed to date. To be considered "official", the transcripts must come from the issuing institution directly to the University of Colorado Denver Graduate Admissions.

Electronic Transcripts should be sent to: graduateadmissions@ucdenver.edu

If sending a physical transcript, please mail to:

Graduate School
Campus Box 163
PO Box 173364
1380 Lawrence Street Suite 1250
Denver, CO 80205-3364

Degree Requirements

First Year

Course	Title	Hours
First Year		
Fall		
BMSC 7806	Core I: Foundations in Biomedical Sciences	6
BMSC 7810	Core Topics in Biomedical Science	1-6
STBB 7650	Research in Structural Biology & Biochemistry ((Must take 2 sections))	1-10
STBB 7660	Structure Seminar	1
Hours		9-23
Total Hours		9-23

Course	Title	Hours
First Year		
Spring		
STBB 7608	Molecular Interactions	3
STBB 7609	Biophysics & Spectroscopy	3
STBB 7650	Research in Structural Biology & Biochemistry	1-10

STBB 7660	Structure Seminar	1
	Hours	8-17
Summer		
STBB 8990	Doctoral Thesis	1-10
	Hours	1-10
	Total Hours	9-27

Second Year

Course	Title	Hours
Second Year		
Fall		
STBB 7631	Molecular Structure A	1.5
STBB 7632	Molecular Structure B	1.5
STBB 7633	Molecular Structure C	1.5
STBB 7660	Structure Seminar	1
PHCL 7605	Responsible Conduct of Research	1
	Hours	6.5
	Total Hours	6.5

Course	Title	Hours
Year 1		
Spring		
STBB 7608	Molecular Interactions	3
STBB 7609	Biophysics & Spectroscopy	3
STBB 7650	Research in Structural Biology & Biochemistry	1-10
STBB 7660	Structure Seminar	1
	Hours	8-17
	Total Hours	8-17

Third Year & Beyond

Fall/Spring/Summer

Code	Title	Hours
STBB 8990	Doctoral Thesis	1-10

Learning Objectives

The goals of the Structural Biology and Biochemistry Program are to:

- Foster scientific excellence and innovation in the field of biomolecular structure and function.
- Develop and advance expertise and technology to support cutting-edge research in biomedical sciences
- Provide training and career development for outstanding scientists
- Identify and characterize molecular targets and develop innovative therapeutics and diagnostic tools
- Exploit discoveries and intellectual properties through strategic partnerships with the industry.

Learning Outcomes

The PhD program in Structural Biology and Biochemistry trains graduate students to become proficient and successful investigators who are able to:

- Demonstrate a basic knowledge of central concepts in the biomedical sciences.

- Understand the current concepts in structural biology and biochemistry.
- Read and critically evaluate the scientific literature.
- Formulate hypotheses based on current concepts in the field and design, conduct, and interpret their own research projects.
- Present research results in peer-reviewed publications and in a dissertation.
- Communicate research results effectively through oral presentations at scientific seminars, conferences, and other venues.
- Write a competitive application for research funding.
- Develop ancillary skills, where necessary, to obtain positions outside of scientific research.

With this knowledge, they will understand molecular structures and mechanisms. Training is provided in the following exciting areas:

- Biomolecular Interactions.
- Protein and RNA structure, function, and dynamics.
- Computational studies of structure and function relationships of biomolecules.
- Structure-based design of new molecules important in biology, biochemistry, and pharmacology.
- Proteomics and metabolics.

The courses and research emphasize both breadth and flexibility while encouraging interdisciplinary training. Students may choose research projects from a variety of laboratories at the University of Colorado and the National Jewish Medical and Research Center. Training will result in a PhD degree awarded by the Program in Structural Biology and Biochemistry.

Courses

BMSC 7806 - Core I: Foundations in Biomedical Sciences (6 Credits)
Course will focus on the fundamental principles of biomedical sciences. Lectures and recitations/discussions will primarily address the basics of molecular biology, biochemistry, genetics, cell biology and energetic principles. Course is typically limited to biomedical science PhD and BSBT MS students. Previously offered as IDPT 7806
Grading Basis: Letter Grade
Repeatable. Max Credits: 6.
Typically Offered: Fall.

BMSC 7810 - Core Topics in Biomedical Science (1-6 Credits)
Sections focus on different core topics in biomedical science, and will address subject areas such as protein structure and function, neurobiology, embryology, stem cell research, and cancer biology. Students can enroll in multiple Core Topic Courses topics in one semester. Previously offered as IDPT 7810.
Grading Basis: Letter Grade
Repeatable. Max Credits: 20.
AMC-PHD PhD Students only
Typically Offered: Fall.

PHCL 7605 - Responsible Conduct of Research (1 Credit)

The Department of Pharmacology in the University of Colorado School of Medicine organizes and offers an interactive course during the fall semester entitled "Responsible Conduct of Research". The course is designed to inform students, trainees and faculty to the NIH requirements for ethical and responsible research.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall.

STBB 7608 - Molecular Interactions (3 Credits)

Provides chemical/physical basis for protein structure, folding, function & stability; presents methods/principles of protein/peptide purification & enzyme catalysis including electron transfer & mutagenesis. The role of molecular dynamics & use of molecular simulations in the investigations of protein-ligand/protein-protein interactions. Cross-listed with PHSC 7608.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Spring.

STBB 7609 - Biophysics & Spectroscopy (3 Credits)

This course will teach fundamentals of modern molecular spectroscopies and biophysical techniques as applied to biomolecules and the structural/dynamic information they afford. Cross listed with PHSC 7609

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Spring.

STBB 7631 - Molecular Structure A (1.5 Credits)

Gain an in-depth understanding of the underlying principles of an NMR experiment, so that student can turn NMR theory into NMR practice for their research.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall.

STBB 7632 - Molecular Structure B (1.5 Credits)

Understand the theory and practice of structural determination using x-ray crystallography.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall.

STBB 7633 - Molecular Structure C (1.5 Credits)

The purpose of this course is to provide students with a concise understanding of biological mass spectrometry and its application to study and characterize various classes of biomolecules in state of the art research. Course is 7.5 weeks.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall.

STBB 7650 - Research in Structural Biology & Biochemistry (1-10 Credits)

Research work in Structural Biology and Biochemistry. 2 laboratory hours per week per credit.

Grading Basis: Letter Grade with IP

Repeatable. Max Credits: 10.

A-GRAD Restricted to graduate students only.

Typically Offered: Fall, Spring, Summer.

STBB 7660 - Structure Seminar (1 Credit)

Seminar series provides a forum for the presentation of scientific experiments and information in structural biology by faculty, postdoctoral fellows and graduate students.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall, Spring.

STBB 8990 - Doctoral Thesis (1-10 Credits)

Doctoral thesis work in Structural Biology and Biochemistry.

Grading Basis: Letter Grade with IP

Repeatable. Max Credits: 10.

A-GRAD Restricted to graduate students only.

Additional Information: Report as Full Time.

Typically Offered: Fall, Spring, Summer.

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