Twin Cities Campus

Biochemistry, Molecular Biology and Biophysics Ph.D.

Biochemistry, Molecular Biology, & Biophysics TCBS

Graduate School

Link to a list of faculty for this program.

Contact Information:
Department of Biochemistry, Molecular Biology and Biophysics
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- Program Type: Doctorate
- Requirements for this program are current for Fall 2022
- Length of program in credits: 48
- This program requires summer semesters for timely completion.
- Degree: Doctor of Philosophy

Along with the program-specific requirements listed below, please read the General Information section of the catalog website for requirements that apply to all major fields.

The Biochemistry, Molecular Biology and Biophysics (BMBB) graduate program is an interdisciplinary program that is supported by the College of Biological Sciences (CBS) and the Medical School of the University of Minnesota. The program provides a broad research-based education involving faculty from BMBB as well as many faculty members from several other departments in CBS, the Medical School, the College of Science and Engineering (CSE), the College of Food, Agricultural and Natural Resources Sciences (CFANS), and the College of Veterinary Medicine.

BMBB focuses on determining the molecular mechanisms that underlie basic biological functions using an integrated approach that encompasses biochemistry, chemistry, biophysics, genomics, molecular biology, proteomics, and structural biology. Special emphasis is placed on revealing how biological processes go awry in diseases including cancer, diabetes, heart disease, and AIDS. The program has four areas of emphasis: synthetic biology and biotechnology, molecular biology, metabolic and systems biology, and chemical and structural biology. All students are expected to demonstrate a minimum level of competence in these areas but will emphasize the area most related to their thesis project.

While graduate training in a BMBB laboratory involves first-year coursework and associated preliminary examinations, the focal point for graduate education is thesis research. Laboratory-based exploration coupled with journal clubs, seminars, scientific meetings and retreats, career counseling and scientific ethics constitutes the major components of the program. Support for graduate education comes from a variety of sources but is augmented by several NIH and NSF-based training grants. PhD graduates from the University of Minnesota obtain full-time employment immediately after graduation or pursue advanced training in academic or corporate postdoctoral positions.

Students pursuing the PhD are admitted to BMBB under the auspices of Molecular, Cellular and Structural Biology (MCSB), a first year program administered by BMBB and the Molecular, Cellular, Developmental Biology and Genetics (MCDB&G) graduate programs. After the first year, students select either BMBB or MCDB&G to complete their degree.

Related PhD and MS programs in BMBB:

As a part of the BMBB program, graduate studies leading to a PhD degree may be pursued on the Duluth campus. A PhD in BMBB may also be obtained through the Combined MD-PhD program. Please visit the program website for more information (http://www.med.umn.edu/mdphd/index.htm).

Note: One cannot apply for admission to the master's degree in BMBB. Students are only admitted to the BMBB PhD program. Alternative, related master's degree programs that admit students are the master's of biological sciences (MBS) (http://cce.umn.edu/master-of-biological-sciences) and the master's in microbial engineering (http://bti.umn.edu/MicE/).

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

The program can accommodate for a variety of educational backgrounds. However, applications from students with an undergraduate degree in the biological, chemical, or physical sciences are encouraged.

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Other requirements to be completed before admission:
Recommended academic preparation includes one year each of calculus, organic chemistry, and basic biology, including biochemistry and genetics. For students of demonstrated ability, background deficiencies can be made up during the first year of graduate study. Successful applicants must have previous research experience in an academic or industrial setting in addition to any course-related laboratory experiences. It is important to demonstrate an aptitude for basic science research prior to embarking on a graduate career in this program.

Special Application Requirements:
Additionally, applicants must submit three letters of recommendation from persons familiar with their academic and research capabilities. A statement of interests and goals, and a complete set of transcripts are required. The deadline to submit a completed application is December 1. Completed files are reviewed between January and February. Graduate studies begin fall semester only. Related Ph.D. and M.S. Programs in BMBB: As a part of the BMBB program, graduate studies leading to a PhD degree may be pursued on the Duluth Campus. A PhD in BMBB may also be obtained through the Combined MD-PhD Program. Please visit the program website for more information (http://www.med.umn.edu/mdphd/index.htm). Note: One cannot apply for admission to the master's degree in BMBB. Students are only admitted to the BMBB PhD program. Alternative, related master's degree programs that admit students are the Master of Biological Sciences (MBS) (http://cce.umn.edu/master-of-biological-sciences) and the Master in Microbial Engineering (http://bti.umn.edu/MicE/).
For an online application or for more information about graduate education admissions, see the General Information section of this website.

International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 107
  - Internet Based - Writing Score: 25
  - Internet Based - Reading Score: 25
- IELTS
  - Total Score: 7

Key to test abbreviations(TOEFL, IELTS).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

24 credits are required in the major.
0 credits are required outside the major.
24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses towards program requirements is not permitted.

A minimum GPA of 3.00 is required for students to remain in good standing.

Students must complete three seminar presentations and two teaching assignments between years 2 and 4.

Students must register for BIOC 8084 and 8184 at least once during their first or second year in the program.

Biochemistry Required Coursework (12 Credits)
Core Courses (4 credits)
Complete the following core courses. MCDG 8920 must be taken for two credits.
BIOC 5002 - Critical Evaluation of Biochemistry Research (1.0 cr)
BIOC 8184 - Graduate Seminar (1.0 cr)
MCDG 8920 - Special Topics (1.0 - 4.0 cr)
Student Seminar (1 credit)

BIOC 8084 - Research and Literature Reports (1.0 cr)
or MCDG 8900 - Student Research Seminar (1.0 cr)

Ethics (1 credit)

BIOC 8401 - Ethics, Public Policy, and Careers in Molecular and Cellular Biology (1.0 cr)
or GCD 8401 - Ethics, Public Policy & Careers in Molecular Cell Biology (1.0 cr)

Module Options (6 Credits)

Complete six credits, in consultation with the director of graduate studies, from the following list:
BIOC 5535 - Introduction to Modern Structural Biology -- Diffraction (2.0 cr)
BIOC 5536 - Introduction to Modern Structural Biology - Nuclear Magnetic Resonance (2.0 cr)
BIOC 8005 - Biochemistry: Structure and Catalysis (2.0 cr)
BIOC 8006 - Biochemistry: Metabolism and Control (2.0 cr)
BIOC 8007 - Molecular Biology of the Genome (2.0 cr)
BIOC 8008 - Molecular Biology of the Transcriptome (2.0 cr)

Emphasis Electives (12 Credits)

Complete 12 credits of coursework, in consultation with the advisor, from one of the four BMBB emphases: synthetic biology and biotechnology, molecular biology, metabolic and systems biology, or chemical and structural biology. Non-BMBB courses may be used to build an emphasis with advisor and director of graduate studies approval.
BIOC 5216 - Current Topics in Signal Transduction (2.0 cr)
BIOC 5309 - Biocatalysis and Biodegradation (3.0 cr)
BIOC 5351 - Protein Engineering (3.0 cr)
BIOC 5352 - Biotechnology and Bioengineering for Biochemists (3.0 cr)
BIOC 5361 - Microbial Genomics and Bioinformatics (3.0 cr)
BIOC 5444 - Muscle (3.0 cr)
BIOC 5528 - Spectroscopy and Kinetics (4.0 cr)
BIOC 8084 - Research and Literature Reports (1.0 cr)
BIOC 8184 - Graduate Seminar (1.0 cr)
BIOL 8100 - Improvisation for Scientists (1.0 cr)
CHEM 8011 - Mechanisms of Chemical Reactions (4.0 cr)
CHEM 8021 - Computational Chemistry (4.0 cr)
CHEM 8411 - Introduction to Chemical Biology (4.0 cr)
CHEM 8412 - Chemical Biology of Enzymes (4.0 cr)
CHEM 8735 - Bioinorganic Chemistry (4.0 cr)
CHEN 8754 - Systems Analysis of Biological Processes (3.0 cr)
CSCI 5461 - Functional Genomics, Systems Biology, and Bioinformatics (3.0 cr)
GCD 5005 - Computer Programming for Biology (3.0 cr)
GCD 8008 - Mammalian Gene Transfer and Genome Engineering (2.0 cr)
GCD 8131 - Advanced Molecular Genetics and Genomics (3.0 cr)
GCD 8151 - Cellular Biochemistry and Cell Biology (2.0 - 4.0 cr)
GCD 8900 - Seminar (1.0 - 2.0 cr)
GRAD 5102 - Preparation for University Teaching for Nonnative English Speakers (2.0 cr)
GRAD 8101 - Teaching in Higher Education (3.0 cr)
GRAD 8200 - Teaching and Learning Topics in Higher Education (1.0 cr)
MICA 8002 - Structure, Function, and Genetics of Bacteria and Viruses (4.0 cr)
MICA 8003 - Immunity and Immunopathology (4.0 cr)
MICA 8004 - Cellular and Cancer Biology (4.0 cr)
MICA 8010 - Microbial Pathogenesis (3.0 cr)
MICA 8013 - Translational Cancer Research (2.0 cr)
PHCL 5111 - Pharmacogenomics (3.0 cr)
PUBH 6450 - Biostatistics I (4.0 cr)
PUBH 7445 - Statistics for Human Genetics and Molecular Biology (3.0 cr)
SCB 8181 - Stem Cell Biology (3.0 cr)
STAT 5021 - Statistical Analysis (4.0 cr)

Thesis Credits

Take 24 doctoral thesis credits.
BIOC 8888 - Thesis Credit: Doctoral (1.0 - 24.0 cr)

Joint- or Dual-degree Coursework:MD/PhD-Biochemistry, Molecular Biology and BiophysicsStudent may take a total of 18 credits in common among the academic programs.