

NATURAL SCIENCES GENERAL

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Professional Science Master in Biological Sciences

The Professional Science Master's (PSM) with a concentration in Biomedical Sciences offers rigorous academic training and professional practical skills to prepare students for challenging careers in the biomedical sciences and allied health sciences. The program strives to provide strong scientific knowledge and promote global-awareness, ethics, communication and other important professional skills through acquiring knowledge within and across disciplines at DU. Students will gain an awareness and knowledge of the many current issues and concerns facing the fields of allied health and biomedical sciences industries.

Molecular and Cellular Biophysics

The Molecular and Cellular Biophysics PhD (MCB) program provides opportunities for doctoral studies in the interdisciplinary field of biophysics. Participation of faculty from the Departments of Biological Sciences, Chemistry & Biochemistry, and Physics & Astronomy enhances the strength and breadth of our program by incorporating cross-disciplinary and collaborative approaches to research. The MCB PhD program is centered on research activities that coincide with faculty experience and expertise. Areas of research in the MCB program include cellular physiology, developmental dynamics, protein folding and aggregation, protein network analysis, signal transduction cascades, synthetic biology, systems biology and the development of novel imaging techniques. Projects at the interface of traditional disciplines of physics, biology and chemistry as well as methods of mathematical analysis and computer modeling are particularly encouraged.

The MCB PhD program offers both a core foundation in biophysical theory and practice yet provides flexibility and individualized attention such that students with diverse scientific backgrounds will have the opportunity to be trained in molecular and cellular biophysics. During their first year in the program, students conduct lab rotations, take a year-long course sequence that covers foundations of molecular and cellular biophysics and take additional graduate courses to supplement their undergraduate training. At the end of their first year, students will join the lab in which they will conduct their thesis research.

Students with strong quantitative undergraduate backgrounds (e.g., undergraduate degrees in physics, chemistry, mathematics, computer science/engineering) who desire to apply these skills to various biological problems, as well as students with a background in cell or molecular biology with a solid foundation in mathematics and physics are particularly encouraged to apply. Financial aid is usually offered in the form of Graduate Teaching or Graduate Research Assistantships, which cover tuition costs and provide a stipend for living expenses.

Doctor of Philosophy in Molecular and Cellular Biophysics

Application Deadlines

- Fall 2018 Priority Deadline: January 31, 2018
- Fall 2018 Final Submission Deadline: June 1, 2018

Admission Requirements

- **Online admission application**
- **\$65.00 Application Fee**
- **University Minimum Degree and GPA Requirements**
- **Transcripts:** (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/admission-process-and-standards-for-all-applicants/transcripts-and-proof-of-degree>) One official transcript from each post-secondary institution.
- **GRE** (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/admission-process-and-standards-for-all-applicants/university-admission-criteria>): The Graduate Record Examination (GRE) is required and a subject test is recommended. Competitive subject GRE scores will strengthen a candidate's application. Applicants can report subject GRE scores in any of the following disciplines: Physics, Chemistry, Biology, Biochemistry, Cell and Molecular Biology. Scores must be received directly from the appropriate testing agency by the deadline. The institution code for the University of Denver is 4842.
- **Letters of Recommendation:** Three (3) letters of recommendation are required. Letters should be submitted by recommenders through the online application.
- **Personal Statement:** A personal statement of at least 300 words is required. The statement should include information concerning your education, practical (research) experience, special interests and specific purpose for applying to the interdisciplinary program in molecular and cellular biophysics at the University of Denver.

- **Prerequisites:** A minimum of one year of calculus and one year of college physics (preferably calculus-based), regardless of undergraduate major, are required.

Additional Standards for Non-Native English Speakers

Official scores from the Test of English as a Foreign Language (TOEFL), International English Language Testing System (IELTS) or Cambridge English: Advanced (CAE) are required of all graduate applicants, regardless of citizenship status, whose native language is not English or who have been educated in countries where English is not the native language. The minimum TOEFL/IELTS/CAE test score requirements for the degree program are:

- **Minimum TOEFL Score (paper-based test):** 550
- **Minimum TOEFL Score (internet-based test):** 80
- **Minimum IELTS Score:** 6.5
- **Minimum CAE Score:** 169
- **English Conditional Admission Offered:** No, this program does not offer English Conditional Admission.

Read the English Language Proficiency (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/additional-standards-for-non-native-english-speakers/english-language-proficiency-ielts-toefl>) policy for more details.

Read the English Conditional Admission (ECA) (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/additional-standards-for-non-native-english-speakers/english-conditional-admission-eca>) policy for more details.

Read the Required Tests for GTA Eligibility (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/additional-standards-for-non-native-english-speakers/required-tests-for-gta-eligibility>) policy for more details.

Additional Standards for International Applicants

Per Student & Exchange Visitor Program (SEVP) regulation, international applicants must meet all standards for admission before an I-20 or DS-2019 is issued, [per U.S. Federal Register: 8 CFR § 214.3(k)] or is academically eligible for admission and is admitted [per 22 C.F.R. §62]. Read the Additional Standards For International Applicants (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/additional-standards-for-international-applicants>) policy for more details.

Financial Aid

There are many different options available to finance your education. Most University of Denver graduate students are granted some type of financial support. Our Office of Financial Aid is committed to helping you explore your options.

PROFESSIONAL SCIENCE MASTER IN BIOLOGICAL SCIENCES

Application Deadlines

- Fall 2018 Priority Deadline: March 1, 2018
- Fall 2018 Final Submission Deadline: September 14, 2018

Admission Requirements

- **Online admission application**
- **\$65.00 Application Fee**
- **University Minimum Degree and GPA Requirements:**
- **Transcripts:** (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/admission-process-and-standards-for-all-applicants/transcripts-and-proof-of-degree>) One official transcript from each post-secondary institution.
- **GRE** (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/admission-process-and-standards-for-all-applicants/university-admission-criteria>): Application to the PSM program requires the Graduate Record Examination (GRE) general test or the MCAT. The GRE subject test is not required. Scores must be received directly from the appropriate testing agency by the program's stated deadline. The institution code for the University of Denver is 4842.
- **Letters of Recommendation:** Three (3) letters of recommendation are required. Letters should be submitted by recommenders through the online application.
- **Personal Statement:** A personal statement of at least 300 words is required. The personal statement of interest and qualifications should address your career goals as they relate to the PSM specialization in Biomedical Sciences (maximum 2 pages).
- **Prerequisites:** Students with an undergraduate major in chemistry, physics or mathematics as well as those with minimal preparation in biology will be considered. Course prerequisites include: one year of chemistry, one year of calculus (recommended), one year of physics, and two years of biology.

Additional Standards for Non-Native English Speakers

Official scores from the Test of English as a Foreign Language (TOEFL), International English Language Testing System (IELTS) or Cambridge English: Advanced (CAE) are required of all graduate applicants, regardless of citizenship status, whose native language is not English or who have been educated in countries where English is not the native language. The minimum TOEFL/IELTS/CAE test score requirements for the degree program are:

- **Minimum TOEFL Score (paper-based test):** 550
- **Minimum TOEFL Score (internet-based test):** 80
- **Minimum IELTS Score:** 6.5
- **Minimum CAE Score:** 169
- **English Conditional Admission Offered:** In cases where minimum TOEFL/IELTS/CAE scores were not achieved or no English proficiency test was taken, the Biological Sciences program may offer English Conditional Admission (ECA) to academically qualified non-native English speakers.

Read the English Language Proficiency (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/additional-standards-for-non-native-english-speakers/english-language-proficiency-ielts-toefl>) policy for more details.

Read the English Conditional Admission (ECA) (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/additional-standards-for-non-native-english-speakers/english-conditional-admission-eca>) policy for more details.

Read the Required Tests for GTA Eligibility (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/additional-standards-for-non-native-english-speakers/required-tests-for-gta-eligibility>) policy for more details.

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Per Student & Exchange Visitor Program (SEVP) regulation, international applicants must meet all standards for admission before an I-20 or DS-2019 is issued, [per U.S. Federal Register: 8 CFR § 214.3(k)] or is academically eligible for admission and is admitted [per 22 C.F.R. §62]. Read the Additional Standards For International Applicants (<http://bulletin.du.edu/graduate/admission-and-enrollment-policies/additional-standards-for-international-applicants>) policy for more details.

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Doctor of Philosophy in Molecular and Cellular Biophysics

Graduate studies in the program are highly individualized; programs should fit each student's unique needs and interests. Students are required to perform original, publishable research and to present a thesis based on research to the faculty of the molecular and cellular biophysics program.

A student qualifies for the PhD degree after demonstrating growth as an independent investigator—identifying a significant research question; proposing a hypothesis or model to answer the question; testing the hypothesis with appropriate experiments; and writing a dissertation acceptable to the department.

The structure of the PhD program in Molecular and Cellular Biophysics is as follows:

- required core courses and elective courses during the first year
- required lab rotations during the first year
- required seminar/special topics courses during the second year
- qualifying exams first year and second year
- thesis research second year to completion

Degree Requirements

Coursework Requirements

Code	Title	Credits
Required Courses		
First Year		
BIOP 4100	Foundations in Biophysics	3
BIOP 4150	Cellular Biophysics	3
CHEM 3130	Chemical Systems III	3
BIOP 4995	Independent Research	1-9
Second Year		
3 quarters of BIOP 4210 are required		

BIOP 4210	Current Topics in Biophysics	2
BIOP 4210	Current Topics in Biophysics	2
BIOP 4210	Current Topics in Biophysics	2

Electives

During the first two years electives can be chosen from existing 3000- or 4000-level courses in the Division and must be chosen with consultation and the approval of the Steering committee. This use of electives is critical given the interdisciplinary nature of this PhD program and scientific discipline and the fact that incoming students will come from a range of disciplines in the physical sciences and life sciences.

The remainder of the credit hours required for the degree may include:

BIOP 4992	Directed Study	
BIOP 4995	Independent Research	
BIOP 5995	Independent Research	

Total Credits		90
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Minimum credits required for the degree: 90 (must be approved by the program Steering committee)**Non-coursework Requirements**

- passing performance in the qualifying examinations
- completion of a research dissertation of publishable quality
- successful oral defense of the dissertation

Additional requirements:

- successful completion of research rotations during the first year
- maintaining a minimum GPA of 3.0
- passing performance in the qualifying examinations
- attendance at departmental seminars and the presentation of one seminar per year
- completion of a research dissertation of publishable quality
- successful oral defense of the dissertation

A complete description of the program's official requirements and details of qualifying examinations are available on the Natural Sciences & Mathematics (<http://www.du.edu/nsm/departments/molecularandcellular>) website.

Master of Science in Molecular and Cellular Biophysics

The MS in Molecular and Cellular Biophysics is a terminal master's degree for students who enter the PhD in Molecular and Cellular Biophysics but demonstrate a mastery in the program that indicates an MS degree is more suitable.

Degree Requirements**Coursework Requirements**

Code	Title	Credits
Required courses		
BIOP 4100	Foundations in Biophysics	3
BIOP 4150	Cellular Biophysics	3
CHEM 3130	Chemical Systems III	3
BIOP 4210	Current Topics in Biophysics (Three quarters are required.)	2
BIOP 4210	Current Topics in Biophysics (Three quarters are required.)	2
BIOP 4210	Current Topics in Biophysics (Three quarters are required.)	2
BIOP 4995	Independent Research (Student must reach a minimum of 45 credit hours with approved independent research coursework.)	1-9

Minimum Number of Credits Required		45
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Minimum credits required for the degree: 45**Non-coursework requirements**

- Thesis
- Oral Defense

Professional Science Master in Biological Sciences

Degree Requirements

Coursework Requirements

Code	Title	Credits
Required Courses		
BIOL 4085	Accelerated Biostatistics	2
BIOL 4155	Leadership in Science	1
BIOL 4211	Advanced Cell Biology	3
BIOL 4212	Advanced Molecular Biology	3
BIOL 4231	Responsible Conduct in Rsrch	1
BIOL 4310	Foundations in Literature: Cell and Molecular Biology	2
must be taken 2 times		
BIOL 4870	Medical Ethics	4
BIOL 4880	Capstone in Biomedical Sciences	4
BIOL 4991	Independent Study	1-17
Elective Courses		26
Electives can be chosen from the approved list of existing elective courses in consultation with the Program Director. Additional upper level (3000- or 4000-level) elective courses will be considered with approval of the Program Director.		
Natural Sciences		
BIOL 3025	Science and the Law	2,4
BIOL 3100	Histology: Medical Microanatomy	4
BIOL 3120	General Microbiology	4
BIOL 3145	Cellular and Molecular Biology of Cancer	2-4
BIOL 3160	Biophysics: Ion Channels & Disease	4
BIOL 3230	Nutrition	3
BIOL 3250	Human Physiology	5
BIOL 3610	Developmental Biology	4
BIOL 3630	Cell Biology of Development	4
BIOL 3640	Introductory Neurobiology	4
BIOL 3641	Systems Neuroscience	4
BIOL 3642	Neuropharmacology	4
BIOL 3644	Neuromuscular Pathophysiology	4
BIOL 3670	Molecular Immunology	4
BIOL 3704	Advanced Topics in Cell Biology	1-4
BIOL 3800	Human Molecular Biology	4
BIOL 3910	Viruses & Infectious Human Diseases	4
BIOL 3920	Forensic Pathology	2-4
BIOL 4213	Advanced Cell Signaling	3
CHEM 3130	Chemical Systems III	3
CHEM 3812	Biochemistry-Membranes/Metabolism	3
CHEM 3811	Biochemistry-Proteins	3
CHEM 3813	Biochemistry-Nucleic Acids	3
CHEM 3820	Biochemistry Lab	3
GEOG 3470	GIS & Environmental Health Geography	4
Global Health		
INTS 4056	Information Management in Humanitarian Crises	5
INTS 4367	Global Health Affairs	5
INTS 4483	Practical Applications in Global Health	5
INTS 4362	Gender and Health	5
INTS 4366		5
INTS 4368	HIV & AIDS in International Affairs	5
INTS 4423	Introduction to Epidemiology	5

INTS 4435	Health and Development	5
INTS 4465	Population and Society	5
INTS 4492	Health and Humanitarian Aid	5
INTS 4516	Major Diseases in Global Health (From Pathophysiology to Action)	5
INTS 4576	Seminar: Community-Based Research Methods	5
Social Sciences		
COMN 4020	Communication Studies: Relational	4
COMN 4110	Theories in Interpersonal Communication	4
COMN 4701	Topics in Communication	1-4
PSYC 4002	Prosem in Memory and Cognition	5
PSYC 4011	Proseminar in Emotion	5
PSYC 4021	Prosem in Social Psychology	5
PSYC 4031	Developmental Proseminar: Cognition & Perception	5
PSYC 4085	Stress & Health	5
PSYC 4254	Intro to Neural Network Models	5
PSYC 4255	Imaging the Mind	5
PSYC 4256	Seminar:Cognitive Neuroscience	5
PSYC 4258	Social Neuroscience	5
PSYC 4262	Affective Neuroscience	4
PSYC 4033	Devel Proseminar: Biological	5
PSYC 4511	Prosem in Psychopathology	5
PSYC 4525	Prosem in Develop Neuropsych	5
PSYC 4526	Prosem in Cog Neuroscience	5
Engineering		
ENBI 4500	Biofluids	4
ENBI 4510	Biomechanics	4
ENBI 4520	Introduction to Cardiovascular Engineering	4
ENBI 4800	Adv Topics (Bioengineering) ¹	1-5
Business		
ACTG 4610	Financial Accounting and Reporting	4
FIN 4630	Managerial Finance	4
INFO 4100	Survey of Business Analytics	4
INFO 4280	Project Management	4
MGMT 4620	Organizational Dynamics	4
MGMT 4630	Strategic Human Resources Management	4
MKTG 4100	Marketing Concepts	4
Public Policy		
PPOL 4400	Analytical & Critical Skills	4
PPOL 4600	Regulatory Policy	4
PPOL 4700	Public Management & Budgeting	4
Total Credits		45

¹ Students may take ENBI 4800 Advanced Topics: Bio-Fluid Mechanics or ENBI 4800 Advanced Topics: Computational Biomechanics.

Minimum credits required for degree: 45

Non-coursework Requirements

- Capstone project- The capstone project includes a written and public oral presentation of the project. The program requires a capstone project which involves interactions with allied health and biomedical professions from outside of the DU community. The capstone experience will be culminated in a formal scholarly work (both written and orally presented) that reflects a student's individual interest and the integration of science with strong professional skills.

Additional requirements:

- maintain a minimum GPA of 3.0
- successful completion of capstone project

- completion of capstone paper
- successful oral defense of capstone project