COMPUTATIONAL BIOSCIENCE (PHD)

Overview

The program was founded and is directed by Professor Lawrence Hunter, founder of the International Society for Computational Biology, and the popular ISMB and PSB conferences. The CPBS Program is globally recognized for its research and teaching of computational biology and bioinformatics at the University of Colorado's Anschutz Medical Campus. The Program is designed to produce graduates with depth in computational methods and molecular biomedicine, an intimate familiarity with the science and technology that synthesizes the two, and the skills necessary to pioneer novel computational approaches to significant biomedical questions.

The Computational Bioscience Program of the University Of Colorado School Of Medicine is dedicated to training computational biologists who aspire to achieve excellence in research, education and service, and who will apply the skills they learn toward improving human health and deepening our understanding of the living world. The Computational Bioscience Program provides graduates with the foundation for a lifetime of continual learning. Our curriculum integrates training in computation and biomedical sciences with student research and teaching activities that grow increasingly independent through the course of the program. Our graduates are able to do independent computational bioscience research, to collaborate effectively with other scientists, and to communicate their knowledge clearly to both students and the broader scientific community.

Admissions Requirements

To apply for admission applicants must submit the following:

- Online application
  - Personal Statement: A roughly one-page personal statement describing the applicant's career goals and purpose for seeking a Computational Bioscience PhD
  - Resume: The applicant's current resume or curriculum vitae, including professional work/practice since graduating with a bachelor's degree (or equivalent).
  - Past Work Statement
  - Three recommendations: to be completed by people who know your professional, academic and/or personal achievements or qualities well. As such, references must be from professional contacts, such as employers, supervisors, former faculty, preceptors, or professional colleagues. References from clergy, family members, friends or politicians will not be accepted.
- Application Fee: A nonrefundable application fee of $50.00 (U.S. dollars) for domestic applicants. Checks or money orders should be made out to the University of Colorado.
- Interview: After the application is complete a telephone or video interview will be arranged with the applicant and around 6 faculty members. This interview will afford the program the opportunity to understand the needs of the applicant and for the candidate to ask questions. The interview process is designed to assess the applicant's knowledge of the profession, communication, and ability to perform in a positive, professional manner when working with others. To be considered for admission, applicants must participate in the interview process.
- Transcripts: Official transcripts from all post-secondary colleges and/or universities should be sent directly to:

  University of Colorado Denver Graduate Admissions
  Campus Box 163
  PO Box 173364
  Denver, CO 80217-3364

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

International students must meet ALL of the requirements above and those required by International Admissions; additionally, their application fee is $75 U.S. Dollars.

Degree Requirements

First Year

Course	Title	Hours
Year 1		
Fall		
BMSC 7806	Core I: Foundations in Biomedical Sciences	6
BMSC 7810	Core Topics in Biomedical Science Core Topics A	1-6
BMSC 7810	Core Topics in Biomedical Science Core Topics B	1-6
CPBS 7711	Methods and Tools in Biomedical Informatics	4
CPBS 7605	Ethics in Bioinformatics	1
	Hours	**13-23**
Spring		
CPBS 7712	Research Methods in Biomedical Informatics	4
CPBS 7605	Ethics in Bioinformatics Section 001	1
CPBS 7605	Ethics in Bioinformatics Section 0V3	1
	Hours	**6**
Summer		
CPBS 8990	Doctoral Thesis	1-10
	Hours	**1-10**
	Total Hours	**20-39**

Second Year

Course	Title	Hours
Year 2		
Fall		
BIOS 6601	Applied Biostatistics I	3
Or take 1 of the following courses:		
BIOS 6611	Biostatistical Methods I	
BIOS 6631	Statistical Theory I	
CPBS 7605	Ethics in Bioinformatics	1
	Hours	**4**
Spring		
CPBS 7605	Ethics in Bioinformatics	1
	Hours	**1**

Summer		
CPBS 8990	Doctoral Thesis	1-10
	Hours	**1-10**
	Total Hours	**6-15**

Third Year & Beyond

Course	Title	Hours
Year 3		
Fall		
CPBS 7605 or CPBS 8990	Ethics in Bioinformatics (Confirm with Program Administrator) or Doctoral Thesis	1
	Hours	**1**
Spring		
CPBS 7605 or CPBS 8990	Ethics in Bioinformatics (Confirm with Program Administrator) or Doctoral Thesis	1
	Hours	**1**
Summer		
CPBS 8990	Doctoral Thesis	1-10
	Hours	**1-10**
	Total Hours	**3-12**

Learning Objectives

Educational Goals and Objectives

Knowledge Goals - Graduates demonstrate their knowledge of core concepts and principles of computational bioscience, and the ability to apply computation to gain insight into significant biomedical problems. This knowledge includes mastery of the fundamentals of biomedicine, statistics and computer science, as well as proficiency in the integration of these fields. Graduates contribute to the discovery and dissemination of new knowledge.

Knowledge Objectives

1. Demonstrate knowledge of the scientific principles that underlie the current understanding of molecular biology, statistics and computer science.
2. Demonstrate an ability to productively integrate knowledge from disparate fields to solve problems in biomedicine using computational methods.
3. Demonstrate knowledge of the types and sources of data most commonly used in computational bioscience, including knowledge of all major public data repositories.
4. Demonstrate the knowledge of the classes of algorithms most often applied in computational bioscience, and their domains of applicability.
5. Demonstrate an understanding of the principles and practice of the scientific method as applied in computational bioscience, including experimental design, hypothesis testing, and evaluation of computational systems.

Communication Skills Communication Skills Goals - Graduates demonstrate interpersonal, oral and written skills that enable them to interact productively with scientists from both biomedical and computational domains, to clearly communicate the results of their work in appropriate formats, and to teach others computational bioscience skills. Graduates are able to bridge the gap between biomedical and computational cultures.

Communication Skills Objectives

1. Communicate effectively, both orally and in writing, in an appropriate range of scientific formats, including formal presentations, collaborative interactions, and the critique of others' work.
2. Demonstrate familiarity with both biomedical and computational modes of expression, and be able to communicate clearly across disciplinary boundaries.
3. Demonstrate commitment and skill in teaching to and learning from students, colleagues, and other members of the scientific community.

Professional Behavior Professional Behavior Goals - Graduates demonstrate the highest standards of professional integrity and exemplary behavior, as reflected by a commitment to the ethical conduct of research, continuous professional development, and thoughtfulness regarding the broader implications of their work.

Professional Behavior Objectives

1. Act in an ethically responsible manner, displaying integrity, honesty, and appropriate conduct at all times.
2. Recognize the limits of one's knowledge, skills, and behavior through self-reflection and seek to overcome those limits.
3. Always consider the broad significance of one's professional actions, including their implications for society and the living world.

Self-Directed and Life Long Learning Skills Self-Directed and Life Long Learning Goals - Graduates demonstrate habits and skills for self-directed and life-long learning, and recognize that computational bioscience is a rapidly evolving discipline. Our focus is on the development of adaptive, flexible and curious scientists able to comfortably assimilate new ideas and technologies during the course of their professional development.

Self-Directed and Life Long Learning Skills Objectives 1. Recognize the need to engage in lifelong learning to stay abreast of new technologies and scientific advances in multiple disciplines. 2. Locate, evaluate and assimilate relevant new knowledge and techniques from a wide variety of sources.

Courses

BIOS 6606 - Statistics for the Basic Sciences (3 Credits)
This course is designed for those wishing to obtain a basic understanding of statistics and its application in biological research. Students will develop statistical literacy and an ability to perform basic statistical analyses, basic graphical statistics, data summarizations, and estimation and inference using statistical software. Restrictions: Enrollment in UCD-AMC graduate program or permission of the instructor.
Grading Basis: Letter Grade
A-PUBH1 Graduate students and public health certificate students only.
Typically Offered: Fall.

BIOS 6611 - Biostatistical Methods I (3 Credits)
This first course in applied statistics covers basic descriptive methods and probability; parametric and nonparametric inference for the one- and two-sample location problem; ANOVA, ANCOVA, and multiple linear regression. Matrix notation, R, and SAS are used. Prerequesite: differential calculus or permission of instructor
Grading Basis: Letter Grade
A-PUBH BIOS
Typically Offered: Fall.

BIOS 6631 - Statistical Theory I (3 Credits)
This course presents an introductory coverage of the theory of discrete and continuous random variables and applications to statistical problems. Topics include probability theory, transformations and expectations, common families of distributions, multiple random variables, and properties of a random sample. Prereq: Differential and integral calculus.
Grading Basis: Letter Grade
A-PUBH1 Graduate students and public health certificate students only.
Typically Offered: Fall.

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.

CPBS 7605 - Ethics in Bioinformatics (1 Credit)
Discussions of professional conduct, social implications of research and questions raised by biomedical research, with an emphasis on topics relevant to computational biologists. Active student participation is required. Offered every other year.
Grading Basis: Letter Grade
Typically Offered: Fall, Spring.

CPBS 7711 - Methods and Tools in Biomedical Informatics (4 Credits)
An introduction to algorithms for the theory and practice of bioinformatics and computational biology. Topics include:1) Experimental design; 2) Statistical concepts; 3) Sequence alignment; 4) networks and systems biology.
Grading Basis: Letter Grade
A-GRAD Restricted to graduate students only.
Typically Offered: Fall.

CPBS 7712 - Research Methods in Biomedical Informatics (4 Credits)
This course focuses on application of algorithms to analysis of different types of big data and provides training in how to plan, develop, execute and report on research in computational biology. Topics include: 1) Molecular Data; 2) Biomedical data; 3) Drug/disease data.
Grading Basis: Letter Grade
A-GRAD Restricted to graduate students only.
Typically Offered: Spring.

CPBS 8990 - Doctoral Thesis (1-10 Credits)
Doctoral Thesis work in Computational Bioscience. Prerequisites: Permission of instructor.
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.

Policies

Please refer to the Graduate School Policies page (http://catalog.ucdenver.edu/cu-anschutz/schools-colleges-programs/graduate-school/#policiestext).

Contact Us

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