BIOINFORMATICS AND COMPUTATIONAL BIOLOGY (M.S.)

Master of Science. Major in Bioinformatics and Computational Biology.

Admission to this program is highly competitive; meeting admission requirements is not a guarantee of admission. Students who wish to enter the master's or doctoral degree program must demonstrate mathematical maturity, skill in the use of high-level programming language, and a basic knowledge of molecular biology. However, students lacking one of these may be admitted with the requirement that they make up the deficiency. The minimum admission requirements are at least a 3.0 undergraduate GPA if the student graduated within the last five years, although this may be waived under exceptional circumstances. Students for whom English is a second language must have a TOEFL score of 600 (250 computer-based or 100 IBT) or higher. Applicants must provide at least three letters of reference speaking to the applicant's aptitude for graduate research and a statement of research interests that clearly identifies the research the student would like to pursue and why they want to pursue it at the University of Idaho.

Both the M.S. and Ph.D. degrees require a thesis. Students will take research and thesis credits BCB 500 or research and dissertation credits BCB 600. The M.S. degree will require at least nine credits of thesis research, and the Ph.D. degree will require at least thirty credits. M.S. theses for a BCB degree will demonstrate a high level of scholarly achievement, and doctoral dissertations will represent a significant, original contribution to the field. In addition to the thesis and dissertation, students will publish their work in appropriate peer-reviewed venues. Students will present their thesis and dissertation publicly at their final defense.

Each student's graduate committee will consist of at least four faculty members. This committee will represent the three BCB disciplines (biological sciences, computer sciences, and mathematical sciences) and will include at least three participating BCB faculty members. Co-advising by major professors in different disciplines will be particularly attractive for BCB degrees, and is possible at the discretion of the student and their committee. There is no explicit requirement for an "external" committee member since each committee will already include faculty from at least three different disciplines.

There will be no qualifying examination. The Ph.D. will require a preliminary examination, which will be taken no later than the end of the fifth semester. The preliminary examination will have three components. First, it will include a written thesis proposal prepared in the format of a federal research grant and submitted to the committee at least four weeks prior to the oral examination. Second, there will be a public, oral presentation of the research proposal. Third, the committee will conduct a non-public oral examination in which committee members will ask questions about the proposed research and about background and core coursework.

Incoming students admitted with background deficiencies will take background courses. For example, biology majors with little formal introduction to computation will take background courses in computer science. The specific required background courses will be determined by the students' graduate committees with the approval of the program director. Note that credits from courses numbered 300 and below do not count toward the BCB degree requirements, though they may be required to fulfill deficiencies.

The core courses form a central, shared educational experience for all BCB students. These courses will enable them to share a common language and to discuss problems from multiple disciplinary points of view. This shared experience will also give BCB students a sense of identity and community, which will encourage them to help each other overcome cultural and terminological differences that usually make such interdisciplinary interactions challenging. When possible and appropriate, core courses will include group projects using team members with backgrounds in different disciplines.

The depth courses provide more detailed knowledge of bioinformatics and computational biology and provide the springboard for graduate research. The list of courses will evolve with the research interests of the BCB faculty participants, and more will be added as new faculty members join the program. See the program webpage at www.uidaho.edu/cogs/bcb (http://www.uidaho.edu/cogs/bcb/) for the latest information.

Other courses may be required as determined by the student's committee.

To explicitly make it easier to bridge the traditional gap between disciplines, the BCB program includes four bridging activities:

- **Seminars and Workshops:** Seminar series are available, and BCB students are required to participate. Seminars are an opportunity for students to interact with experts in a variety of fields. Workshops will provide practical experience with tools and techniques.
- **Lab rotations:** In order to expose doctoral students to the research perspectives of another discipline, we will require them to spend at least one semester in a lab outside the discipline of their major professor. The lab will be the research lab of one of the participating BCB faculty outside the discipline of the student's major professor. The student's committee will determine, in conjunction with participating faculty members, with whom the student will meet this requirement. There is no lab rotation requirement for M.S. students.
- **One Credit Supplements:** General courses in computer science, mathematics, and statistics sometimes lack material specific to bioinformatics and computational biology. Participating faculty will offer one-credit supplements to current courses in order to provide this connection without duplicating courses in the current catalogue. These will be required of BCB students as determined by their graduate committees.
- **Teaching experience:** Each doctoral candidate will be required to have at least one semester of teaching experience relevant to the BCB program with the details of this requirement determined by their committee. This requirement may be satisfied, for example, by teaching a course, running a workshop, offering a supplement, or working as a teaching assistant.

The M.S. requires a minimum of 30 credits, and the Ph.D. requires a minimum of 78 credits. The BCB program assumes the usual graduate full-time load of at least 9 credits per semester. Note that the Ph.D. requires at least 18 credits of "other," supplemental, or workshop courses at the 400-level or above since there are a total of 60 minimum required core, depth, thesis, seminar, and laboratory credits, and the student must have at least 78 credits to graduate.

M.S. Degree

Code	Title	Hours
Core Courses:		
CS 515	Computational Biology: Sequence Analysis	3
BIOL 552	Professional Development for Biologists	3
MATH 563	Mathematical Genetics	3
Depth Courses:		**9**
Students must complete at least 3 credits in Biological Sciences and 3 credits in Computer/Mathematical/Statistical Sciences		
Biological Sciences		
BIOL 421	Advanced Evolution/Population Dynamics	
BIOL 444	Genomics	
BIOL 526	Systems Biology	
BIOL 545	Phylogenetics	
BIOL 547	Virology	
BIOL 554	Biochemistry II	
BIOL 585	Prokaryotic Molecular Biology	
BIOL 587	Cellular and Molecular Basis of Disease	
PLSC 588	Genetic Engineering	
WLF 561	Landscape Genetics	
Computer/Mathematical/Statistical Sciences		
BIOL 526	Systems Biology	
CS 511	Parallel Programming	
CS 570	Artificial Intelligence	
CS 572	Evolutionary Computation	
MATH 451	Probability Theory	
MATH 452	Mathematical Statistics	
MATH 538	Stochastic Models	
MATH 428	Numerical Methods	
PHYS 533	Statistical Mechanics	
STAT 519	Multivariate Analysis	
STAT 565	Computer Intensive Statistics	
Graduate Seminar:		**2**
BCB 501	Seminar	
Thesis:		**10**
BCB 500	Master's Research and Thesis	
Total (min):		**30**

1. Obtain understanding of the disciplines of Bioinformatics and Computational Biology (BCB): the biological sciences, computational sciences, and mathematical sciences. Master the fundamental concepts of BCB from the perspective of each of the three program disciplines with the ability to integrate the multidisciplinary principles.
2. Acquire specialized expertise and master state-of-the-art research topics in one of the three BCB areas: biological sciences, computational sciences, or mathematical sciences.
3. Be able to explain BCB concepts and research results to people with widely varying backgrounds: experts in the same and other fields as well as the general public.
4. Accomplish significant and innovative interdisciplinary research by combining concepts and theories from the three BCB areas.