

Program of Bioinformatics and Computational Biology

James A. Foster, Program Director (229 Janssen Engr. Bldg. 83844-1010; phone 208/885-7062; bcb@uidaho.edu; www.ibest.uidaho.edu/bcb). *Faculty:* Celeste Brown, Steve Brunsfeld, Gary Daughdrill, Brian Dennis, Larry Forney, James Foster, Frank Gao, Stephanie Hampton, Robert Heckendorn, Paul Joyce, Stephen Krone, Mike Laskowski, Stephen Lee, Jim Lorenzen, Scott Nuissmer, Ron Robberecht, Terence Soule, Jack Sullivan, Eva Top, Lisette Waits, Holly Wichman, Christopher Williams.

Bioinformatics and computational biology are new disciplines emerging from the application of mathematics, statistics, and computer science. They explain the vast quantities of biological data that modern molecular techniques have made available. The advent of high throughput data acquisition in the biological sciences, an example of which is the recent completion of a draft of the entire human and mouse genomes, has created far more data than can be analyzed with current techniques. In order to understand and use these data to improve human health, natural and agricultural resource management, and to simply understand the natural world better—will require new techniques and tools. Moreover, industries dependent on that understanding, such as health, pharmaceuticals, agriculture, and forestry will require workers who understand this new knowledge. This is what the Bioinformatics and Computational Biology (BCB) degree program provides.

The University of Idaho offers M.S. and Ph.D. degrees in Bioinformatics and Computational Biology (BCB). The BCB program is offered on-campus in Moscow at the University of Idaho, and is administered by the College of Graduate Studies. A degree in BCB will require coursework and practical experience in biology, mathematics, statistics, and computer science. The focus of the degree will be on learning to develop and use computational and mathematical tools to analyze biological data.

BCB is a highly interdisciplinary program. It requires students and faculty to bridge biological, computational, and mathematical disciplines. BCB faculty members are drawn from nine departments: Biological Sciences, Plant Soils and Entomological Sciences, Fish and Wildlife, Forrest Resources, Mathematics, Statistics, and Computer Science. These academic units span four colleges and one institute: Letters and Science, Natural Resource, Agricultural and Life Sciences, Engineering, and WWAMI. These faculty members are available to serve on BCB graduate student committees.

A graduate degree in Bioinformatics and Computational Biology from UI prepares a student for a lifetime of discovery. It enables the graduate to advance the state of the art, not merely to keep up with it. The graduate program develops the student's critical thinking, investigatory, and expository skills. By understanding the extent and limitation of current knowledge in computer science, the graduate will learn to understand what issues are important and why. He or she will acquire the methodological skills to resolve important open problems and tackle challenging new projects. The student will learn to present problems and solutions, both orally and in writing.

Graduate Committee and Theses

Both the M.S. and Ph.D. degrees require a thesis. Students will take research and thesis credits (BCB500) or research and dissertation credits (BCB600). 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. thesis 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 dissertations 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 (biology, computer science, and mathematics) 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 his or her 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.

Course and Credit Requirements

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 <http://www.ibest.uidaho.edu/bcb> for the latest information. The M.S. will require at least 6 credits of depth courses in one disciplinary area (computer science, biology, or mathematics) and at least 3 credits in each of the other two. The Ph.D. will require at least 9 credits of depth courses in one discipline and at least 3 credits in each of the other two disciplines.

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:** The BCB program will provide an annual seminar series, and all BCB students will be required to participate at least twice. Seminars bring experts from around the world to campus, where they will give research presentations and interact with BCB students. 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 his or her 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 MS requires a minimum 32 credits and the Ph.D. requires a minimum 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. No more than 3 credits of workshop may apply to the degree, and credits for courses numbered below 400 cannot apply toward the degree. (These are general UI requirements.)

| M.S. Degree | |
|--------------------|---|
| Background | As determined on admission |
| Core courses | 9 credits |
| Depth courses | 12 credits: 6 in one area, 3 in each of the other two |
| Seminar | 2 credits |
| Lab rotation | None |
| Supplemental | As determined by thesis committee |
| Thesis | 9 credits, minimum |
| Other | As determined by thesis committee |
| Total (min) | 32 Credits |

| Ph.D. Degree | |
|---------------------|---|
| Background | As determined on admission |
| Core courses | 9 credits |
| Depth courses | 15 credits: 9 in one area, 3 in each of the other two |
| Seminar | 3 credits |
| Lab rotation | 3 credits, not in discipline of major professor |
| Supplemental | As determined by thesis committee |
| Dissertation | 30 credits, minimum |
| Other | As determined by thesis |

| | |
|--------------------|----------------------|
| | committee |
| Total (min) | 78 (see text) |

Admissions Requirements and Procedures

Admission to this program is highly competitive. Students who wish to enter the master's or doctoral degree program must demonstrate mathematical maturity, skill in the use of high-level 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. At least a 3.0 undergraduate GPA if the student graduated within the last five years and a total Graduate Record Examination score of at least 1300+4 are the minimum admission requirements, though exceptions to GPA and GRE requirements may be made in exceptional circumstances. Students for whom English is a second language must have a TOEFL score of 600 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 he or she would like to pursue and why they want to pursue it at the University of Idaho.

To apply: please go to the University of Idaho Graduate Admissions webpage at <http://www.students.uidaho.edu/gradadmissions>, or contact the graduate admissions office at: Graduate Admissions Office; University of Idaho; P.O. Box 443019; Moscow, ID 83844-3019.