Master of Science Program in Bioinformatics and Computational Biology

Saint Louis University

Handbook

for

Graduate Studies

2022-23

Master of Science Program in Bioinformatics and Computational Biology
Saint Louis University

A. OVERVIEW

The Master of Science Program in Bioinformatics and Computational Biology (BCB) is an interdisciplinary program that draws on faculty from the Departments of Biology, Computer Science, Math and Statistics and Chemistry. It exists within the framework of the College of Arts and Sciences at Saint Louis University. Questions pertaining to the Graduate Program at the BCB level should be addressed to the Graduate Program Director, at the College level to the Associate Dean of Graduate Education, and at the University level to the Associate Provost for Graduate Education. Our program adheres to the policies and procedures established by the University and set forth in the SLU Graduate Education Catalog available online. Any conflicts that may arise will be mediated by the Office of Graduate Education in accordance with the Graduate Education policies.

The BCB Graduate Program is overseen by the BCB Graduate Affairs Committee, which includes senior faculty from the BCB program and is chaired by the BCB Program Director.

B. STUDENT ADVISING AND EVALUATIONS

B.1) Graduate Student Advising

Students will be advised by one of the faculty members in the BCB program. The role of the academic advisor is to provide advice on course selection and be the first point of contact for any registration issues.

B.2) Definition of Full-time Graduate Students

1. All enrolled students holding graduate research assistantships, whether full or partial, are defined as full time students.
2. For other students, full-time enrollment is considered 6 credit hours/semester (Fall and Spring).

B.3) Evaluation of Academic Progress and Performance:

1. Academic progress – The University allows a maximum of 5 years to complete a master's degree, but the BCB program expects completion in two years for full-time students.
2. All students must maintain a minimum GPA of 3.0 on a 4.0 scale.
3. Students much receive a grade of B- or better in all required courses (BCB 5200, BCB 5250, BIOL 5030 and BCB 5300.
4. Students who are supported by graduate research assistantships are automatically considered full-time students. Each student will complete annual review of their completed and current coursework, internship or assistantship activities and professional development activities.
5. Graduate Research Assistantships – A full assistantship requires up to 20 hours/week dedicated to bioinformatics-related work for a research project. Partial assistantships have duties that are pro-rated accordingly. Duties for GRA students will be agreed to by both the student and the research mentor. Performance of students who have received a GRA will be evaluated by the research mentor. An award of GRA support

for 1 year does not guarantee that a student will receive the same level of support in the next year.

6. **GlobalGrad Research Fellowships**
   Information about how these fellowships are administered will be provided by the GlobalGrad team.

C. RESPONSIBILITIES OF GRADUATE STUDENTS AND FACULTY ADVISORS:

The efforts of both graduate students and faculty are critical to the success of our graduate programs. While successful completion of course work and internship research are ultimately the responsibility of the graduate student, it benefits from the expertise and assistance of a committed faculty advisor. Therefore, both faculty advisors and students have responsibilities toward the graduate program and each other.

C.1) Responsibilities of Graduate Students:

- Be aware of class registration and graduation requirements.
- If awarded an assistantship, comply with all requirements outlined in the Graduate Assistant Manual on the Information for Current Students page of the Graduate Education website.
- Maintain a 3.0 GPA to remain in good standing in the graduate program.
- Conscientiously perform duties associated with an assistantship or research fellowship, if applicable.
- For students doing research projects, put consistent effort into doing good quality research and meet regularly with mentor to review research progress and data
- Submit application to graduate and fulfill graduation requirements as outlined on the Information for Current Students page on the Graduate Education website.

C.2) Responsibilities of Faculty Advisors and Research Mentors:

- Be aware of student registration and graduation requirements.
- Help guide the student to register for courses that will support and be relevant for his/her field of study and interests.
- Meet with student at least once per semester to assess research progress and provide feedback
- Encourage the student to find opportunities for funding and dissemination of his/her research

D. DEGREE REQUIREMENTS

D.1.) Requirements – The MS degree requires a minimum of **30** hours of post-baccalaureate coursework but does not require a thesis. All students are required to complete an internship or research experience (section E.2). The course work required for the degree is outlined in Table 1. Example 3- and 4-semester roadmaps are provided in section H.

D.2) Internship – All students are required to complete an internship or research experience on a bioinformatics related topic. This experience can be completed with BCB faculty, with

faculty in other SLU departments, with faculty at other universities or research institutes or at bioinformatics related companies. The procedure for arranging an internship is:

1. Students are responsible for identifying and arranging for their research experience with guidance from faculty in the program.
2. Request an "Experience" in Handshake using the College of Arts and Sciences Experiential Learning Report Experience Type at least two weeks prior to the start of term (not later than the end of drop/add period for term). A guide to requesting an Experience can be found on the
3. Make sure that you communicate to your faculty advisor and site supervisor that they will be receiving a request to approve your Experience in Handshake.
4. After your Experience has been approved in Handshake, you will be asked to complete the following forms using DocuSign:

    - The College of Arts and Sciences Learning Contract – Please complete the required fields in DocuSign. DocuSign will then route the form to your site supervisor and your faculty advisor for approval.
    - An Internship Acknowledgment of Risk and Release for elective internships

Once your contract and acknowledgment/release are completed in DocuSign, they will be forwarded to the Registrar and you will be enrolled by the Registrar in your internship course.

After completion of the internship, students will fill out a reflection survey of their experience that will be returned to the program director.

Please Note: Internship work must occur in the same term as the registration for internship credit. Credit for internship work (prior or future) outside of the term of registration is not permitted.

Table 1: List of required and elective courses for BCB Master's degree 2021-22

Required		**Hours**
BCB 5200	Introduction to Bioinformatics I	3
BCB 5250	Introduction to Bioinformatics II	3
BCB 5300	Algorithms in Computational Biology	3
BIOL 5030	Genomics	3
BCB 5810	Bioinformatics Colloquium	1
One or more biology from the following		
BIOL 5090	Biometry (with lab)	4
BIOL 5700	Advanced Molecular Biology	3
BIOL 5520	Biochemical Pharmacology	3
BIOL 5780	Molecular Phylogenetic Analysis	3
One or more computer science from the following		
CSCI 5710	Databases	3
CSCI 5750	Machine Learning	3
CSCI 5610	Concurrent and Parallel Programming	3

CSCI 5620	Distributed Programming	3
Internship/Research Experience chosen from		1-3
BCB 5910	Internship in Bioinformatics	
BCB 5970	Research Topics	
BIOL 5970	Research Topics	
CHEM 5970	Research Topics	
CSCI 5970	Research Topics	
Remaining credits from the following or other 5000 level courses		
BIOL 5050	Molecular Technique Lab	2
BIOL 5070	Advanced Biological Chemistry	3
BIOL 5080	Advanced Cell Biology	3
BIOL 5190	GIS in Biology	3
BIOL 5430	Advanced Virology	3
BIOL 5640	Advanced Microbiology	3
BIOL 5870	Advanced Biometry	3
CSCI 5030	Principles of Software Design	3
CSCI 5360	Web Technologies	3
CSCI 5730	Evolutionary computing	3
CSCI 5740	Intro to Artificial Intelligence	3
CSCI 5760	Deep Learning	3
CSCI 5760	Computer Vision	3
MATH 5021	Introduction to Analysis	3
MATH 5023	Multivariable Analysis	3
MATH 5080	Probability Theory	3
MATH 5830	Mathematical Statistics	3
MATH 5210	Real Analysis	3
STAT 5087	Applied Regression	3
STAT 5088	Bayesian Statistics	3
CHEM 5610	Biochemistry I	3
CHEM 5615	Biochemistry II	3
CHEM 5470	Principles of Medicinal Chemistry	3

Note: this is not an exhaustive list and students, with prior approval, may register for 5000 level courses not listed here. Not all courses are offered every year.

The online SLU course catalog can be accessed here: https://catalog.slu.edu/course-search/

D.3) Transfer of credit – If a student wishes to receive credit for graduate-level coursework completed in a **non-degree** program at another institution, a *"Petition for Transfer of Credit"* form (available online at the Forms and Petitions page of Graduate Education) must be submitted, accompanied by a transcript documenting the coursework and grade(s), for approval by the Graduate Program Director and Associate Dean of Graduate Education for the College of Arts and Sciences. The grades received must be "B" or better. A maximum of 6 hours may be transferred from another program. Coursework completed as part of a master's program or used to fulfill undergraduate degree requirements will not be accepted for transfer credit.

D.4) Coursework at other Universities — Students may enroll in courses at other area universities with the approval of their mentors and the completion of a petition for off-campus enrollment followed by completion of the Inter-University Registration form, both of which are available from the Office of the Registrar.

D.5) Student responsibilities — Ultimately, students are responsible for ensuring that they have met all the requirements for the degree prior to graduation.

D.6) Graduation procedures — Students must apply online for graduation ***during the first two weeks*** of their final semester; applications submitted after the second Friday of the semester will incur a late fee of $50. Once the application is submitted, the master's candidacy advisor will prepare a degree audit that is sent to the student. The degree audit must be reviewed and signed by their faculty advisor, BCB program director and the *Associate Dean of Graduate Education for the College of Arts and Sciences* by the appropriate deadline for that semester (see the Calendar of Deadlines posted on the Graduate Education website).

E. ASSISTANTSHIPS AND FELLOWSHIPS

E.1) General information: The BCB program has access to a limited number of university-funded Graduate Research Assistantships (GRAs). GRAs funded by the University are typically 9-month awards that include a stipend, health insurance for the student (plus the option to purchase family coverage), and a tuition scholarship. Nine hours of tuition are provided during the fall and spring semesters. Typically, the award begins 1 week prior to the start of fall semester and ends at the end of spring semester. In some cases, partial assistantships or assistantships limited to a single semester are awarded.

*E.2) Years of support possible: S*tudents may hold a Graduate Research Assistantship for a maximum of two years while pursuing a master's degree.

F.3) Types of Assistantships:

F.3.b) Graduate Research Assistantships

Graduate Research Assistantships (GRAs) funded by the University are 9-month awards that include a stipend, health insurance, and tuition scholarship. There are no instructional duties associated with appointment to a GRA. Instead, the GRA's faculty sponsor is responsible for directing the research duties of the student. In addition to working on original research, some of the student's time may be spent performing some routine computational tasks or helping oversee undergraduate research. Because the Department has access to a limited number of GRA positions, students must complete their application by March 15th to be considered.

> *E.3.b.1) Who can apply?* All students who complete the application process by March 15th will be considered, but ***priority is generally given to students who have significant undergraduate research experience and already possess some of the computational skills needed to successfully carry out their assigned duties and be capable of working independently.***

E.3.b.2) Review of applications: GRA applications will be reviewed by the BCB Graduate Affairs Committee as part of the overall review of all applications to the program. Some students may be awarded a full or partial assistantship in their second year of the program depending on availability and demonstrated abilities in the course work completed during their first year.

E.3.c) Other Fellowships/Scholarships

Students may receive financial support from outside sources. The terms of such fellowships/scholarships will be specified by the award sponsor. In general, students with fellowship support will pursue their degree requirements, but will not be obliged to carry out any instructional duties. The terms of appointment, continuation, and maximum support will be governed by the terms for graduate assistantships, unless there are overriding conditions specified by the fellowship sponsor.

E.3.d) Grant-supported Research Assistantships — Faculty members will sometimes agree to pay a graduate student's stipend and health insurance from grant funds. In such cases, the faculty member can petition the College of Arts and Sciences Dean for tuition scholarship hours for that student. Tuition scholarship may or may not be provided, depending upon funds available from the Dean for this purpose. Duties of students on Grant-supported Research Assistantships will be outlined by the faculty mentor in accordance with the goals of the funded project.

E.3.e) External scholarships –Another scholarship opportunity is the ACM SIGHPC/Intel Computational & Data Science Fellowships. This is specifically targeted at women and students from racial/ethnic backgrounds who have not traditionally participated in the computing fields.

F. ACADEMIC HONESTY:

The importance of academic honesty at the university level cannot be overemphasized, but in particular, the behavior of graduate students, who are obtaining advanced academic degrees, must be above reproach. The policy on academic honesty in the Graduate Education Catalog states:

> "The University is a community of learning, and its effectiveness requires an environment of mutual trust and integrity. As members of this community, students share with faculty and administrators the responsibility to maintain this environment. Academic integrity is violated by any dishonesty in submitting an assignment, test, research report, or any other documentation required to validate student learning. In a case of clear indication of such dishonesty, the faculty member or administrator has the responsibility to apply sanctions to protect the environment of integrity."

Although not all forms of academic dishonesty are given here, the instances listed below should be seen as actions that violate academic integrity:

- Soliciting, receiving, or providing any unauthorized assistance in the completion of any work submitted;
- Copying from another student;
- Using electronic devices to share information during an exam;

- Copying from a book or class notes during a closed-book exam;
- Submitting materials authored by or editorially revised by another person but represented as their own work;
- Copying a passage or text directly from a published source without appropriately citing/recognizing that source;
- Taking a test or doing an assignment or other academic work for another student;
- Securing or supplying in advance a copy of an examination without the knowledge or consent of the instructor;
- Falsifying or fabricating research data

Any clear violation of academic integrity will be met with sanctions. In a case of dishonesty within a course, the instructor may assign an appropriate grade and/or recommend further sanctions to the Dean, Associate Dean, or Program Director of the particular college, school, or program, who is then responsible for the final decision and notification of all associated parties. The final decision of the Dean, Associate Dean or Program Director may be appealed as described in “Procedures for Academic Appeals.”

Ethical behavior is also expected of students and faculty in the academic setting and extending into professional life. Sexual harassment will not be tolerated and will be sanctioned.

Within the BCB program, honesty in research and its dissemination is particularly critical. Research misconduct, the fabrication or dishonest selection of data, plagiarism of text or figures, false entries into lab notebooks, etc. are all also considered forms of academic dishonesty.

Whether in the classroom, in research, or in preparation of manuscripts or presentations, academic dishonesty will not be tolerated. Any instance of academic dishonesty in our program may be considered grounds for dismissal from the graduate program.

G. Example roadmaps to degree

G.1) Example 3-semester roadmap

Course Subject and Title	Credits	Important Notes
Semester One: (9 credits)		
BCB 5200: Introduction to Bioinformatics I	**3**	
BCB 5030: Genomics	**3**	
BCB 5810: Bioinformatics colloquium	**0**	Audit recommended in 1st semester
CSCI 5710: Databases	3	
Semester Two: (10 credits)		
BCB 5250: Introduction to Bioinformatics II	**3**	
BIOL 5090: Biometry	4	
CSCI 5750: Machine Learning	3	
Summer I: (1-3 credits)		
BCB 5910: Internship	**1**	
Semester Three: (10 credits)		
Completion of BCB 5910: Internship if not during summer		
BCB 5300: Algorithms in Computational Biology	**3**	
BCB 5810: Bioinformatics colloquium	**1**	
BIOL 5700: Advanced Topics in Molecular Biology	3	
CSCI 5610: Concurrent and Parallel Programming	3	Offered every other year

BOLD courses are specific required courses

H.2) Example 4-semester roadmap

Course Subject and Title	Credits	Important Notes
Semester One: (9 credits, 6 toward graduation)		
CSCI 5001: Introduction to Object Oriented Programing	3	**Remedial, if necessary**
BCB 5030: Genomics	**3**	
BCB 5200: Introduction to Bioinformatics I	**3**	
BCB 5810: Colloquium	**0**	Audit recommended in 1st semester
Semester Two: (10 credits, 7 toward graduation)		
CSCI 5002: Data Structures	3	**Remedial, if necessary**
BCB 5250: Introduction to Bioinformatics II	**3**	
BIOL 5090: Biometry	4	
Summer I: (1-3 credits)		
BCB 5910: Internship	**1**	
Semester Three: (10 credits)		
BCB 5300: Algorithms in Computational Biology	**3**	
BCB 5700: Advanced Topics in Molecular Biology	3	
BCB 5810: Colloquium	**1**	
CSCI 5710: Databases	3	
Semester Four: (6 credits)		
CSCI 5820: Distributed programming	3	Offered every other year
CSCI 5750: Machine Learning	3	

BOLD are specific required courses; Shaded boxes are courses that do not count towards the degree requirements