

# BIOINFORMATICS AND COMPUTATIONAL BIOLOGY, M.S.

The use of computational techniques and information systems has revolutionized research in the biological sciences — from the analysis of DNA sequences and the understanding of gene expression and regulation to the structural modeling of proteins and RNAs and the evolutionary relationship between species. Saint Louis University's Master of Science in Bioinformatics and Computational Biology program brings together expertise from SLU in biology, chemistry, computer science, mathematics and statistics, biochemistry and molecular biology. Students in our program learn how to apply computational techniques to answer complex research questions.

## Curriculum Overview

The 30-credit bioinformatics and computational biology program is designed for students with academic backgrounds in the life sciences, mathematics, computer science, health sciences, engineering and statistics. The curriculum consists of a mix of required courses that build a strong foundation in bioinformatics and computational biology and elective classes that allow students to specialize in their expertise. Full-time students can complete the program in 18 to 24 months. Part-time students are welcome in the program.

## Fieldwork and Research Opportunities

Bioinformatics and computational biology program students must complete either a research experience with faculty or an internship with a biotech firm in the St. Louis area, home to one of the largest concentrations of biotech companies in the United States. This requirement gives our M.S. students the opportunity for hands-on experience working with academic researchers or private industry.

## Careers

There are many employment opportunities for graduates with a Master of Science in Bioinformatics and Computational Biology in the biotechnology, pharmaceutical, health care and software industries, as well as in academic, private and governmental research labs. St. Louis is home to many large and small biotech firms and is a national leader in biotech startups. St. Louis has medical schools at Saint Louis University and Washington University and is home to the Donald Danforth Plant Science Center, a world leader in plant and life sciences.

## Admission Requirements

A bachelor's degree in biology, biochemistry, computer science, engineering, health science, mathematics, statistics or a similar scientific field is required. The faculty admissions committee considers the applicant's prior coursework or experience in genetics, biology and computer programming when determining the required coursework.

### Application Requirements

- Application completion
- Transcript(s)
- One letter of recommendation is required; two more are optional
- Résumé

- Statement of professional goals
- GRE general test scores are optional

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### Requirements for International Students

All admission policies and requirements for domestic students apply to international students. International students must also meet the following additional requirements:

- Demonstrate English Language Proficiency (<https://catalog.slu.edu/academic-policies/office-admission/undergraduate/english-language-proficiency/>)
- Academic records, in English translation, of students who have undertaken postsecondary studies outside the United States must include:
  - Courses taken and/or lectures attended
  - Practical laboratory work
  - The maximum and minimum grades attainable
  - The grades earned or the results of all end-of-term examinations
  - Any honors or degrees received.
- WES and ECE transcripts are accepted.
- In order to be issued an I-20 for your F-1 visa application, students must submit financial documents. Proof of financial support that must include:
  - A letter of financial support from the person(s) or sponsoring agency funding the student's time at Saint Louis University
  - A letter from the sponsor's bank verifying that the funds are available and will be so for the duration of the student's study at the University

### Application Deadlines

- April 15 for Fall and November 15 for Spring

## Tuition

| Tuition                                     | Total Program Cost |
|---|--------------------|
| MS Bioinformatics and Computational Biology | \$42,000           |

Additional charges may apply. Other resources are listed below:

Net Price Calculator (<https://www.slu.edu/financial-aid/tuition-and-costs/calculator.php>)

Information on Tuition and Fees (<https://catalog.slu.edu/academic-policies/student-financial-services/tuition/>)

Miscellaneous Fees (<https://catalog.slu.edu/academic-policies/student-financial-services/fees/>)

Information on Summer Tuition (<https://catalog.slu.edu/academic-policies/student-financial-services/tuition-summer/>)

## Scholarships, Assistantships and Financial Aid

Scholarships are available to both U.S. and international students. Research assistantships are offered to select second-year students working on faculty research projects.

Applicants should complete their applications by the program admission deadlines for priority consideration for scholarships.

For information about financial aid, visit the Office of Student Financial Services (<https://www.slu.edu/financial-aid/>).

## Learning Outcomes

1. Graduates will be able to design and implement in silico experiments for biological problems.
2. Graduates will be able to apply and combine existing tools for processing and analysis of biological data sets.
3. Graduates will be able to use small- and large-scale quantitative data sets to model complex biological systems.
4. Graduates will be able to work as part of multidisciplinary teams in corporate or academic environments.
5. Graduates will be able to effectively communicate research approaches and findings.

## Requirements

| Code  | Title                                     | Credits      |
|---|---|--------------|
| <b>Required Courses</b>                                     |   |              |
| BCB 5200  | Introduction Bioinformatics I             | 3            |
| BCB 5250  | Introduction Bioinformatics II            | 3            |
| BCB 5300  | Algorithms in Computational Biology       | 3            |
| BCB 5810  | Bioinformatics Colloquium                 | 1            |
| BIOL 5030   | Genomics                                  | 3            |
| <b>Internship/Research Experience</b>                       |   | <b>1-3</b>   |
| Select one of the following:                                |   |              |
| BCB 5910  | Bioinformatics Internship                 |              |
| BCB 5970  | Research Topics                           |              |
| BIOL 5970   | Research Topics                           |              |
| CHEM 5970   | Research Topics                           |              |
| CSCI 5970   | Research Topics                           |              |
| <b>Bioinformatics &amp; Computational Biology Electives</b> |   | <b>14-16</b> |
| Select remaining courses to reach 30 credits:               |   |              |
| BIOL 5050   | Molecular Techniques Lab                  |              |
| BIOL 5070   | Advanced Biological Chemistry             |              |
| BIOL 5080   | Advanced Cell Biology                     |              |
| BIOL 5090   | Biometry                                  |              |
| BIOL 5190   | Geographic Information Systems in Biology |              |
| BIOL 5430   | Advanced Principles of Virology           |              |
| BIOL 5520   | Biochemical Pharmacology                  |              |
| BIOL 5700   | Advanced Molecular Biology                |              |
| BIOL 5780   | Molecular Phylogenetic Analysis           |              |
| BME 5130  | Medical Imaging                           |              |
| BME 5150  | Brain Computer Interface                  |              |
| CHEM 5370   | Computational Chemistry                   |              |
| CHEM 5470   | Medicinal Chemistry                       |              |
| CHEM 5610   | Biochemistry 1                            |              |
| CHEM 5615   | Biochemistry 2                            |              |
| CHEM 5620   | Biophysical Chemistry                     |              |
| CSCI 5030   | Principles of Software Development        |              |
| CSCI 5300   | Software Engineering                      |              |
| CSCI 5360   | Web Technologies                          |              |

|           |  |
|-----------|--|
| CSCI 5610 | Concurrent and Parallel Programming                                  |
| CSCI 5620 | Distributed Computing  |
| CSCI 5710 | Databases  |
| CSCI 5730 | Evolutionary Computation   |
| CSCI 5740 | Introduction to Artificial Intelligence                              |
| CSCI 5750 | Introduction to Machine Learning                                     |
| CSCI 5760 | Deep Learning  |
| CSCI 5830 | Computer Vision  |
| HDS 5310  | Analytics, Statistics & Visualization Methods in Health Data Science |
| HDS 5330  | Predictive Modeling and Health Machine Learning                      |
| MATH 5021 | Introduction to Analysis   |
| MATH 5023 | Multivariable Analysis   |
| MATH 5080 | Probability Theory   |
| STAT 5084 | Time Series  |
| STAT 5085 | Mathematical Statistics  |
| STAT 5087 | Applied Regression   |
| STAT 5088 | Bayesian Statistics and Statistical Computing                        |

**Total Credits** **30**

## Continuation Standards

Students must maintain a cumulative grade point average (GPA) of 3.00 in all graduate/professional courses.

## Prerequisite Courses

The following courses may be required to fill in missing prerequisite coursework, such as data structures. These prerequisite courses do not count toward the 30 credits needed for graduation.

- General Biology: Information Flow and Evolution (BIOL 1240)/Principles of Biology I Laboratory (BIOL 1245)
- General Biology: Transformations of Energy and Matter (BIOL 1260)/Principles of Biology II Laboratory (BIOL 1265))
- General Chemistry 1 (CHEM 1110)/General Chemistry 1 Laboratory (CHEM 1115)
- General Chemistry 2 (CHEM 1120)/General Chemistry 2 Laboratory (CHEM 1125))
- Biochemistry and Molecular Biology (BIOL 3020) or Cell Structure & Function (BIOL 3040)
- Principles of Genetics (BIOL 3030)
- Introduction to Object-Oriented Programming (CSCI 1300)
- Data Structures (CSCI 2100)
- Calculus I (MATH 1510)
- MATH 1300X Elementary Statistics with Computers (3 cr), Foundation of Statistics (MATH 3850) or Mathematical Statistics (MATH 4850)

Students may complete these prerequisites as part of the program, but the courses will not count toward the 30 credits required for the degree.

## Roadmap

Roadmaps are recommended semester-by-semester plans of study for programs and assume full-time enrollment unless otherwise noted.

Courses and milestones designated as critical (marked with !) must be completed in the semester listed to ensure a timely graduation. Transfer credit may change the roadmap.

This roadmap should not be used in the place of regular academic advising appointments. All students are encouraged to meet with their advisor/mentor each semester. Requirements, course availability and sequencing are subject to change.

| Course               | Title                               | Credits   |
|----------------------|-------------------------------------|-----------|
| <b>Year One</b>      |                                     |           |
| <b>Fall</b>          |                                     |           |
| BCB 5200             | Introduction Bioinformatics I       | 3         |
| BIOL 5030            | Genomics                            | 3         |
| <b>Credits</b>       |                                     | <b>6</b>  |
| <b>Spring</b>        |                                     |           |
| BCB 5250             | Introduction Bioinformatics II      | 3         |
| BCB Electives        |                                     | 6         |
| <b>Credits</b>       |                                     | <b>9</b>  |
| <b>Summer</b>        |                                     |           |
| BCB 5910             | Bioinformatics Internship           | 2         |
| <b>Credits</b>       |                                     | <b>2</b>  |
| <b>Year Two</b>      |                                     |           |
| <b>Fall</b>          |                                     |           |
| BCB 5300             | Algorithms in Computational Biology | 3         |
| BCB 5810             | Bioinformatics Colloquium           | 1         |
| BCB Elective         |                                     | 3         |
| <b>Credits</b>       |                                     | <b>7</b>  |
| <b>Spring</b>        |                                     |           |
| BCB Electives        |                                     | 6         |
| <b>Credits</b>       |                                     | <b>6</b>  |
| <b>Total Credits</b> |                                     | <b>30</b> |

## Contact Us

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For questions about the program or application process, please contact:

Maureen J. Donlin, Ph.D.  
Program director  
[maureen.donlin@health.slu.edu](mailto:maureen.donlin@health.slu.edu)

Graduate Admission  
[graduate@slu.edu](mailto:graduate@slu.edu)

SSE Graduate Admissions  
[ssegrad-admissions@slu.edu](mailto:ssegrad-admissions@slu.edu)