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. The fields of bioinformatics and computational biology have become an important academic discipline for such breakthroughs and a critical part of success for firms in the biotechnology sector.

The Master of Science in Bioinformatics and Computational Biology program brings together expertise from across Saint Louis University in biology, chemistry, computer science, mathematics and statistics, biochemistry and molecular biology.

Leadership
Maureen J. Donlin, Ph.D.
Program Director

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 are required to complete either a research experience with faculty or an internship with a biotech firm in the St. Louis area, which is home to one of the largest concentrations of biotech companies in the country. This requirement gives our M.S. students the opportunity for hands-on experience working with academic researchers or private industry. Industry partners include:

- Bayer-Monsanto
- BioSTL
- Cofactor Genomics
- Confluence Discovery Technologies
- Donald Danforth Plant Sciences Center
- Mallinckrodt Pharmaceuticals
- MoGene
- Nestlé-Purina
- PierianDx
- Sigma-Aldrich

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 Sciences 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 required coursework.

Application Requirements
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- Application completion and fee
- Transcript(s)
- One letter of recommendation is required; two more are optional
- Résumé
- Statement of professional goals
- GRE general test scores are optional

Requirements for International Students
All admission policies and requirements for domestic students apply to international students along with the following:

- Demonstrate English Language Proficiency
- Proof of financial support must include:
  - A letter of financial support from the person(s) or sponsoring agency funding the 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 study at the University
- Academic records, in English translation, of students who have undertaken postsecondary studies outside the United States must include the 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, and any honors or degrees received. WES and ECE transcripts are accepted.

Application Deadlines
- April 15
- March 15 is the priority deadline for scholarship award consideration.

Scholarships, Assistantships and Financial Aid
Scholarships are available to both U.S. and international students. Research assistantships offered to select students working on faculty research projects.

For priority consideration for scholarship awards and graduate assistantships, applicants should complete their applications by the program admission deadlines listed.

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

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<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td>BCB 5200</td>
<td>Introduction Bioinformatics I</td>
<td>3</td>
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<tr>
<td>BCB 5250</td>
<td>Introduction Bioinformatics II</td>
<td>3</td>
</tr>
<tr>
<td>BCB 5300</td>
<td>Algorithms in Computational Biology</td>
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<td>BCB 5810</td>
<td>Bioinformatics Colloquium</td>
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</tr>
<tr>
<td>BIOL 5030</td>
<td>Genomics</td>
<td>3</td>
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Biology Elective

Select one of the following: 3-4

- BIOL 5090 Biometry
- BIOL 5520 Biochemical Pharmacology
- BIOL 5700 Advanced Molecular Biology
- BIOL 5780 Molecular Phylogenetic Analysis

Computer Science Elective

Select one of the following: 3

- CSCI 5610 Concurrent and Parallel Programming
- CSCI 5620 Distributed Computing
- CSCI 5710 Databases
- CSCI 5750 Introduction to Machine Learning

Internship/Research Experience

Select one of the following: 1-3

- BCB 5910 Bioinformatics Internship
- BCB 5970 Research Topics
- or BIOL 597 Research Topics
- or CSCI 597 Research Topics

Bioinformatics & Computational Biology Electives

Select remaining courses to reach 30 credits: 7-10

Courses may also be selected from Biology and Computer Science Electives listed above.

- BIOL 5050 Molecular Techniques Lab
- BIOL 5070 Advanced Biological Chemistry
- BIOL 5190 Geographic Information Systems in Biology
- BIOL 5430 Advanced Principles of Virology
- BIOL 5630 Concepts of Immunobiology
- BIOL 5640 Advanced Microbiology
- CSCI 5030 Principles of Software Development
- CSCI 5360 Web Technologies
- CSCI 5730 Evolutionary Computation
- CSCI 5740 Introduction to Artificial Intelligence
- CSCI 5760 Deep Learning

CSCI 5830 Computer Vision
CHEM 5610 Biochemistry 1
CHEM 5615 Biochemistry 2
CHEM 5470 Principles of Medicinal Chemistry
MATH 5021 Introduction to Analysis
MATH 5023 Multivariable Analysis
MATH 5080 Probability Theory
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.

Pre-requisite Courses

The following course may be required to fill in missing pre-requisite coursework, such as data structures. These pre-requisite courses do not count towards 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)
- Calculus I (MATH 1510)
- Calculus II (MATH 1520)
- Elementary Statistics with Computers (MATH 1300), 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
Year One
Fall

<p>| ! Participation in BCB Colloquium |
|-----------------------------|-------------------|
| BCB 5200 | Introduction Bioinformatics I | 3 |</p>
<table>
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<td>BIOL 5030</td>
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<tr>
<td>Spring</td>
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<tr>
<td>BCB 5250</td>
<td>Introduction Bioinformatics II</td>
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</tr>
<tr>
<td>BIOL 5090</td>
<td>Biometry</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 5570</td>
<td>Machine Learning for Networks</td>
<td>3</td>
</tr>
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<td></td>
<td><strong>Credits</strong></td>
<td><strong>10</strong></td>
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<tr>
<td>Summer</td>
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<tr>
<td>BCB 5910</td>
<td>Bioinformatics Internship</td>
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**Year Two**

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<td>BCB 5300</td>
<td>Algorithms in Computational Biology</td>
<td>3</td>
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<tr>
<td>BCB 5810</td>
<td>Bioinformatics Colloquium</td>
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<tr>
<td>BIOL 5700</td>
<td>Advanced Molecular Biology</td>
<td>3</td>
</tr>
<tr>
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<td><strong>Credits</strong></td>
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<tr>
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<tbody>
<tr>
<td>CSCI 5300</td>
<td>Software Engineering</td>
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</tr>
<tr>
<td>CSCI 5610</td>
<td>Concurrent and Parallel Programming</td>
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</tr>
<tr>
<td></td>
<td><strong>Credits</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

**Total Credits**  **30**

**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

Cory Washington, M.A.  
Graduate Recruitment Coordinator - cory.washington@slu.edu