BIOINFORMATICS, MASTER OF SCIENCE

MS in Bioinformatics (https://advanced.jhu.edu/academics/graduate/ms-bioinformatics/)
Joint Offering with the Whiting School of Engineering

Johns Hopkins University offers an innovative graduate program that prepares professionals for success in bioinformatics. Drawing from the strengths of the Krieger School of Arts and Sciences and the Whiting School of Engineering, this program fully integrates the computer science, bioscience, and bioinformatics skills and knowledge needed to pursue a career in this dynamic field.

The 11-course degree program is thesis-optional and can be completed part-time or full-time and onsite, online, or through a combination of onsite and online courses.

Admissions Criteria for all Advanced Academic Programs (https://e-catalogue.jhu.edu/arts-sciences/advanced-academic-programs/enrollment-services/admission/)
PROGRAM-SPECIFIC REQUIREMENTS

In addition to the materials and credentials required for all programs, the Master of Science in Bioinformatics requires an undergraduate degree in the biological sciences or engineering with at least a 3.0 on a 4.0 scale.

- **Resume**
- **Statement of purpose (500 words)**
- **Program-specific prerequisite courses:**
  - Two semesters of organic chemistry
  - One semester of biochemistry
  - One semester of an introduction to programming using Java, C++, C, or Python
  - One semester of data structures
  - One semester of probability/statistics
  - One semester of calculus

Program Requirements

Students take 11 courses to complete the degree—two core required courses, seven core customizable courses, an elective from bioscience, and an elective from computer science. After completion, students may choose an independent study project (optional).

Code	Title	Credits
Core Courses - Required:		
AS.410.602	Molecular Biology	4
AS.410.610	Epigenetics, Gene Organization & Expression	4
Core Courses - Customizable		
AS.410.633	Introduction to Bioinformatics	4
or EN.605.652	Biological Databases and Database Tools	
AS.410.634	Practical Computer Concepts for Bioinformatics	4
or EN.605.641	Principles of Database Systems	
EN.605.620	Algorithms for Bioinformatics	3
or EN.605.621	Foundations of Algorithms	
Select four of the following: [1,2,3]		16
AS.410.635	Bioinformatics: Tools for Genome Analysis	
AS.410.639	Protein Bioinformatics	
AS.410.640	Molecular Phylogenetic Techniques	
AS.410.666	Next Generation DNA Sequencing and Analysis	
AS.410.671	Gene Expression Data Analysis and Visualization	
AS.410.712	Advanced Practical Computer Concepts for Bioinformatics	
AS.410.713	Advanced Genomics and Genetics Analyses	
AS.410.734	Practical Introduction to Metagenomics	
AS.410.736	Genomic and Personalized Medicine	
EN.605.643	Linked Data and the Semantic Web	
EN.605.647	Neural Networks	
EN.605.651	Principles of Bioinformatics	
EN.605.653	Computational Genomics	
EN.605.656	Computational Drug Discovery,Dev	
EN.605.657	Statistics for Bioinformatics	
EN.605.716	Modeling and Simulation of Complex Systems	
EN.605.751	Algorithms for Structural Bioinformatics	
EN.605.755	Systems Biology	
EN.705.601	Applied Machine Learning	
Electives		
Computer Science		
Select one of the following: [1,3]		3
EN.605.601	Foundations of Software Engineering	
EN.605.644	XML Design Paradigms	
EN.605.649	Introduction to Machine Learning	
EN.605.662	Data Visualization	
EN.605.681	Principles of Enterprise Web Development	
EN.605.684	Agile Development with Ruby on Rails	
EN.605.686	Mobile Application Development for the Android Platform	
EN.605.701	Software Systems Engineering	
EN.605.741	Large-Scale Database Systems	
EN.605.746	Advanced Machine Learning	
EN.605.747	Evolutionary and Swarm Intelligence	
EN.605.759	Independent Project in Bioinformatics	
EN.605.788	Big Data Processing Using Hadoop	
Biotechnology		
Select one of the following: [1,2]		4
AS.410.603	Advanced Cell Biology	
AS.410.604	Cellular Signal Transduction	
AS.410.612	Human Molecular Genetics	
AS.410.613	Principles of Immunology	
AS.410.616	Virology	
AS.410.622	Molecular Basis of Pharmacology	
AS.410.629	Genes & Disease	
AS.410.630	Gene Therapy	

AS.410.632	Emerging Infectious Diseases
AS.410.638	Cancer Biology
AS.410.641	Clinical & Molecular Diagnostics
AS.410.648	Clinical Trial Design and Conduct
AS.410.656	Recombinant DNA Laboratory
AS.410.752	High Throughput Screening & Automation Lab
AS.410.800	Independent Research in Biotechnology

[1] You may select other electives with the approval of your adviser

[2] See course listings page (https://e-catalogue.jhu.edu/course-descriptions/_biotechnology/) for the Center for Biotechnology Education

[3] See course listings page for Computer Science (https://e-catalogue.jhu.edu/course-descriptions/computer_science/)

MS in Bioinformatics with Thesis Option

Students interested in pursuing the MS in Bioinformatics with the thesis are required to take 12 courses. The thesis requires a two-semester research project. Students complete AS.410.800 Independent Research in Biotechnology first and AS.410.801 Biotechnology Thesis the following semester. Students interested in this option should consult with the program director or their academic adviser.

Learning Outcomes

Students in this program will:

- Critique current and classic research in molecular biology
- Search public databases in order to analyze data in a biological context
- Implement sequence alignment tools to elucidate the deeper context of biological data
- Develop bioinformatics tools to address biological problems
- Write computer programs to build databases within a biological context in multiple computer languages
- Design deployable computer algorithms