

# Bioinformatics, MS

The Master of Science (MS) in Bioinformatics seeks to provide students with core knowledge in bioinformatics programming, integrating knowledge from the biological, computational, and mathematical disciplines. Upon completion, students are equipped to apply bioinformatics and computational methods to biological problems. Students in the MS program have the opportunity to gain professional work experience via co-op.

The program consists of core course work in computational methods, programming, and statistics, enhanced by electives in molecular biology, biochemistry, molecular modeling, web development, database design and management, data mining, and other related topics.

## Program Requirements

Complete all courses and requirements listed below unless otherwise indicated.

### Core Requirements

Code	Title	Hours
<b>Computational Methods</b>		
BINF 6308	Bioinformatics Computational Methods 1	4
BINF 6309	Bioinformatics Computational Methods 2	4
<b>Research and Seminar</b>		
BIOL 6381	Ethics in Biological Research	2
BIOT 5219	The Biotechnology Enterprise	2
<b>Statistics and Programming</b>		
BINF 6200	Bioinformatics Programming	4
MATH 7340	Statistics for Bioinformatics	4
<b>Co-op and Experiential Learning</b>		
BINF 6500	Professional Development for Co-op	0
Select one of the following:		
BINF 6964	Co-op Work Experience	
BINF 5964	Projects for Professionals <sup>1</sup>	

<sup>1</sup> The option of BINF 5964 Projects for Professionals is not available at all campus locations. Please refer to your advisor or admissions coach for course availability each semester at your campus location.

### Concentrations or Electives Option

A concentration is not required. Students may complete electives (from the elective list below) in lieu of a concentration.

- Bioinformatics and Cheminformatics
- Bioinformatics Enterprise
- Biotechnology
- Data Analytics (p. 3)
- Health Informatics (p. 4)
- Medical Health Informatics (p. 4)
- Omics
- Electives Option (p. 4)

### Elective List

Code	Title	Hours
Electives outside this list may be chosen in consultation with faculty advisor:		
BINF 6400	Genomics in Bioinformatics	
BINF 6420	Omics in Bioinformatics	
BIOE 5235	Biomedical Imaging	
BIOE 5410	Molecular Bioengineering	
BIOE 5420	Cellular Engineering	
BIOE 6100	Medical Physiology	
BIOL 5100	Biology Colloquium	
BIOL 5543	Stem Cells and Regeneration	

BIOL 5549	Inventions in Microbial Biotechnology
BIOL 5573	Medical Microbiology
BIOL 5581	Biological Imaging
BIOL 5583	Immunology
BIOL 5585	Evolution
BIOL 5587	Comparative Neurobiology
BIOL 5591	Advanced Genomics
BIOL 5593	Cell and Molecular Biology of Aging
BIOL 5597	Immunotherapies of Cancer and Infectious Disease
BIOL 6299	Molecular Cell Biology for Biotechnology
BIOL 6300	Biochemistry
BIOL 6301	Molecular Cell Biology
BIOL 6303	Neurobiology and Behavior
BIOT 5120	Foundations in Biotechnology
BIOT 5145	Basic Biotechnology Lab Skills
BIOT 5220	The Role of Patents in the Biotechnology Industry, Past and Future
BIOT 5225	Managing and Leading a Biotechnology Company
BIOT 5227	Launching Your Science: Biotechnology Entrepreneurship
BIOT 5340	Introduction to Biotherapeutic Approvals
BIOT 5500	Concepts in Regulatory Science
BIOT 5560	Bioprocess Fundamentals
BIOT 5631	Cell Culture Processes for Biopharmaceutical Production
BIOT 5635	Downstream Processes for Biopharmaceutical Production
BIOT 5640	Drug Product Processes for Biopharmaceuticals
BIOT 5700	Molecular Interactions of Proteins in Biopharmaceutical Formulations
BIOT 5810	Cutting-Edge Applications in Molecular Biotechnology
BIOT 5820	Cellular Therapies
BIOT 5850	Higher-Order Structure Analytics
BIOT 6214	Experimental Design and Biostatistics
BIOT 6320	Quality Management Systems and Validation
BIOT 7245	Biotechnology Applications Laboratory
CHEM 5550	Introduction to Glycobiology and Glycoprotein Analysis
CHEM 5616	Protein Mass Spectrometry
CHEM 5617	Protein Mass Spectrometry Laboratory
CHEM 5620	Protein Chemistry
CHEM 5638	Molecular Modeling
CHEM 7317	Analytical Biotechnology
CS 5010	Programming Design Paradigm
CS 5100	Foundations of Artificial Intelligence
CS 5200	Database Management Systems
CS 5400	Principles of Programming Language
CS 5500	Foundations of Software Engineering
CS 5600	Computer Systems
CS 5610	Web Development
CS 5700	Fundamentals of Computer Networking
CS 5800	Algorithms
CS 6140	Machine Learning
CS 6200	Information Retrieval
CS 6220	Data Mining Techniques
DA 5020	Collecting, Storing, and Retrieving Data
DA 5030	Introduction to Data Mining/Machine Learning
DS 5230	Unsupervised Machine Learning and Data Mining
EEMB 5130	Population Dynamics
HINF 5101	Introduction to Health Informatics and Health Information Systems

HINF 5102	Data Management in Healthcare
HINF 5105	The American Healthcare System
HINF 5110	Global Health Information Management
HINF 5200	Theoretical Foundations in Personal Health Informatics
HINF 6220	Database Design, Access, Modeling, and Security
HINF 6404	Patient Engagement Informatics and Analytics
INSH 5301	Introduction to Computational Statistics
INSH 5302	Information Design and Visual Analytics
MATH 5131	Introduction to Mathematical Methods and Modeling
MATH 7203	Numerical Analysis 1
MATH 7205	Numerical Analysis 2
MATH 7233	Graph Theory
MATH 7241	Probability 1
MATH 7243	Machine Learning and Statistical Learning Theory 1
MATH 7341	Probability 2
MATH 7342	Mathematical Statistics
MATH 7344	Regression, ANOVA, and Design
PHSC 6290	Biophysical Methods in Drug Discovery
PHSC 6300	Pharmaceutical Science Seminar
PHYS 5116	Network Science 1
PHYS 7332	Network Science Data 2
PT 5410	Functional Human Neuroanatomy
PT 5411	Lab for PT 5410

### Program Credit/GPA Requirements

32 total semester hours required

Minimum 3.000 GPA required

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#### BIOINFORMATICS AND CHEMINFORMATICS CONCENTRATION

Code	Title	Hours
BINF 6400	Genomics in Bioinformatics	4
BIOL 6299	Molecular Cell Biology for Biotechnology	3
Elective from Elective List (p. 1)		5

#### BIOINFORMATICS ENTERPRISE CONCENTRATION

Code	Title	Hours
BIOT 5225	Managing and Leading a Biotechnology Company	3
BIOT 5227	Launching Your Science: Biotechnology Entrepreneurship	3
BIOT 5400	Scientific Information Management for Biotechnology Managers	3
Elective from Elective List (p. 1)		3

#### BIOTECHNOLOGY CONCENTRATION

Code	Title	Hours
BIOT 5120	Foundations in Biotechnology	3
BIOT 5631	Cell Culture Processes for Biopharmaceutical Production	3
BIOL 6299	Molecular Cell Biology for Biotechnology (Electives)	3
Elective from Elective List (p. 1)		3

#### DATA ANALYTICS CONCENTRATION

Code	Title	Hours
DA 5020	Collecting, Storing, and Retrieving Data	4
DA 5030	Introduction to Data Mining/Machine Learning (or Elective)	4
INSH 5302	Information Design and Visual Analytics	4

**HEALTH INFORMATICS CONCENTRATION**

<b>Code</b>	<b>Title</b>	<b>Hours</b>
HINF 5101	Introduction to Health Informatics and Health Information Systems	3
HINF 5102	Data Management in Healthcare	3
HINF 6220	Database Design, Access, Modeling, and Security	3
Elective from Elective List (p. 1)		3

**MEDICAL HEALTH INFORMATICS CONCENTRATION**

<b>Code</b>	<b>Title</b>	<b>Hours</b>
HINF 5105	The American Healthcare System	3
HINF 5110	Global Health Information Management	3
HINF 5200	Theoretical Foundations in Personal Health Informatics	4
Elective from Elective List (p. 1)		2

**OMICS CONCENTRATION**

<b>Code</b>	<b>Title</b>	<b>Hours</b>
BINF 6400	Genomics in Bioinformatics	4
BINF 6420	Omics in Bioinformatics	4
Elective from Elective List (p. 1)		4

**ELECTIVES OPTION**

<b>Code</b>	<b>Title</b>	<b>Hours</b>
Complete 12 semester hours from the approved Elective List. (p. 1)		12