

Bioinformatics Major

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Bioinformatics is the theory, application and development of computing tools to solve problems and create hypotheses in all areas of biological sciences. Biology in the post-genome world has been and continues to be transformed from a largely laboratory-based science to one that integrates experimental and information science. Bioinformatics contributes to advances in biology by providing tools that handle datasets too large and/or complex for manual analysis. Examples of some of these tools include assembly of DNA sequences of entire genomes, gene finding algorithms, microarray expression analysis, molecular system modeling, and biomarker discovery from mass spectra. Computational tools are central to the organization, analysis, and harvesting of biological data at the level of macromolecules, cells, and systems. Consequently, there is a growing need for trained professionals who understand the languages of both biology and computer science. Biologists trained in more traditional programs may not have a working knowledge of statistics and algorithms, whereas computer scientists trained in more traditional programs may not have a working knowledge of the chemistry and biology required in the field.

The undergraduate bioinformatics degree program at the University of Pittsburgh is operated jointly by the departments of biological sciences and computer science. This program offers training that builds a solid foundation in chemistry, biology, computer science, mathematics, and statistics. The training will enable students to communicate fluently with experts across these disciplines and to have the skills necessary to apply computing tools to address contemporary problems in biology and medicine. It will enhance the professional opportunities for undergraduates to pursue careers in pure or applied research in academia, government, pharmaceutical, medical, or biotechnology sectors.

Required Courses for the Bioinformatics major

Core Level Courses (42 credits)

BIOSC 0150 Foundations of Biology 1
BIOSC 0160 Foundations of Biology 2
BIOSC 0350 Genetics
BIOSC 1810 Macromolecular Structure & Function
CHEM 0310 Organic Chemistry 1 *
CHEM 0320 Organic Chemistry 2
MATH 0220 Analytical Geometry & Calculus 1
STAT 1000 Applied Statistical Methods
STAT 1221 Applied Regression
CS 0401 Intermediate Programming using JAVA **
CS 0445 Data Structures
CS 0441 Discrete Structures for CS
CS 1501 Algorithm Implementation

* General Chemistry 0110 and 0120 are pre-requisites to taking CHEM 0310.

** Students without a background in programming will be encouraged to take Introduction to Programming CS 0007 prior to taking CS 0401.

Upper Level Courses (22 credits)

BIOSC 1540 Computational Biology
BIOSC/CS 1640 Bioinformatics Software Design
Undergraduate Research and Seminars
Electives (12 credits) to be chosen from an approved list of courses in Statistics, Chemistry, Biological Sciences and/or Computer Science. With the approval of the Bioinformatics Program Committee, the student may take electives in other departments.

Capstone experience: Prior to graduation, all bioinformatics majors must satisfy the capstone experience requirements through the new Bioinformatics course and/or Undergraduate Research.

Restrictions: Bioinformatics majors who have completed CS 0401 may not enroll in CS 0004, CS 0007 or CS 0110.

Writing (W) requirement: Students must complete at least one W-course in the major.

Grade requirements: A grade of C (not C-) or better is required in each of the core and upper level courses that are to count toward the major. This requirement also satisfies the Arts and Sciences requirement of a minimum GPA of 2.0 in major courses.

Satisfactory/No Credit option: No Bioinformatics major courses may be taken on an S/NC basis.

Related area: Due to its interdisciplinary nature, the Bioinformatics major does not require a related area.

Honors major requirements: Honors in Bioinformatics is granted if, in addition to fulfilling all requirements for the major, the student must:

1. complete three semesters (3 x 2 credits) or the equivalent (summer counts as a semester equivalent) of undergraduate research together with a written honors thesis presented in the last semester of the senior year;
2. maintain a GPA of 3.5 or above in all Bioinformatics major courses; and
3. maintain an overall GPA of 3.25 or above.

Advising: Bioinformatics advising is housed in both the Department of Biology and the Department of Computer Science. For information, contact one of the advisors.

Department of Computer Science

Matthew Wolfson
6145 Sennott Square
412-624-8492
wolfson@cs.pitt.edu

John Ramirez
6141 Sennott Square
412-624-8441
ramirez@cs.pitt.edu

Department of Biological Sciences

Christine Berliner
A230 Langley Hall
412-624-4819
christin@pitt.edu

Sample Schedule Plan

(see a Bioinformatics advisor for a customized schedule plan)

Fall 1		Spring 1	
BIOSC 0150	3 credits	BIOSC 0160	3 credits
CHEM 0110	4 credits	CHEM 0120	4 credits
CS 0007	3 credits	CS 0401	4 credits
2 Gen Ed	<u>6 credits</u>	1 Gen Ed	<u>3 credits</u>
Total	16	Total	14
Fall 2		Spring 2	
CS 0445	3 credits	BIOSC 0350	3 credits
CS 0441	3 credits	CHEM 0320	3 credits
CHEM 0310	3 credits	STAT 1000	4 credits
MATH 0220	4 credits	2 Gen Ed	<u>6 credits</u>
1 Gen Ed	<u>3 credits</u>	Total	16
Total	16		
Fall 3		Spring 3	
BIOSC 1810	3 credits	BIOSC 1903	2 credits
CS 1501	3 credits	BIOSC 1540	3 credits
Major Elective	3 credits	Major Elective	3 credits
2 Gen Ed	<u>6 credits</u>	Seminar	1 credit
Total	15	2 Gen Ed	<u>6 credits</u>
Total	15	Total	15
Fall 4		Spring 4	
STAT 1221	3 credits	Research	3 credits
Capstone	3 credits	Seminar	1 credit
Major Elective	3 credits	Major Elective	3 credits
2 Gen Ed Req	<u>6 credits</u>	Open Elective	3 credits
Total	15	2 Gen Ed Req	<u>6 credits</u>
Total	15	Total	16

Checklist for the Bioinformatics Major

Prerequisite Courses

- _____ CS 0007
- _____ CHEM 0110
- _____ CHEM 0120

Core Courses

- _____ BIOSC 0150
- _____ BIOSC 0160
- _____ BIOSC 0350
- _____ BIOSC 1810
- _____ CHEM 0310
- _____ CHEM 0320
- _____ MATH 0220
- _____ STAT 1000
- _____ STAT 1221
- _____ CS 0401
- _____ CS 0445
- _____ CS 0441
- _____ CS 1501

Upper Level Courses

- _____ BIOSC 1540
- _____ BIOSC 1640
- _____ Undergraduate Research
- _____ Undergraduate Seminar 1
- _____ Undergraduate Seminar 2
- _____ Elective
- _____ Elective
- _____ Elective
- _____ Elective

Approved Elective Course List

Biological Sciences

- BIOSC 1820 Metabolic Pathways and Regulation
- BIOSC 1830 Biochemistry Laboratory
- BIOSC 1940 Molecular Biology
- BIOSC 1950 Molecular Genetics Laboratory
- BIOSC 1500 Cell Biology
- BIOSC 1903 Undergraduate Research
- BIOSC 1545 Mathematics of Biology

Computer Science

- CS 1510 Design and Analysis of Algorithms
- CS 1515 Scientific Computation
- CS 1520 Programming Languages for Web Applications
- CS 1555 Database Management Systems
- CS 1566 Computer Graphics
- CS 1571 Introduction to Artificial Intelligence
- CS 1645 Introduction to High Performance Computing Systems
- CS 1950 Directed Study

Chemistry

- CHEM 1410 Physical Chemistry 1
- CHEM 1420 Physical Chemistry 2
- CHEM 0250 Intro Analytical Chemistry
- CHEM 1710 Undergraduate Research

Statistics

- STAT 1301 Statistical Packages
- STAT 1311 Applied Multivariate Analysis
- STAT 1321 Applied Time Series
- STAT 1902 Directed Study