Bioinformatics Major
www.biology.pitt.edu/undergraduate or www.cs.pitt.edu/undergrad/bioinformatics
Revised: 12/2015

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 and continues to be transformed from a largely laboratory-based science to one integrating experimental and information science. Bioinformatics provides biological 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.

The Bioinformatics major 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

**Biological Science courses (12 cr.)**
- BIOSC 0150 Foundations of Biology 1
- BIOSC 0160 Foundations of Biology 2
- BIOSC 0350 Genetics
- BIOSC 1810 Macromolecular Structure & Function

**Chemistry courses (6 cr.)**
- CHEM 0310, CHEM 0320 Organic Chemistry 1, 2
  * CHEM 0110 and 0120 are pre-requisites for CHEM 0310.

**Computer Science courses (13 cr.)**
- CS 0401 Intermediate Programming using JAVA
- CS 0445 Data Structures
- CS 0441 Discrete Structures for CS
- CS 1501 Algorithm Implementation
  ** Students without a programming background are encouraged to take Introduction to Programming CS 0007 prior to taking CS 0401.

**Mathematics courses (11 cr.)**
- MATH 0220 Analytical Geometry & Calculus 1
- STAT 1000 Applied Statistical Methods
- STAT 1221 Applied Regression

**Upper Level courses (6 cr.)**
- BIOSC 1540 Computational Biology
- BIOSC/CS 1640 Bioinformatics Software Design

**Research Courses (4 cr.)**
- BIOSC 1903/CS 1950 Undergraduate Research
  * Taken as variable credits over multiple terms as early as sophomore year. Research must be approved by Kirk Pruhs or Paula Grabowski.

Approved Elective courses (12 cr.)
Twelve credits chosen in statistics, chemistry, biological sciences, and/or computer science from the following courses. Students may take electives in other departments with approval.

**Biological Sciences**
- BIOSC 1500 Cell Biology
- BIOSC 1820 Metabolic Pathways and Regulation
- BIOSC 1830 Biochemistry Lab
- BIOSC 1940 Molecular Biology
- BIOSC 1950 Molecular Genetics Lab

**Chemistry**
- CHEM 0250 Introduction to Analytical Chemistry
- CHEM 1410 Physical Chemistry 1
- CHEM 1420 Physical Chemistry 2
- CHEM 1460 Computational Drug Discovery

**Computer Science**
- CS 1510 Design and Analysis of Algorithms (W opt.)
- 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

**Statistics**
- STAT 1301 Statistical Packages
- STAT 1311 Applied Multivariate Analysis
- STAT 1321 Applied Time Series
Course requirements

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

Capstone experience: BIOSC 1640 and CS 1640 satisfy the bioinformatics major capstone experience requirements for graduation. Capstone request must be made to Kirk Pruhs.

Restrictions: Bioinformatics majors who have completed CS 0401 may not enroll in CS 0004, CS 0007 or CS 0110. BIOSC 1000 cannot be substituted for BIOSC 1810. CHEM 1810 can only be substituted for BIOSC 1810 if it is not possible for the student to schedule BIOSC 1810.

Grade requirements

BIOSC courses: 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. The elective courses for the major must also be completed with a grade of C or better. A minimum GPA of 2.0 in all departmental courses taken is required for graduation. If a C- or lower is earned in an elective course for the major but is not repeated, the course will be used to calculate the overall GPA but will not be counted toward the 32 credits required for the major.

Co-Requisite courses: Students must also earn a minimum GPA of 2.0 in the co-requisite Chemistry and Mathematics courses.

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

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

Advising: Bioinformatics advising is available in both the Department of Biology and the Department of Computer Science. Bioinformatics majors must select an official advisor from either Computer Science or Biological Sciences.

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Checklist for the Bioinformatics Major

Pre-requisite courses
________ CS 0007
________ CHEM 0110
________ CHEM 0120

Core Courses
________ BIOSC 0150 or 0715 (UHC) or BIOSC 0190
________ BIOSC 0160 or BIOSC 0716 (UHC) or BIOSC 0191
________ BIOSC 0350
________ BIOSC 1810
________ CHEM 0310
________ CHEM 0320
________ CS 0401
________ CS 0441
________ CS 0445
________ CS 1501 (W option recommended)
________ MATH 0220
________ STAT 1000
________ STAT 1221

Upper Level courses
________ BIOSC 1540
________ BIOSC 1640/CS 1640

Research courses
________ BIOSC 1903/CS 1950 (1 cr.)
________ BIOSC 1903/CS 1950 (1-2 cr.)
________ BIOSC 1903/CS 1950 (0-1 cr.)
________ BIOSC 1903/CS 1950 (0-1 cr.)

Approved Electives
________ Elective
________ Elective
________ Elective
________ Elective