

School of Arts and Sciences

BIOINFORMATICS

www.cs.pitt.edu

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

Core Level Courses (42 units)

BIOSC 0150 Foundations of Biology 1 (3 credits)

BIOSC 0160 Foundations of Biology 2 (3 credits)

BIOSC 0350 Genetics (3 credits)

BIOSC 1810 Macromolecular Structure & Function (3 credits)

CHEM 0310 Organic Chemistry 1 (3 credits)*

CHEM 0320 Organic Chemistry 2 (3 credits)

MATH 0220 Analytical Geometry & Calculus 1 (4 credits)

STAT 1000 Applied Statistical Methods (4 credits)

STAT 1221 Applied Regression (3 credits)

CS 0401 Intermediate Programming using JAVA (4credits)**

CS 0445 Data Structures (3 credits)

CS 0441 Discrete Structures for CS (3 credits)

CS 1501 Algorithm Implementation (3 credits)

*General Chemistry 0110 and 0120 are prerequisites 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 units)

BIOSC 1540 Computational Biology (3 credits)

BIOSC/CS 1640 Bioinformatics Software Design (3 credits)

Undergraduate Research and Seminars (4 credits)

Electives (12 units) 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 other electives in other departments.

Approved Course Electives

Biological Sciences:

BIOSC 1820 Metabolic Pathways and Regulation (3 credits)

BIOSC 1830 Biochemistry Laboratory (3 credits)

BIOSC 1940 Molecular Biology (3 credits)

BIOSC 1950 Molecular Genetics Laboratory (2 credits)

BIOSC 1500 Cell Biology (3 credits)

BIOSC 1903 Undergraduate Research (2 credits)

BIOSC 1545 The Mathematics of Biology

Chemistry:

CHEM 1410 Physical Chemistry 1 (3 credits)

CHEM 1420 Physical Chemistry 2 (3 credits)

CHEM 0250 Intro Analytical Chemistry (3 credits)

CHEM 1710 Undergraduate Research (2 credits)

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 (2 credits)

Statistics:

STAT 1301 Statistical Packages (3 credits)

STAT 1311 Applied Multivariate Analysis (3 credits)

STAT 1321 Applied Time Series (3 credits)

STAT 1902 Directed Study (2 credits)

General Requirements

Capstone experience:

Prior to graduation, all Bioinformatics majors must satisfy the Capstone Experience requirements through the new Bioinformatics course and/or Undergraduate Research

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:

1. 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. Maintains a GPA of 3.5 or above in all Bioinformatics major courses
3. Maintains an overall GPA of 3.25 or above

Bioinformatics is housed in both the Department of Biology and the Department of Computer Science.

For information, contact:

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For more information about other majors, contact:

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Special Programs and Opportunities

Undergraduate research is an important and valuable aspect of the department. It provides you with the opportunity to interact with faculty as an undergraduate. Your professors are also prominent research scientists, and the department encourages students to become aware of faculty research and to develop projects with faculty. Involvement in research develops close working relationships, knowledge of lab techniques and equipment not normally available to undergraduates, and provides practical experience useful in future employment or in graduate or professional schools. In some cases, undergraduates coauthor research papers or give presentations at national meetings.

An **internship** can be one of the most enlightening and productive aspects of your undergraduate education. It not only gives you a closer look at working in a particular field, but can help you gain a competitive edge, make contacts in the marketplace, and earn credits towards your degree. Pittsburgh is an exciting place for internship opportunities: internationally known as a renowned center for health care and ground-breaking medical research; home to many corporate headquarters, including H.J. Heinz, Fisher Scientific, PPG Industries, Westinghouse Electric, and Mellon Bank; and a city with a wealth of cultural and entertainment activities, including three professional sports teams and the Carnegie system of museums. Internships are not limited to Pittsburgh, however. Every year, students complete internships in cities such as Philadelphia, Washington, D.C., New York City, and their own hometowns. Some students even complete an internship as part of their study abroad experience.

The **Careers in Science** lecture series features a series of workshops designed to educate and inform the department's undergraduate majors on some options available to them once they graduate with a degree. Past speakers have presented information about careers in forensic science, genetic counseling, and public health, just to name a few.

Study Abroad

Studying abroad is an exciting way to add an international perspective to your undergraduate education and strengthen your credentials as a graduate. Since only a small percentage of American students study abroad, this experience distinguishes you as a candidate on the job market. While earning credits toward your degree, you also broaden your personal experience and gain an appreciation of other cultures. Scholarships are available, and financial aid is applicable.

