BIOINFORMATICS (BIOI)

Bioinformatics Undergraduate Courses

BIOI 1000 DIGITAL HEALTH AND BIOLOGICAL SYSTEMS (3 credits)
This course is an introduction to how computing and technology can be applied to human health and biological systems in an interdisciplinary setting. Students will learn to discern between computing specializations such bioinformatics and health informatics. The course will explore the application of computing to health, life sciences, and agriculture in both current and historical contexts, and how these applications impact society. Topics covered include bioinformatics, health informatics, user experience and design, data security and privacy, and more. (Cross-listed with ACMP 1300).
Distribution: Natural/Physical Science General Education course

BIOI 3000 APPLIED BIOINFORMATICS (3 credits)
This course will provide students with the practical skills needed for the analysis of -omics data. Topics covered will include biological databases, molecular biology tools (e.g., primer design, contig assembly), gene prediction and mining, database searches, genome comparison, sequence alignments, phylogenetic inference, gene expression data analyses, functional annotation of protein sequences, protein structure and modeling. Specialized software (e.g., Vector NTI) and widely used web-based computation tools (e.g.., Entrez, BLAST, ClustalX, Phylip, PyMOL, and SwissPDBviewer) will be illustrated. Multiple approaches for solving particular problems will be presented. (Cross-listed with ACMP 3400).
Prerequisite(s): BIOI 1000 and either CIST 1400 or CIST 1600

BIOI 4500 INDEPENDENT STUDY (1-3 credits)
This course allows students to research a topic of their interest that is not available in a formal course. The topic to be studied must be agreed upon by the student and the instructor.
Prerequisite(s): Junior or Senior within the Bioinformatics undergraduate program. Not open to non-degree graduate students.

BIOI 4510 BIOINFORMATICS INTERNSHIP (1-3 credits)
The purpose of this course is to provide the students with an opportunity for practical application and further development of knowledge and skills acquired in the Bioinformatics undergraduate program. The internship gives students professional work experience and exposure to the challenges and opportunities faced by IT professionals in the workplace.
Prerequisite(s): Junior/Senior standing and permission of Director of the School of Interdisciplinary Informatics. Not open to non-degree graduate students.

BIOI 4860 BIOINFORMATICS ALGORITHMS (3 credits)
The main objective of this course is to provide an organized forum for students to understand the foundations of algorithmic design and analysis in the context of health and biological data. The course will present fundamental concepts in algorithms (exhaustive, greedy, graph, heuristic, and more) and explore how those concepts extend to bioinformatics and related fields, such as biomedical informatics, and health informatics. Students will learn about historical context of these algorithms and how they were pivotal in forming more complex modern approaches, and will explore advanced algorithms in their area of interest. Students will also exercise their programming skills with the opportunity to implement and apply bioinformatics algorithms to real data, so to better grasp the technical components of algorithmic design and analysis. (Cross-listed with BMI 8866, ACMP 4860).
Prerequisite(s): ACMP 3200 or CSCI 3320

BIOI 4870 DATABASE SEARCH AND PATTERN DISCOVERY IN BIOINFORMATICS (3 credits)
This required course for undergraduate bioinformatics majors provides foundational knowledge on database aspects used in the field and an overview of their applications in bioinformatics, biomedical informatics, and health/clinical informatics. The course begins with a brief review of key concepts in computational molecular biology related to database search/development, database management systems, the difference between primary and secondary databases, and bioinformatics-related aspects of modeling and theory in computer science. The major focus is on the multiple challenges and aspects of bio-database development, search, and pattern discovery. The course uses problem-based learning to help students develop database management skills as they apply to high throughput "-omics." data, the basics of data management, data provenance and governance, standards, and analysis through KDD-based workflows. This course will also consider the fundamentals of artificial intelligence and machine learning as they pertain to bioinformatics, from the perspective of database storage, I/O, and analysis. (Cross-listed with CSCI 8876).
Prerequisite(s): CSCI 4850 or permission of instructor. Not open to non-degree graduate students.

BIOI 4890 COMPUTERIZED GENETIC SEQUENCE ANALYSIS (3 credits)
The goal of this course is to introduce students to major topics in computerized analysis of genetic sequences. In particular the course will allow students to become familiar with the computational tools and software that aid in the modern molecular biology experiments and analysis of experimental results. Following the completion of this course, it is expected that the students will have a basic understanding of the theoretical foundations of the sequence analysis tools and develop competence in evaluating the output from these tools in a biological context. This course will emphasize hands-on experience with the programs for nucleotide and amino acid sequence analysis and molecular phylogeny. (Cross-listed with BMI 8896).
Prerequisite(s): Junior or senior-level standing in the Bioinformatics program or permission from the instructor.

BIOI 4950 SPECIAL TOPICS IN BIOINFORMATICS (3 credits)
This course is intended to provide a mechanism for offering instruction in subject areas that are not covered in other regularly scheduled courses. In general, courses offered under the BIOI 4950 designation will focus on evolving subject areas in bioinformatics.
Prerequisite(s): Prerequisites of a specific offering of BIOI 4950 will be determined by the supervising faculty member and identified in the course proposal. It is anticipated that permission of the faculty member teaching the course will be required for registration.