Bioinformatics and Computational Biology (BCB)

Courses primarily for undergraduates:

BCB 444. Introduction to Bioinformatics.
(Cross-listed with BIOL, BCBIO, COM S, CPR E, GEN). (4-0) Cr. 4. F. *Prereq: MATH 165 or STAT 401 or equivalent*
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: database searching, sequence alignment, gene prediction, RNA and protein structure prediction, construction of phylogenetic trees, comparative and functional genomics, systems biology. Nonmajor graduate credit.

BCB 490. Independent Study.
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS. *Prereq: Permission of instructor*

Courses primarily for graduate students, open to qualified undergraduates:

BCB 544. Introduction to Bioinformatics.
(Cross-listed with GDCB, CPR E, COM S). (4-0) Cr. 4. F. *Prereq: MATH 165 or STAT 401 or equivalent*
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: database searching, sequence alignment, gene prediction, RNA and protein structure prediction, construction of phylogenetic trees, comparative, functional genomics, and systems biology.

BCB 567. Bioinformatics I (Fundamentals of Genome Informatics).
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. F. *Prereq: COM S 208; COM S 330; STAT 341; credit or enrollment in BIOL 315, STAT 430*
Biology as an information science. Review of algorithms and information processing. Generative models for sequences. String algorithms. Pairwise sequence alignment. Multiple sequence alignment. Searching sequence databases. Genome sequence assembly.

BCB 568. Bioinformatics II (Advanced Genome Informatics).
(Cross-listed with GDCB, STAT, COM S). (3-0) Cr. 3. S. *Prereq: BCB 567, BBMB 301, BIOL 315, STAT 430, credit or enrollment in GEN 411*
Advanced sequence models. Basic methods in molecular phylogeny. Hidden Markov models. Genome annotation. DNA and protein motifs. Introduction to gene expression analysis.

BCB 569. Bioinformatics III (Structural Genome Informatics).
(Cross-listed with BBMB, COM S, CPR E). (3-0) Cr. 3. F. *Prereq: BCB 567, GEN 411, STAT 430*
Algorithmic and statistical approaches in structural genomics including protein, DNA and RNA structure. Structure determination, refinement, representation, comparison, visualization, and modeling. Analysis and prediction of protein secondary and tertiary structure, disorder, protein cores and surfaces, protein-protein and protein-nucleic acid interactions, protein localization and function.

BCB 570. Bioinformatics IV (Computational Functional Genomics and Systems Biology).
(Cross-listed with CPR E, COM S, GDCB, STAT). (3-0) Cr. 3. S. *Prereq: BCB 567, BIOL 315, COM S 311 and either 208 or 228, GEN 411, STAT 430*
Algorithmic and statistical approaches in computational functional genomics and systems biology. Elements of experiment design. Analysis of high throughput gene expression, proteomics, and other datasets obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, simulation and inference of transcriptional regulatory modules and networks, protein-protein interaction networks, metabolic networks, cells and systems: Dynamic systems, Boolean, and probabilistic models. Multi-scale, multi-granularity models. Ontology-driven, network based, and probabilistic approaches to information integration.

BCB 590. Special Topics.
Cr. arr. Repeatable. *Prereq: Permission of instructor*

BCB 593. Workshop in Bioinformatics and Computational Biology.
(1-0) Cr. 1. Repeatable. F.S.
Current topics in bioinformatics and computational biology research. Lectures by off-campus experts. Students read background literature, attend preparatory seminars, attend all lectures, meet with lecturers.

BCB 596. Genomic Data Processing.
(Cross-listed with COM S, GDCB). (3-0) Cr. 3. F. *Prereq: Some experience in computation*
Study the practical aspects of genomic data processing with an emphasis on hands-on projects. Topics include base-calling, sequence cleaning and contaminant removal; fragment assembly procedures and EST clustering methods; genome closure strategies and practices; sequence homology search and function prediction; and annotation and submission of GenBank reports. Next-generation sequencing topics like model genome resequencing, short-read assembly and transcriptome abundance measurement will also be covered.

BCB 598. Cooperative Education.
Cr. R. Repeatable. F.S.SS. *Prereq: Permission of the program chair*
Off-campus work periods for graduate students in the field of bioinformatics and computational biology.

BCB 599. Creative Component.
Cr. arr.

Courses for graduate students:

BCB 660. Selected Topics in Bioinformatics and Computational Biology.
(3-0) Cr. 1-4. Repeatable, maximum of 4 times. F.S.SS. *Prereq: Permission of Instructor*
Topics of interest in the major research areas of computational molecular biology, including genomics, structural genomics, functional genomics, and computational systems biology.

BCB 690. Student Seminar in Bioinformatics and Computational Biology.
Cr. 1. Repeatable. S.
Student research presentations.

BCB 691. Faculty Seminar in Bioinformatics and Computational Biology.
(1-0) Cr. 1. Repeatable.
Faculty research series.

BCB 697. Graduate Research Rotation.
Cr. arr. Repeatable. F.S.SS.
Graduate research projects performed under the supervision of selected faculty members in the Bioinformatics and Computational Biology major.

BCB 699. Research.
Cr. arr. Repeatable.