BIOINFORMATICS AND COMPUTATIONAL BIOLOGY (BCB)

Courses primarily for undergraduates:

BCB 4900: Independent Study
Credits: 1-5. Repeatable, maximum of 9 credits.
Prereq: Instructor Permission for Course
(Typically Offered: Fall, Spring, Summer)

Courses primarily for graduate students, open to qualified undergraduates:

BCB 5230: Mathematical Modeling in Biology
(Cross-listed with MATH 5230/ BCBIO 5230).
Credits: 3. Contact Hours: Lecture 3.
Prereq: MATH 2660 *or* MATH 2670 *or Graduate Classification*
Introduction to mathematical techniques for modeling and simulation, parameter identification, and analysis of biological systems. Applications drawn from many branches of biology and medicine. Apply differential equations, difference equations, and dynamical systems theory to a wide array of biological problems. MATH 2650 or equivalent recommended. (Typically Offered: Fall)

BCB 5440: Fundamentals of Bioinformatics
(Cross-listed with GDCB 5440/ COMS 5440/ CPRE 5440).
Credits: 4. Contact Hours: Lecture 3, Laboratory 2.
A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies. Offered odd-numbered years. (Typically Offered: Fall)

BCB 5460: Computational Skills for Biological Data
(Cross-listed with EEOB 5460).
Credits: 3. Contact Hours: Lecture 1, Discussion 2.
Computational skills necessary for biologists working with big data sets. UNIX commands, scripting in R and Python, version control using Git and GitHub, and use of high performance computing clusters. Combination of lectures and computational exercises. (Typically Offered: Fall)

BCB 5670: Bioinformatics Algorithms
(Cross-listed with COMS 5670/ CPRE 5670).
Credits: 3. Contact Hours: Lecture 3.
Biology as an information science. A review of the algorithmic principles that are driving the advances in bioinformatics and computational biology.

BCB 5680: Statistical Bioinformatics
(Cross-listed with COMS 5680/ GDCB 5680/ STAT 5680).
Credits: 3. Contact Hours: Lecture 3.
Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models. (Typically Offered: Spring)

BCB 5690: Structural Bioinformatics
(Cross-listed with BBMB 5690/ COMS 5690/ CPRE 5690/ GDCB 5690).
Credits: 3. Contact Hours: Lecture 3.
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution. (Typically Offered: Fall)

BCB 5700: Systems Biology
(Cross-listed with COMS 5700/ CPRE 5700/ GDCB 5700/ STAT 5700).
Credits: 3. Contact Hours: Lecture 3.
Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration. (Typically Offered: Spring)

BCB 5850: Fundamentals of Predictive Plant Phenomics
(Cross-listed with GDCB 5850/ ME 5850).
Credits: 4. Contact Hours: Lecture 3, Laboratory 3.
Principles of engineering, data analysis, and plant sciences and their interplay applied to predictive plant phenomics. Transport phenomena, sensor design, image analysis, graph models, network data analysis, fundamentals of genomics and phenomics. Multidisciplinary laboratory exercises. (Typically Offered: Fall)

BCB 5900: Special Topics
Credits: 1-30. Repeatable.
Prereq: Instructor Permission for Course

BCB 5930: Workshop in Bioinformatics and Computational Biology
Credits: 1. Contact Hours: Lecture 1.
Repeatable, maximum of 1 credits.
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. (Typically Offered: Fall, Spring)

BCB 5980: Cooperative Education
Credits: Required. Repeatable.
Off-campus work periods for graduate students in the field of bioinformatics and computational biology. (Typically Offered: Fall, Spring, Summer)

BCB 5990: Creative Component
Credits: 1-30. Repeatable.
Prereq: Instructor Permission for Course

Courses for graduate students:

BCB 6600: Selected Topics in Bioinformatics and Computational Biology
Credits: 1-4. Contact Hours: Lecture 4.
Repeatable, maximum of 4 credits.
Topics of interest in the major research areas of computational molecular biology, including genomics, structural genomics, functional genomics, and computational systems biology. (Typically Offered: Fall, Spring, Summer)

BCB 6900: Student Seminar in Bioinformatics and Computational Biology
Credits: 1. Contact Hours: Lecture 1.
Repeatable.
Student research presentations. (Typically Offered: Spring)

BCB 6910: Faculty Seminar in Bioinformatics and Computational Biology
Credits: 1. Contact Hours: Lecture 1.
Repeatable.
Faculty research series.

BCB 6930: Entrepreneurship for Graduate Students in Science and Engineering
(Cross-listed with AGRON 6930/ EE 6930/ ENGR 6930/ GENET 6930/ ME 6930).
Credits: 1. Contact Hours: Lecture 3.
Repeatable, maximum of 2 credits.
Understanding key topics of starting a technology based company, from development of technology-led idea to early-stage entrepreneurial business. Concepts discussed include: entrepreneurship basics, starting a business, funding your business, protecting your technology/ business IP. Subject matter experts and successful, technology-based entrepreneurs will provide real world examples from their experience with entrepreneurship. Learn about the world class entrepreneurship ecosystem at ISU and Central Iowa. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring)

BCB 6970: Graduate Research Rotation
Credits: 1-30. Repeatable.
Graduate research projects performed under the supervision of selected faculty members in the Bioinformatics and Computational Biology major. (Typically Offered: Fall, Spring, Summer)

BCB 6990: Research
Credits: 1-30. Repeatable.
Prereq: Instructor Permission for Course
(Typically Offered: Fall, Spring, Summer)