BIOINFORMATICS AND COMPUTATIONAL BIOLOGY (BCB)

Any experimental courses offered by BCB can be found at:
registrar.iastate.edu/faculty-staff/courses/explistings/ **(**http://www.registrar.iastate.edu/faculty-staff/courses/explistings/**)**

Courses primarily for undergraduates:

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 523: Mathematical Modeling in Biology
(Cross-listed with MATH). (3-0) Cr. 3. F.
Prereq: MATH 266 or MATH 267
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 265 or equivalent recommended.

BCB 544: Fundamentals of Bioinformatics
(Cross-listed with COM S, CPR E, GDCB). (4-0) Cr. 4. Alt. F., offered odd-numbered years.
Prereq: MATH 165 or STAT 401 or equivalent
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.

BCB 546: Computational Skills for Biological Data
(Cross-listed with EEOB). Cr. 3. F.
Prereq: Graduate student status or permission of the instructor
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.

BCB 567: Bioinformatics Algorithms
(Cross-listed with COM S, CPR E). (3-0) Cr. 3.
Prereq: COM S 228; COM S 230; credit or enrollment in BIOL 315, STAT 430
Biology as an information science. A review of the algorithmic principles that are driving the advances in bioinformatics and computational biology.

BCB 568: Statistical Bioinformatics
(Cross-listed with COM S, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or (BIOL 315 and one of STAT 430 or STAT 483 or STAT 583), credit or enrollment in GEN 409
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.

BCB 569: Structural Bioinformatics
(Cross-listed with BBMB, COM S, CPR E, GDCB). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
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.

BCB 570: Systems Biology
(Cross-listed with COM S, CPR E, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430 or STAT 483 or STAT 583
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.

BCB 585: Fundamentals of Predictive Plant Phenomics
(Cross-listed with GDCB, M E). Cr. 4. F.
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.

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 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 693: Entrepreneurship for Graduate Students in Science and Engineering
(Cross-listed with AGRON, E E, ENGR, GENET, M E). (3-0) Cr. 1. Repeatable, maximum of 2 credits. F.S.
Prereq: Graduate student status and completion of at least one semester of graduate coursework.
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.

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.