

Bioinformatics (BINF)

BINF 5110 AI in Research and Work 1 Credit

This course provides an introduction to the effective and responsible use of artificial intelligence (AI) tools in academic research, programming, and everyday professional tasks. Emphasizing both conceptual understanding and critical application, students will explore how AI can streamline workflows while also learning to recognize and avoid its potential pitfalls. Topics include core AI terminology, major categories of AI tools (e.g., large language models and code assistants such as ChatGPT, Copilot, DEEPL, Google AI, Meta AI, claude.ai, and scite.ai), and practical applications in writing, research planning, and software development. The course also addresses the limitations of current AI systems, including hallucinations (factually incorrect output), ethical risks such as plagiarism, and the importance of transparency in AI-assisted work.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment limited to students in the MS-BIO-SM or MS-SYSM-SM programs.

Enrollment is limited to Graduate level students.

BINF 5115 Compt. and Algorith. Thnking 1 Credit

This course introduces fundamental algorithms used in bioinformatics, emphasizing both conceptual understanding and practical problem-solving. Students will study key computational methods including sequence alignment algorithms (e.g., Needleman-Wunsch, Smith-Waterman), string matching algorithms (e.g., Boyer-Moore, Knuth-Morris-Pratt), clustering techniques (k-means, DBSCAN), and tree-based data structures such as binary search trees. In addition to mastering these specific algorithms, students will learn to generalize core principles and apply them to novel or related computational problems. The course emphasizes step-by-step exercises completed on paper to build algorithmic thinking, reinforce theoretical knowledge, and prepare students to adapt solutions beyond standard cases.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment limited to students in the MS-BIO-SM or MS-SYSM-SM programs.

Enrollment is limited to Graduate level students.

BINF 5125 Intro to Molecular Biology 1 Credit

Level: Graduate

Grading: Main Campus (UGrad, Grad)

BINF 5130 Sci. Debating and Writing 2 Credits

This is an interactive journal club, scientific debating, and scientific writing course that focuses on recent research in Bioinformatics. Students will (i) present selected papers in the fields of Bioinformatics; (ii) prepare and lead interactive discussions in the form of a scientific debate; (iii) develop critical analysis, communication, and writing skills; and (iv) experience fact-based debating. Papers will be selected in consultation with faculty. Each session will begin with a student-led presentation (approx. 20 minutes) of one selected scientific publication. The publication can be selected from a provided reading list, or the student can find a topic-related publication that has to be approved by the lecturer. The presenting student will act as the Debate Leader. Four additional students will be assigned to argue either in favor (two students pro) or against (two students contra) the credibility of the publication's results.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BINF 5210 Bioinformatics 4 Credits

A mixture of lectures and hands-on sessions with introduction to bioinformatics concepts, methods, databases and applications, covering genomic sequence analysis, molecular evolution, and protein sequence, structural, functional analysis. Non-bioinformatics major students may be able to take individual units of this course on Genomic Sequence Analysis (BCHB-571) and Protein Sequence Analysis (BCHB-572), depending on the number of enrollments for BCHB 521.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BINF 5220 Machine Learning 3-4 Credits

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

BINF 5230 Molecular Biology 2 Credits

Level: Graduate

Grading: Main Campus (UGrad, Grad)

BINF 5240 Bioinformatics Computing 3 or 5 Credits

A hands on introduction to programming for Bioinformatics using the scripting language Python. Students will build a portfolio of scripts that automate common bioinformatics tasks such as accessing data in relational databases and web-based repositories, interfacing with external tools such as blast, and building web-based resources for use by interactive users or as web-services.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

BINF 5730 Bioinformatics Sem Series I 1 Credit

Bioinformatics Seminar Series

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

BINF 5740 Bioinformatics Sem Series II 1 Credit*Level:* Graduate, Undergraduate*Grading:* Main Campus (UGrad, Grad)*Mutual exclusion:* BCHB 574*Course registration restrictions:*

Enrollment limited to students in the MS-BIO program.

BINF 5800 SYSTEMS BIOL/BIOINFORMATICS 3 Credits

An introduction to bioinformatics in systems biology, covering microarray data analysis, proteomic/metabolomic informatics, and regulatory network and pathway analysis. Non Bioinformatics major students may be able to take individual units of this course on Transcriptomics (BCHB 581), Proteomics (BCHB 582) and Systems Biology (BCHB 583), depending on the number of enrollments for BCHB 580.

Level: Graduate, Undergraduate*Grading:* Main Campus (UGrad, Grad)*Mutual exclusion:* BCHB 580, BCHB 5800**BINF 5860 Mol. Bio for Bioinf. 3 Credits**

An introductory molecular biology and biochemistry course that emphasizes topics of special interest to students of bioinformatics, including properties of amino acids and proteins, the central dogma (DNA replication, mRNA transcription, protein translation) and regulation of gene expression. The course consists of a mixture of lectures and tutorial sessions where students work on problem sets related to the lecture material.

Level: Graduate, Undergraduate*Grading:* Main Campus (UGrad, Grad)**BINF 5990 Next Gen Seq Data Analysis 2 Credits**

This course will cover analysis and interpretation of Next Generation Sequencing (NGS) data. Topics will include genome sequencing and annotation, gene expression analysis (RNAseq), and genomic variant analysis. A substantial part of the course will be devoted to hands-on tutorials using the Galaxy and R platforms to work with NGS data, from the raw sequencing reads through biological interpretation of the results. Students will apply what they have learned by conducting an independent RNAseq analysis project and presenting their results in the format of a scientific paper. Upon completing the course, students should be familiar with the practical aspects of carrying out an NGS analysis workflow and appreciate how NGS technology can be used to further our understanding of biological systems.

Level: Graduate, Undergraduate*Grading:* Main Campus (UGrad, Grad)*Mutual exclusion:* BCHB 599*Course registration restrictions:*

Enrollment limited to students in the MS-BIO program.

BINF 6200 Bioinformatics Algorithms 1-3 Credits

Self-paced course in bioinformatics algorithms using rosalind.info. Students will complete 28 problems in the 1 credit section.

Level: Graduate*Grading:* Main Campus (UGrad, Grad)*Mutual exclusion:* BCHB 620*Course registration restrictions:*

Enrollment limited to students in the MS-BIO program.

Enrollment is limited to Graduate level students.

BINF 6300 Broad Aspects of AI in Biotech 1 Credit

This course is designed to provide students with a high-level understanding of key industry trends where AI intersects with Biotechnology. It will cover broad descriptions of AI techniques and concepts (machine learning, neural networks, computer vision, big data, etc.) and biotech applications such as imaging, genomics, and drug development. The class will discuss strategic considerations for the development and commercialization of successful data pipelines. It will also ponder the paradigm changes for biotech, health care providers, and regulators.

Level: Graduate, Undergraduate*Grading:* Main Campus (UGrad, Grad)*Course registration restrictions:*

Enrollment is limited to Graduate level students.

BINF 6970 Databases for Bioinformatics 3 Credits

Physical and logical organization of databases. Data retrieval languages, relational database languages, security and integrity, concurrency, overview of the databases in bioinformatics. Course Objectives In this course, students will learn how to create and manipulate a database system using MySQL. He or she will also learn how to design a database using the E/R model. Upon completion, students will understand how databases are used in bioinformatics and should be able to design and implement a complete normalized relational database system.

Level: Graduate*Grading:* Main Campus (UGrad, Grad)*Mutual exclusion:* BCHB 697*Course registration restrictions:*

Enrollment limited to students in the MS-BIO program.

Enrollment is limited to Graduate level students.

BINF 7950 Bioinf. Internship Proposal 1 Credit

Students will write, submit, and revise their Bioinformatics Internship Proposal for approval prior to starting their internship.

Level: Graduate*Grading:* Main Campus (UGrad, Grad)*Mutual exclusion:* BCHB 587*Course registration restrictions:*

Enrollment limited to students in the MS-BIO or MS-BIO-SM programs.

Enrollment is limited to Graduate level students.

BINF 7951 BIOINFORMATICS INTERNSHIP 0-4 Credits

Internship for a bioinformatics project with defined objectives in a research laboratory on campus or off-campus (e.g. NIH, JCVI, CNMC, CARB). Internships can be in various topics such as genomic and proteomic informatics, protein structural and functional analysis, comparative genomics, pathway and network analysis, systems biology, medical informatics, biomedical text mining and ontologies, data integration and mining, and bioinformatics tool and database development.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Mutual exclusion: BCHB 907

Course registration restrictions:

Enrollment limited to students in the MS-BIO or MS-BIO-SM programs.

Enrollment is limited to Graduate level students.

BINF 7952 Bioinformatics Internship II 0-4 Credits

Bioinformatics Internship II

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Equivalent to BINF 909

Course registration restrictions:

Enrollment is limited to students with a program in Bioinformatics, Bioinformatics, Bioinformatics or Bioinformatics.

Enrollment is limited to Graduate level students.

Enrollment limited to students in a Master of Science degree.

BINF 9001 Tutorial: Biochem/Bioinformatics 1-16 Credits

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BINF 9993 Continuous Registration

Continuous Registration

Level: Graduate

Grading: Main Campus (UGrad, Grad)