BIOINFORM AND PROTEOM-GENOMICS (BIPG)

BIPG 5100 Fund Bioinformatics Proteomics
[3 credit hours]
Introduction to bioinformatics and computational biology. Both theory and practical methods for evaluating and managing biomedical data will be covered. Topics range from sequence analysis to structure prediction. Includes computer laboratory sessions. May be taken concurrently with BIPG520/720.
Term Offered: Fall

BIPG 5110 Practical Bioinformatics
[1 credit hour]
This course will provide students with practical experience with the most common bioinformatics tasks. Short lectures will be integrated with computer exercises in the Bioinformatics Computer Lab.
Term Offered: Summer

BIPG 5120 Clinical Bioinformatics
[3 credit hours]
This course introduces graduate students and healthcare professionals to the science of Clinical Bioinformatics and application in healthcare setting. We aim to provide students a basic understanding of the health informatics and bioinformatics methodologies and practices, along with the omics technologies used for clinical diagnostic and treatment purposes. The emphasis of this course is on the clinical rather than research applications of these technologies and methodologies. We will illustrate how the discipline of Clinical Bioinformatics provides an important bridge between the cutting-edge science and the delivery of personalized/precision medicine in clinical practice. By understanding the role of a Clinical Bioinformatician it will become clear how integral they are to ensuring the beneficial opportunities of genomic medicine are fully realized in patient care.
Term Offered: Spring, Summer, Fall

BIPG 5200 Statistical Methods in Bioinformatics
[3 credit hours]
This course introduces students to statistical methods commonly used in bioinformatics. Students will learn to use statistical programs and related bioinformatics resources locally and on the Internet. Lectures and lab discussion will emphasize on the statistical models and methods underlying the computational tools. The course briefly reviews basic statistical methods and methods more specific to bioinformatics research, including Markov chains, hidden Markov models, Bayesian statistics, and Bayesian networks. Students will learn the principles behind these statistical methods and how they can be applied to analyze throughput data.
Term Offered: Fall

BIPG 5300 Current Topics in BPG
[1 credit hour]
In-depth analysis of original scientific papers/seminars in the fields of bioinformatics, proteomics and genomics for the development of critical analysis and scientific communication skills. May be repeated for credit.
Term Offered: Spring, Summer, Fall

BIPG 5400 Biodatabases
[1 credit hour]
This course will introduce students to database concepts, design, and implementation, using the most popular database formats utilized in biomedical research. The practicum provides hands-on experience with real-world databases.
Term Offered: Summer

BIPG 5500 Mining Omics Data
[1 credit hour]
This course aims at providing hands-on training on mining bioinformatics databases. Students will learn how to handle and analyze transcriptomic and other relevant data. Topics covered include preprocessing, identifying differentially expressed genes, classification and presentation of findings.
Term Offered: Summer

BIPG 5800 Rotations in BPG
[0-4 credit hours]
Students will participate in selected on-going research programs with faculty members in the Bioinformatics, Proteomics and Genomics program. May be repeated for credit.
Term Offered: Fall

BIPG 6100 Bioinformatic Computation
[3 credit hours]
Use, design, strengths and limitations of bioinformatics programs run on desktop computers. Programming in PERL to acquire and analyze biological sequences. Construction and management of databases. Introduction of LINUX, C++, and Java. Includes computer laboratory sessions.
Term Offered: Spring, Summer

BIPG 6110 Case Studies in Omics Medicine
[1 credit hour]
The rapid advancement in 'omics' technologies are presently adding new components to the advancement of precision medicine and clinical care. The understanding of strengths and limitation of Omics technologies is fundamental for the selection of appropriate type for specific clinical scenario. This course presents case-report involving the application of omics technology for the prevention, diagnosis, and treatment of disease. Students will be introduced to omics research and technology in genomics, epigenomics, transcriptomics, proteomics, and metabolomics. Students will learn about selected Omics technologies and their strengths and limitations. Students will also learn underlying principles of these technologies and how to critically judge the robustness of the Omics data.
Term Offered: Spring, Summer, Fall

BIPG 6200 Advanced Programming in Bioinformatics
[3 credit hours]
This course introduces students to programming methods commonly used in bioinformatics. The course consists of two parts. The first part focuses on Python programming and the second part focuses on R programming. The Python part of the course provides a general overview of the Python programming. Students will learn and practice programming concepts using the Python programming language. Focus lies on how to think computationally and students will learn and practice to write programs to tackle problems in bioinformatics. The course will also contain a section on how to use code written by other programmers in your own Python programs. The R part of the course provides the programming tools needed for data analysis in bioinformatics. The student will learn how to access and summarize big dataset using the R program. Each section will be driven by a particular problem in bioinformatics and students will gain experience in R programming addressing bioinformatics problems.
Prerequisites: BIPG 6100 with a minimum grade of C
Term Offered: Fall

BIPG 6300 Clinical Proteomics
[2 credit hours]
This course teaches advanced proteomics techniques of disease, pathways, targets and drug effects, such as advanced proteomics experimental and computational techniques to support clinical research needs. Protein structure and classification, including their functional role and protein-protein interaction will be presented. Protein identification by mass spectrometry and bioinformatics analysis will be taught to help in drug discovery and translating bench to bedside, building on basic scientific research to create new therapies, medical procedures, or diagnostics.
Term Offered: Fall

BIPG 6400 Applications of Bioinformatics
[3 credit hours]
Lectures and hands-on activities that demonstrate the application of bioinformatics, proteomic and genomics techniques to solve research problems being studied by selected faculty from MCO, UT, BGSU or another institution.
Term Offered: Spring

BIPG 6500 Applied Statistics for Bioinformatics
[3 credit hours]
This course will provide students with practical statistical and data analysis skills to perform rigorous analysis of high-throughput biological data. The course assumes familiarity with the statistical methods and with R programming. The course covers the statistical concepts necessary to design experiments and analyze high-dimensional data generated by high-throughput technologies. Also included are stochastic modeling and statistical methods applied to problems such as mapping disease-associated genes, SNP and mutation analysis, transcriptomics, miRNA, DNA methylation and epigenetics, proteomics, metabolomics, and metagenomics.
Term Offered: Spring, Fall

BIPG 6600 BIPG Internship
[1-6 credit hours]
Focused practical training in Biomarker discovery and validation with a pharmaceutical-oriented company. Builds upon didactic course work.

BIPG 6700 Research in Bioformatics
[1-6 credit hours]
Supervised research in bioinformatics, especially designed for new graduate students to gain research credits before taking their Qualifying Exam. Students will study bioinformatics applications to biochemical research, usually in a laboratory setting, as well as discussing current literature and advanced techniques in all areas of bioinformatics.

BIPG 6800 Practical Genomics
[3 credit hours]
This course provides a broad overview of the field of bioinformatics, algorithmic solutions for biological data analysis, and applications in genomics. The course is addressed to students in computational and interdisciplinary programs, such as Biomedical Informatics, Biostatistics, Computer Science and Engineering, Biomedical Engineering, as well as Systems Biology & Physiology, Cancer Biology, and related programs. Other students interested in learning about computational methods in biomedical research are also encouraged to take this course.
Term Offered: Spring

BIPG 6890 Independent Study in BPG
[0-4 credit hours]
Intense study in an area of bioinformatics, proteomics and genomics (BPG). Course content, assignments, meeting times and grade requirements are arranged with a BPG faculty member. May be repeated for credit.
Term Offered: Spring, Summer, Fall

BIPG 6990 Thesis in Bioinformatics
[1-15 credit hours]
Research in bioinformatics, or interdisciplinary investigation of biomedical problems with significant bioinformatic components. This research is at the masters level, leading to completion of a scientific project for presentation as a thesis. May be repeated for credit.
Term Offered: Spring, Summer, Fall

BIPG 7100 Fund Bioinform and Proteomics
[3 credit hours]
Introduction to bioinformatics and computational biology. Both theory and practical methods for evaluating and managing biomedical data will be covered. Topics range from sequence analysis to structure prediction. Includes computer laboratory sessions. May be taken concurrently with BIPG520/720.
Term Offered: Fall

BIPG 7110 Practical Bioinformatics
[1 credit hour]
Short lectures integrated with computer tasks in Bioinformatics Computer Lab. The bioinformatics resources will primarily be those freely available on the internet. The course will meet twice a week for 2-hour sessions in the Bioinformatics Computer Lab. The course will last four weeks during the Summer semester. The following topics will be presented in the eight sessions: searching biological databases, pair-wise sequence alignments, BLAST searches, multiple sequence alignment, phylogenetic analysis, gene prediction, and transcription factor binding sites and other DNA motifs. No prerequisites.
Term Offered: Summer

BIPG 7120 Clinical Bioinformatics
[3 credit hours]
This course introduces graduate students and healthcare professionals to the science of Clinical Bioinformatics and application in healthcare setting. We aim to provide students a basic understanding of the health informatics and bioinformatics methodologies and practices, along with the omics technologies used for clinical diagnostic and treatment purposes. The emphasis of this course is on the clinical rather than research applications of these technologies and methodologies. We will illustrate how the discipline of Clinical Bioinformatics provides an important bridge between the cutting-edge science and the delivery of personalized/precision medicine in clinical practice. By understanding the role of a Clinical Bioinformatician it will become clear how integral they are to ensuring the beneficial opportunities of genomic medicine are fully realized in patient care.
Term Offered: Spring, Summer, Fall

BIPG 7300 Transcriptomic Data Science
[3 credit hours]
Transcriptomic though part of genomics has evolved tremendously over the past 10 years and has expanded to many other domains including drug discovery and cellular anatomy. This course introduces students to the basic biology of modern transcriptomics and the experimental tools that we use to measure it. Starting with the Central Dogma of Molecular Biology I will cover how next-generation sequencing can be used to measure RNA expression and its regulation. Recent advances in transcriptomic data science including single cell RNA sequencing, RNA-editing, and transcriptomic signature-based drug discovery approaches will also be covered. Students will also get an introduction to the key concepts in cluster computing and data science that you'll need to understand how data from next-generation sequencing experiments are generated and analyzed. The course is designed based on the need of transcriptomic data science and cluster computing in job market. Accordingly, the major focus will be on project-based teaching.
Term Offered: Spring, Summer

BIPG 7350 Algorithms for Bioinformatics
[3 credit hours]
The course introduces students to design and use of major algorithm classes that are often used in bioinformatic analyses. These include, but are not limited to, exhaustive search, greedy algorithms, dynamic programming, divide#and#conquer, and graph#based formulations. Lectures, and individual and group-based projects are used.
Term Offered: Spring

BIPG 7400 Biodatabases
[1 credit hour]
This course will introduce students to database concepts, design, and implementation, using the most popular database formats utilized in biomedical research. The practicum provides hands-on experience with real-world databases.
Term Offered: Summer

BIPG 7500 Microarray Analysis
[1 credit hour]

BIPG 8100 Bioinformatic Computation
[3 credit hours]
Use, design, strengths and limitations of bioinformatics programs run on desktop computers. Programming in PERL to acquire and analyze biological sequences. Construction and management of databases. Introduction of LINUX, C++, and Java. Includes computer laboratory sessions.
Term Offered: Spring

BIPG 8400 Applications of Bioinformatics
[3 credit hours]

BIPG 8890 Independent Study in BPG
[0-4 credit hours]
Intense study in an area of bioinformatics, proteomics and genomics (BPG). Course content, assignments, meeting times and grade requirements are arranged with a BPG faculty member. May be repeated for credit.

BIPG 9990 Dissertation Research in BIPG
[1-9 credit hours]
Formal intensive study of specific topic in bioinformatics, or bioinformatic applications in other biomedical fields. This research should be conducted after the doctoral student passes their qualifying exam. Individual studies may include the application of both experimental and theoretical scientific methods, with the goal of advancing bioinformatic methods and/or of advancing biomedical fields through the use of such methods. May be repeated for credit.
Term Offered: Spring, Summer, Fall