

Course Descriptions

BINF 5445 Theory and Applications in Bioinformatics (UALR): 4 Credits - An overview of concepts central to the science and use of bioinformatics. Draws upon the fields of biostatistics, computer and information science, and the life sciences. Course is offered for both graduate and undergraduate credit. The graduate version of the course is an integral part of the UALR/UAMS Joint Graduate Program in Bioinformatics. The undergraduate version of the course is the final course in the UALR undergraduate minor in bioinformatics. No Prerequisites

***BINF 6101 Reasoning Medical Data:** 3 Credits – This course will provide participants with basic knowledge of the methods used in First Order Logic (FOL) to prepare the ground for using Description Logic (DL) on biomedical data. Theoretical issues fostering the understanding of how DL differs from FOL and why these differences are important will be discussed. No Prerequisites

***BINF 6102 Semantic Web:** 3 Credits - The Semantic Web is the future of data management in bioinformatics. A thorough understanding of the Semantic Web is a prerequisite for conducting data intensive research such as translational science. This course introduces graduate students to a wide range of cutting edge Semantic Web technologies in biomedicine. No Prerequisites

***BIOM 5108 Special Topics:** 3 Credits - In-depth consideration of topics of current research importance and specialized subjects not covered in general courses. Topics vary by year. Representative topics include: surveys of recent advances in biomedical informatics domains and in-depth exploration of new computational or research approaches in biomedical informatics. No Prerequisites

***BIOM 5190 Biomedical Informatics Research & Application Seminar:** 1 Credit - This seminar provides exposure to current research and application in Biomedical Informatics and the faculty, trainees, and other experts conducting it. Topics include ongoing research, research results, and translation of findings into practice and reflect the breadth of ongoing work across Biomedical Informatics as a discipline. This weekly seminar is given by local and visiting researchers and practitioners in the discipline. Seminar speakers will highlight relevant informatics and information science principles and methodology. Students participating in the seminar for course credit will be encouraged to explore literature relevant to the seminar topic and participate in constructive critique and academic discussion about the research. Seminar attendance encourages use of critical analysis and appraisal skills to participate in scientific dialog. This course can be taken for 1 credit hour. No Prerequisites

***BIOM 6110 Fundamental of Managing Research Data:** 1 credit - This graduate course presents the fundamental concepts, theories and principles involved in managing research data across the spectrum of Biomedicine from molecules to populations. This introductory pragmatic course covers basic types of data, corresponding collection and management methods. Resource estimation and oversight will also be covered and will prepare doctoral students for the data collection and management aspects of their dissertation research and beyond. No Prerequisites

***BMIG 5014 Anatomy for Imaging:** 3 Credits - This graduate course focuses on the structure of the human body and will include skeletal structure, muscular structure, organ systems and their structural organization. Students will gain knowledge not only of the gross anatomical structure of the human body, but also of visualization of that structure using modern imaging methods including magnetic resonance imaging, computed tomography, ultrasound, and positron emission tomography. For each anatomical region and organ system, histological and histopathological correlates will also be examined. No Prerequisites

***BMIG 5114 Bioconductor for Genomic Scale Data:** 1 Credit - The aim for this graduate course is to introduce students to tools required for analysis of high-throughput genomic data using Bioconductor. The focus will be on two main technologies: next generation sequencing and microarrays. The class will

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cover installation of Bioconductor, common data structures including *ExpressionSets*, *SummarizedExperiments* container for multiple assays, GRanges objects used across several types of analyses, computing on genomic regions and genomic annotations with Bioconductor. An introduction to statistical concepts and methodologies in the analysis of data based on microarrays and next generation sequencing platforms will be covered. Lastly the course will introduce reproducible reports and workflows using Rmarkdown. No Prerequisites

***BMIG 5801 Capstone Course:** 3 Credits - A capstone project will be performed under the close supervision of the each student's advisor. Project possibilities include, but are not limited to: developing a project that fits into a larger framework, systematic review, piece of an ongoing research project, substantial background literature review, grant writing, and ect. Prerequisites: None. Course is taken during final semester of enrollment.

***BMIG 5016 Clinical and Translational Research:** 1 Credit - This graduate course provides an introduction to Clinical and Translational research. Topics focus on environmental forces shaping the direction of the development of new therapeutics in the United States and include clinical and translational research as part of healthcare, the therapeutic development process, relevant federal agencies and regulations, and economic factors. No Prerequisites

***BMIG 5017 Clinical Data Standards:** 1 Credit - This graduate course reviews the various standards used in healthcare, with special focus on how those standards are used in electronic health records. No Prerequisites

***BMIG 6110 Clinical Decision Support:** 2 Credits - This graduate course covers clinical decision support approaches and methods in healthcare settings. Prerequisites: Health Information Systems

***BMIG 5113 Clinical Imaging Informatics:** 3 Credits - This graduate course covers the basic principles of the field of Medical Imaging Informatics, with an emphasis on Clinical Imaging Informatics. Starting from an introduction to the basic imaging modalities, the course continues with how images are captured, stored, processed, viewed, documented, and tied into a patient's medical record. The course covers the use of imaging information in several key medical specialties. Prerequisites: Introduction to Biomedical Informatics

***BMIG 6011 Clinical Research Informatics:** 3 Credits - This graduate course presents information-reliant processes in clinical research with an emphasis on major theories, principles, and methods used in practice and inquiry in Clinical Research Informatics. Prerequisites: Introduction to BMI, Fundamentals of Managing Research Data, Clinical and Translational Research, and Intro to Human Computer Interaction.

***BMIG 6111 Comparative Microbial Genomics:** 3 Credits - The aim for this graduate course is to teach about the comparison of massive availability of genome sequence of microbes and other organisms. The course is designed to enable student to use computational tools through lectures and hands-on practical to extract biological meanings and discover novel features from the genomic data. Prerequisites: Genomics and Metagenomics

***BMIG 6012 Data Warehousing, Aggregation, and Reporting:** 1 Credit - This graduate course covers data warehousing in biomedical informatics. No Prerequisites

***BMIG 6800 Dissertation Research:** Credit Varies (18 Credit-hour minimum) - Under supervision of graduate faculty, an original research study will be designed and conducted with written dissertation following Graduate School guidelines. All coursework completed.

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***BMIG 5210 Genomics and Metagenomics:** 3 Credits - This graduate course teaches methods for comparison of genomes and metagenomes. Students completing this course should be able to locate reference genomes, computationally compare genomes of interest and clearly communicate the results of the investigation using three different formats: a journal club report critiquing a recently published paper, a poster, and finally by writing a scientific paper which is formatted and suitable for publication. No Prerequisites

***BMIG 5013 Health Information Systems:** 1 Credit - This graduate course covers information systems used in healthcare. Topics focus on system functionality required to support care in inpatient and outpatient settings and associated data and workflows. No Prerequisites

***BMIG 5115 Healthcare in the US:** 1 Credit - This graduate course presents the components of the healthcare system in the United States with a focus on current challenges and external forces shaping those challenges. Special emphasis is given to topics impacting or impacted by technology in healthcare. No Prerequisites

***BMIG 6013 Healthcare Informatics of Quality and Patient Safety:** 1 Credit - This graduate course presents topics in healthcare quality and safety. Topics focus on methods and tools to achieve the Institute of Medicine components of healthcare quality in clinical settings. No Prerequisites

***BMIG 6010 Information Systems in Clinical Research:** 1 Credit - This graduate course covers information systems used in Clinical Research with an emphasis on automation, system functionality, system integration, and information exchange. Common information-reliant and automated processes and methodology are explored. Prerequisites: Clinical Research Informatics

***BMIG 5015 Introduction to Biological Network Analysis:** 1 Credit - The aim of this course is to provide an introduction to network/Graph theory, how it can be applied to biological data and statistical analysis of biological networks. The course will start with an overview of graphs; basic definitions and concepts, families of graphs, describe creating network graphs and analysis of network graph characteristics, statistical models for Network graphs and network topology inference. The course will concentrate on building correlation networks as an example. Prerequisites: Bioconductor for Genomic Scale Data

***BMIG 5011 Introduction to Biomedical Informatics I:** 4 Credits - Introduces key application areas, thought leaders, seminal work and methods common across Biomedical Informatics. Major topics include defining the discipline, information flow at the molecular and cellular level, declarative, probabilistic and procedural knowledge, Biomedical ontology, relational theory, and concepts involving development, implementation, use, and evaluation of computer systems in biomedicine. The lab portion of the course offers hands-on exposure to and experience with methods and tools used across the discipline. After the course, the student should have a comfort level discussing areas of practice and digesting research findings. No Prerequisites

BMIG 5012 Introduction to Biomedical Informatics II: 4 Credits - This graduate course is the second part of a two-course introduction to the discipline of biomedical informatics. The introduction to the discipline is continued through additional key application areas, thought leaders, seminal work and methods common across Biomedical Informatics. Major topics covered include structured, semi-structured and unstructured data in biomedicine, computer-aided human use of data in biomedicine, and ethical, policy and legal issues in biomedical informatics.

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This two-part course series serves as the foundation for the Biomedical Informatics Graduate Program educational goals by providing a survey of the discipline and general awareness of the major areas of practice and crosscutting concepts, theories and methods. The didactic portion of the course offers students the opportunity to internalize the goals and value of the discipline to human health. The lab portion of the course offers hands-on exposure to and experience with methods and tools used across the discipline. After the course, the student should have a comfort level discussing areas of practice and digesting research findings. No Prerequisites

***BMIG 5112 Introduction to Human Computer Interaction:** 3 Credits - This graduate course is a survey course covering select topics from cognitive science, human factors, human centered design, and usability relevant to biomedical informatics. Prerequisites: Introduction to Biomedical Informatics

***BMIG 5116 Managing Organizations, People, and Projects:** 3 Credits -This graduate course covers principles of leadership and management of organizations and projects. Topics covered include leadership models, interdisciplinary teams, effective communication, project management, change management, and strategic and financial planning for clinical information. No Prerequisites

***BMIG 501X Medical Decision-making:** 1 Credit - This graduate course covers medical decision making with a focus on traditional approaches and methods. No Prerequisites

***BMIG 5010 Project Rotations in Biomedical Informatics:** 2 Credits - An Introduction to methods and tools often used in Biomedical Informatics through ‘hands-on’ experiences by helping to solidify your ability to grasp the core concepts of a research problem, come up with a properly-scoped proposal to explore possible solutions to the problem, all under the guidance of a faculty mentor. No Prerequisites

***BMIG 6220 Neuroimaging Informatics and Connectomics:** 3 Credits – This graduate course will explore in depth the use of advanced imaging techniques and quantitative analysis approaches in Neuroscience research. The focus is distinct from clinical imaging and standard clinical practice. Pre-clinical and advanced imaging techniques not yet approved for the clinic will be explored. Image creation, quantitative analysis, and management technologies will be presented drawing on the primary literature and making full use of unique imaging resources such as the Human Connectome Project’s *ConnectomeDB* and *Workbench*. Prerequisites: Anatomy for Imaging, PHYO 5013 General Physiology or equivalent, and Research Imaging and Informatics

***BMIG 6215 Research:** Credit Varies - Students will participate in a research project under the supervision of a faculty member. No Prerequisites

***BMIG 6050 Research Design in Biomedical Informatics:** 3 Credits - This graduate course provides an introduction to research design in biomedical informatics. Topics include epistemology, concept, construct and theory development, qualitative and mixed methods approaches as well as experimental and quasi-experimental design. The purpose of this course is to aid students in selecting, articulating and defending appropriate research designs for thesis or doctoral research. No Prerequisites

***BMIG 6210 Research Imaging Informatics:** 3 Credits - This graduate course will explore in depth the use of advanced radiology and pathology imaging techniques and quantitative analysis approaches in biomedical research. The focus is distinct from clinical imaging and standard clinical practice. Pre-clinical and advanced imaging techniques not yet approved for the clinic will be explored. Image creation, quantitative analysis and management technologies will be presented drawing on the primary literature and making full use of unique imaging resources at UAMS such as the *Cancer Imaging Archive*. Prerequisites: Anatomy for Imaging, PHYO 5013 General Physiology or equivalent, Introduction to BMI, Methods in Biomedical Informatics, and Clinical Imaging Informatics

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***BMIG 5211 Scientific Data Visualization:** 1 Credit - This graduate course covers guidelines for efficient scientific visualizations of small and large-scale data sets. Students completing this course should be able to present a scientific dataset in a clear, informative and reader-friendly manner. The course includes discussion of the figures of selected scientific publications. Students will make criticisms on the figures to identify the strong and weak components and discuss the alternative ways to improve the visualization. Prerequisites: BIOS 5013 Biostatistics I or equivalent and Bioconductor for Genomic Scale Data

***BMIG 5800 Thesis Research:** Credit Varies (6 Credit hour minimum) - Under supervision of graduate faculty, an original research study will be designed and conducted with written thesis following Graduate School guidelines. Prerequisites: All coursework completed.

***BIOS 5013 Biostatistics:** 3 Credits - Introductory topics in descriptive biostatistics and epidemiology, database principles, basic probability, diagnostic test statistics, tests of hypotheses, sample size estimation, power of tests, frequency cross-tabulations, correlation, nonparametric tests, regression, randomization and analysis of variance. No Prerequisites

CPSC 7375 Machine Learning (UALR): 3 Credits - In-depth study of machine learning foundation, neural networks, learning paradigms, inductive learning, deductive learning, learning techniques, rough classifiers, fuzzy systems, genetic algorithms, lattices, pattern recognition and applications. No Prerequisites

IFSC 5345 Information Visualization (UALR): 3 Credits - The design and presentation of digital information. Use of graphics, animation, sound, visualization software and hypermedia in presenting information to the user. Methods of presenting complex information to enhance comprehension and analysis. Incorporation of visualization techniques into human-computer interfaces. No Prerequisites

PCOL 5211 Scientific Communication and Ethics I: 1 Credit - Formal training in scientific communication and ethics for students in the first of graduate school. Various faculty within and outside the department will lead discussions concerning ethical conduct related to scientific publishing. Students will also prepare an oral presentation of recent peer reviewed research. No Prerequisites

PCOL 5221 Scientific Communication and Ethics II: 1 Credit - Formal training in scientific communication and ethics for students in the second year of graduate school. Various faculty within and outside the department will lead discussions concerning ethical conduct related to scientific publishing. Students will also prepare an oral presentation of recent peer reviewed research. Prerequisites: PCOL 5211

PCOL 5231 Scientific Communication and Ethics III: 1 Credit - This course will provide additional formal training in scientific communications and ethics. PCOL 5211 and PCOL 5221

PCOL 5241 Scientific Communication and Ethics IV: 1 Credit - This course will provide additional formal training in scientific communications and ethics. Prerequisites: PCOL 5211, PCOL 5221, and PCOL 5241

IFSC 7320 Database Systems (UALR): 3 Credits - Database systems and data modeling, including entity-relationship model, relational data model, normalization, structured query language (SQL), transaction management, object-oriented databases and basics of physical database design and query evaluation. No Prerequisites

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IFSC 7370 Data Science and Technologies (UALR): 3 Credits - This course provides a survey of the skills and concepts needed for managing, processing, and analyzing massive amounts of data in real time. Topics covered include data sourcing, storing and sharing, integration and data mining strategies along with hands-on experience working with sample technologies selected from a complex ecosystem of tools and platforms. No Prerequisites