May be repeated for credit.

BME 700: Dissertation Research off Campus - Domestic

Prerequisite: Must be advanced to candidacy (G5). Major portion of research will take place off-campus, but in the United States and/or U.S. provinces. Please note, Brookhaven National Labs and the Cold Spring Harbor Lab are considered on-campus. All international students must enroll in one of the graduate student insurance plans and should be advised by an International Advisor.

Fall, Spring, 1-9 credits, S/U grading
May be repeated for credit.

BME 701: Dissertation Research off Campus - International

Prerequisite: Must be advanced to candidacy (G5). Major portion of research will take place outside of the United States and/or U.S. provinces. Domestic students have the option of the health plan and may also enroll in MEDEX. International students who are in their home country are not covered by mandatory health plan and must contact the Insurance Office for the insurance charge to be removed. International students who are not in their home country are charged for the mandatory health insurance. If they are to be covered by another insurance plan they must file a waiver be second week of classes. The charge will only be removed if other plan is deemed comparable.

All international students must received clearance from an International Advisor.
Fall, Spring, 1-9 credits, S/U grading
May be repeated for credit.

BME 800: BME RESEARCH

Full-time summer research.

S/U grading
May be repeated for credit.

BMI

Biomedical Informatics

BMI 501: Introduction to Biomedical Informatics

This course introduces the unique characteristics of clinical and life science data and the methods for representation and transformation of biomedical data, information, and knowledge to improve human health. The course will provide an overview of basic concepts and will serve as a Launchpad into other more focused courses that explore the computational and analytics needs of BMI, as well as the clinical, research and translational applications of informatics. There will be three major themes: Information representation, management and sharing: biomedical data representation and management; standards, terminologies, and ontologies such as HL7, IHE, SNOMED, ICD-9; Privacy, confidentiality and data sharing. Clinical Informatics: Health care environment and processes; electronic health records and management; clinical decision making clinical information retrieval clinical natural language processing. Imaging informatics: radiological image modalities; DICOM and PACS systems; computer-aided diagnosis; digital pathology; analytical pathology imaging. This course will provide hand-on assignments for the participants to familiarize the concepts. Prerequisite: Graduate standing in BMI or permission of instructor.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 502: Life Sciences for Biomedical Informatics

This course presents the fundamentals of human cell biology, biochemistry, genetics and cell/organ physiology. The biochemical and molecular bases of cell structure, energy metabolism, gene regulation, heredity, and development are discussed, as are the structure and function of cell membranes and the physiology of cell to cell signaling, cellular respiration, and homeostasis of organs and individuals. Can be used for credit toward masters or doctoral degree in BMI only with permission and NOT in addition to BMI 503. Can NOT be used for credit toward certificate in Biomedical Informatics.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 503: Computer Science for Biomedical Informatics

This course presents the fundamentals of computer science and problem solving for computer programming. Students learn how computers store and manipulate data using programming languages and algorithms and how computers are controlled by operating systems and networked. Software engineering, data abstractions, and database management systems are described. Applications include computer graphics and artificial intelligence. A theory of computing is presented. Approaches to devising solutions to problem are discussed. Structured programming tools are presented including sequential and decision logic and loops. Data and file operations are explained including processing arrays, sorting, stacks, queues, linked lists, and binary trees. Object-oriented programming and sequential file applications are discussed. Can be used for credit toward masters or doctoral degree in BMI only with permission and NOT in addition to BMI 502. Can NOT be used for credit toward certificate in Biomedical Informatics.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 511: Translational Bioinformatics

This course will provide students with an integrative computational toolbox at the intersection between Biomedical and Quantitative Sciences. Students will develop storage, analytic, and interpretive methods to optimize the transformation of large biomedical and genomic datasets, into proactive, predictive, preventive, and participatory health information. Applying a working knowledge of Computational Statistics in a Biomedical/Biomolecular context, students will gain the ability integrate those Computational Tools and Big Data resources in the Biomedical research enterprise as well as in the clinical workflow. Accordingly, this course will familiarize the participants with the data processing methodologies associated with a range of biological signals that spans from Biological sequences to Histology images, and from mining medical records to Genome Wide Association Studies (GWAS) and gene prioritization.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 512: Clinical Informatics

This course offers a comprehensive study of Clinical Informatics. It provides a holistic review of the health care delivery system both historically and presently. It presents Clinical Informatics and its legal and ethical issues, followed by an overview of Clinical Informatics. This includes data content and structures; nomenclatures and classification systems; quality, performance, utilization, and risk management; Clinical Informatics databases; and a review of statistics and research. Clinical informatics management principles and theories presented include change, project, and knowledge management. Aspects of human resources and financial management, including reimbursement methodologies are presented as these relate to Clinical Informatics.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 513: Imaging Informatics

Imaging Informatics is a multidisciplinary field which intersects Clinical Informatics, medical physics, engineering, computer and information sciences. It touches concepts across the whole imaging chain, including image creation and acquisition, image distribution and management, image storage and retrieval, image processing, analysis and understanding, image visualization and

interpretation. The goals of the course are to gain familiarity with the terminology, core concepts, and standard practices, understand the current state of the field and enable critical reading of the literature and to perform research. The course will cover both radiological imaging and pathology imaging. Topics include: radiological imaging modalities, DICOM standards, image management and PACS systems, image exchange and IHE, image processing techniques, content based image retrieval, structured reporting and annotations, image visualization, digital pathology and analytical pathology imaging. The course will also cover emerging technologies in Imaging Informatics.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 520: Data Analytics and Software Stacks

This course will cover cutting-edge data analytic applications, infrastructure, and analytic methods. Students will have the opportunity to analyze real (de-identified) healthcare datasets and spatio-temporal and molecular datasets drawn from cancer research. Each class session will include discussions of applications, infrastructure, and algorithms. Students will present papers, and there will also be guest lectures from visiting experts. Students will attend lectures, present and critique papers, and work with a team of students on a substantial project throughout the semester. Students are expected to demonstrate a high level of independence, critical thinking, and initiative.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 530: Software Development in Biomedical Informatics

This is an advanced topic in the BMI series, designed for participants with plans to develop Biomedical Informatics software applications. The BMI530 course is divided in two parts. The first part will provide an overview of approaches to software development in a Biomedical context, where reproducibility, governance and availability are particular concerns. The participants will be introduced, hands-on, to practices such as the use of version control services (such as GitHub), collaborative development models (such as agile programming, extreme programming, unit testing, continuous code review, pair programming etc) and software architectural patterns (such as Model-View-Controller, MVC, and Model-View-Adapter, MVA). The increasing reliance on Cloud Computing infrastructure and Web 3.0 technologies for both software development and deployment will be object of particular attention. The increasing reliance on Big Data resources in Biomedicine, and the broadening use of Web Computing will be approached as part of the exercise of configuring class projects for the second part of the course. Accordingly, a particular focus will be put on the use of Representation State Transfer (REST) architectures and hands-on familiarization with REST APIs (Application Programming Interfaces). The second part of the course will put these concepts into practice through the development of small software projects. Groups of one to three people per project development team will be configured to develop software that solves problems brought to the class by the participants, preferably, but not necessarily, as contributions to manuscripts and/or funded research. Prerequisite: BMI 503 and programming experience, BMI 520, or permission by instructor (face-to-face meeting required).

3 credits, Letter graded (A, A-, B+, etc.)

BMI 552: Quality Improvement Methods for Clinical Informatics

Teaches health care management professionals how to perform improvement projects and incorporate quantitative measurement into daily work routines to form the foundation for a quality improvement-oriented culture. Using Minitab software, provides strategies to gather and analyze the data needed to plan, implement, monitor, and evaluate health care quality improvement initiatives.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 560: Personalized Medicine

This course is focused on the multidisciplinary research and clinical context associated with the development of personalized health care delivery solutions. It will place particular emphasis on assessing opportunities identified by translational and operational research of the clinical settings that define the practical utility of personalized medicine. Accordingly, the clinical decision support systems (CDS)[JA1] being developed for clinical pharmacogenomics, specifically those that establish pharmacotyping in drug prescription, will play a central role in this course. Its content will cover innovative drug formulations and nanotheranostics, molecular imaging and signatures, medical genomics[JA2] , translational nanomedicine and informatics, stem cell therapy approaches, modeling and predictability of drug response, pharmacogenetics-guided drug prescription, pediatric drug dosing, pharmacovigilance and regulatory aspects, ethical and cost-effectiveness issues, pharmacogenomics knowledge bases, personal genome sequencing, molecular diagnostics, as well as information-based medicine.

3 credits, Letter graded (A, A-, B+, etc.)

BMI 590: Independent Study in Biomedical Informatics

Independent study in Biomedical Informatics. Must have the approval of the Research and Directed Study Committee of the Department of Biomedical Informatics prior to registration. Prerequisite: Graduate standing in BMI, or permission of instructor

1-3 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

BMI 591: Independent Reading in Biomedical Informatics

Supplementary specialized readings in Biomedical Informatics for graduate students under faculty supervision. Must have the approval of the Research and Directed Study Committee of the Department of Biomedical Informatics prior to registration.

1-3 credits, Letter graded (A, A-, B+, etc.)
May be repeated 1 times FOR credit.

BMI 592: Biomedical Informatics Masters Pre-Candidates Seminar

This course is designed to expose students to current research and other topics in Biomedical Informatics. Speakers are invited from both on and off campus.

1 credit, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

BMI 595: Special Topics in Biomedical Informatics

Examination of special topics in Biomedical Informatics,by one or more members of the faculty.

1-3 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

BMI 596: Special Problems in Biomedical Informatics

Examination of special problems in Biomedical Informatics, conducted jointly by graduate students and one or more members of the faculty.

1-6 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

BMI 692: Biomedical Informatics Candidates Seminar

This course is designed to expose students to current research and other topics in Biomedical Informatics. Speakers are invited from both on and off campus.

1 credit, Letter graded (A, A-, B+, etc.)

BMI 699: Dissertation Research-On Campus

Independent research conducted on campus under the supervision of a Biomedical Informatics faculty member in support of the Ph.D. Dissertation. Permission to register requires the agreement of the faculty member to supervise the research. May be repeated

1-12 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

BMI 700: Dissertation Research-Off Campus, Domestic

Independent research conducted off campus, in the United States, under the supervision of a Biomedical Informatics faculty member in support of the Ph.D. Dissertation. Permission to register requires the agreement of the faculty member to supervise the research. May be repeated

1-2 credits, Letter graded (A, A-, B+, etc.)
May be repeated 1 times FOR credit.

BMI 701: Dissertation Research-Off Campus, International

Independent research conducted off campus, outside the United States, under the supervision of a Biomedical Informatics faculty member in support of the Ph.D. Dissertation. Permission to register requires the agreement of the faculty member to supervise the research.

1-12 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

BNB

Neurobiology and Behavior

BNB 551: Writing Neuroscience

Seminar course for doctoral students in Neuroscience providing practical instruction in written communication in Neuroscience. Topics include writing effective abstracts, cover letters, figure captions, and grant specific aims, among others.

1 credit, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

BNB 552: Neurobiological Techniques

A series of laboratory exercises designed to give students hands-on experience in the basic laboratory techniques of contemporary neuroscience. Includes intracellular and extracellular recording, neuronal tissue culture, neuroanatomical techniques, and integrative physiology.

Fall, 2 credits, Letter graded (A, A-, B+, etc.)

BNB 555: Laboratory Rotations in Neuroscience

Course for doctoral students in Neuroscience in which students participate in three formal laboratory rotations in program faculty laboratories during the first year. Student make oral presentations for each rotation. Instruction is provided in how to organize and present material in a seminar format, including the proper use of visual aids. Enrollment restricted to students in the Graduate Program in Neuroscience.

Fall and Spring, 1-3 credits, Letter graded (A, A-, B+, etc.)
May be repeated 2 times FOR credit.

BNB 560: Introduction to Mammalian Neuroanatomy

This course consists of visual presentations and supplemental lectures providing an overview of the structural organization of the nervous system. The mammalian nervous system and its sensory, motor and cognitive components are emphasized. Opportunities for examination of whole brains and historical sections, and some hands-on experience with basic neuroanatomical techniques may also be available.

1 credit, Letter graded (A, A-, B+, etc.)

BNB 561: Introduction to Neuroscience I

First of a two semester core course introducing students to basic principles of neuroscience. The major focus is cellular and molecular neurosicence. Topics covered include the ionic basis of resting potentials and electrical excitability, the structure, function and molecular biology of voltage- and ligand-gated ion channels, exocytosis, cellular networks, and gene regulation.

4 credits, Letter graded (A, A-, B+, etc.)

BNB 562: Introduction to Neuroscience II

Second of two-semester core course introducing students to basic principles of neuroscience. The major focus is systems neuroscience. Topics covered include analyses of all major sensory systems, motor systems, and systems mediating higher order, cognitive functions in the nervous system.

4 credits, Letter graded (A, A-, B+, etc.)

BNB 563: Advanced Topics in Neuroscience: Individual Learning Plans

In this 12 hour module course, students will work with an identified faculty preceptor on an agreed upon topic of interest. Agreement of preceptor and an outline of the topic must be submitted to and approved by the Course Director in order for students to register for this class. Students and preceptors will work together to develop a reading list (minimum 6-10 papers) from the primary literature that adequately covers the topic. Students will present two or more of these papers in journal club format to the preceptor and to a larger group, e.g., a lab group, as applicable. Students will also synthesize their readings into a written report that follows one of the following Nature Reviews Neuroscience formats (below, but strict adherence to word limits, reference numbers, etc., is NOT expected). NOTE: Students and their research faculty mentors are strongly encouraged to consider using this as a vehicle for beginning to develop the Introduction to the thesis/thesis proposal. Offered:

Fall, 1 credit, Letter graded (A, A-, B+, etc.)
May be repeated 2 times FOR credit.

BNB 564: Advanced Topics in Neuroscience: Curriculum Development

In this 12 hour module course, students will work with an identified faculty preceptor on an agreed upon topic of interest that addresses a gap in the current Graduate Program in Neuroscience curriculum. Agreement of preceptor and an outline of the topic selected must be submitted to and approved by the Course Director in order for students to register for this class. Students and preceptors will work together to develop a course based on the selected topic. Students will first investigate principles of curricular design. They will follow these in generating a course description, a list of overall learning objectives, and a detailed syllabus that identifies the titles, learning objectives and required background readings for each of the course#s sessions. Required readings much include both texts and the primary literature. Students will also generate the in-class materials for at least two class sessions. One must be a Powerpoint for a standard lecture, and one must be any materials needed for some form of active learning (individual or group) of the material. Finally, students must identify the means that students will be evaluated, and identify how these methods will demonstrate achievement of the stated learning objectives, keeping in mind that the form of evaluation will differ depending on whether objectives are related to knowledge, skills, etc. NOTE: Students and their research faculty mentors are strongly encouraged to consider using this as a vehicle for delving deeply into a topic or technique of interest that is relevant to the thesis/thesis proposal. Offered:

Fall, 1 credit, Letter graded (A, A-, B+, etc.)
May be repeated for credit.