BIOCHEMISTRY AND MOLECULAR BIOLOGY (BMB)

BMB 5000 Cancer Biology I: Introduction to Cancer Biology: Molecular, Cellular and Genetic Basis of Cancer (3 Credits)
J. Hawse, M. Fernandez-Zapico (Fall) – This course will provide an introductory foundation for understanding cancer biology through the discussion of normal and abnormal tissue pathology, and the molecular, cellular and genetic mechanisms that contribute to tumorigenesis. Topics that will be covered in the course include: the histopathology of cancer, tumor initiation and promotion, oncogenes and tumor suppressors, cell cycle control, cell migration and angiogenesis. In addition, several lectures will focus on the cellular, molecular and genetic approaches to study cancer in vitro and in animal models.
Grading: Standard Letter, Test-Out/Waivers

BMB 5100 Chemical Principles of Biopolymer Systems (2 Credits)
J. Maher, S. Schellenberg (Fall) – An introduction to the fundamental principles of biomacromolecular structure and function, including nucleic acids, and proteins. The course also provides a survey of methods of structure determination and analysis, principles of enzyme catalysis and kinetics. Prerequisites for this course is MGS 5030. Standard requirements for two years of college chemistry (including organic chemistry), one year of biology, one year of physics, and one year of calculus. An undergraduate course in biochemistry is highly recommended.
Prerequisites: (MGS 5030, or MGS 5031, or FNDN 7120)
Grading: Standard Letter, Test-Out/Waivers

BMB 5150 Molecular Cell Biology (2 Credits)
G. Razidlo (Winter) - This class is designed to convey the central principles of how eukaryotic cells function at the structural and biochemical level. Organized around major questions in cell biology, the goal is to identify and approach unanswered questions, with an emphasis of topics on: the cytoskeleton, extracellular matrix and cell-cell interactions, protein transport in the secretory and endocytic pathways, cell signaling, cellular energetics, and cell cycle, mitosis, programmed cell death. The course format utilizes didactic lectures combined with student discussions and presentations.
Prerequisites: MGS 5030, or MGS 5031
Grading: Standard Letter, Test-Out/Waivers

BMB 5200 Biochemistry and Molecular Biology Works in Progress (1 Credit)
Works-in-Progress presentations on experimental research projects, given by graduate students in the Biochemistry and Molecular Biology tracks. Register in fall quarter only (1 cr./yr.). Attendance required fall, winter and spring. At least 70% attendance is required. Students present annually after year 1.
Grading: Sat / Unsat

BMB 5350 Hormones and Cancer (1 Credit)
J. Hawse (Odd: Spring) – This course is a didactic class design to give the student an overview of hormonal carcinogenesis. The malignancies to be covered include breast cancer, prostate cancer, endometrial cancer, ovarian cancer, and thyroid cancer. The course will review epidemiology, signaling pathways, the role of hormones, and novel therapeutic approaches of the mentioned cancers.
Grading: Sat / Unsat

BMB 5450 Genomics and Functional Genomics (3 Credits)
P. Harris, X. Xu (Winter) - We provide an overview of the present state of genomic and other 'omics capabilities and how we can use them to understand human disease. In addition, we highlight diseases where genetics is the defining feature or where genetic variants play a significant role, and how we can determine the causes and risk factors for these diseases. The functional genomics portion considers how we can employ model systems from cells, through organoids, to in vivo models from nematode worm to pigs to study human disease; specifically, how genes and gene variants play in role in disease pathogenesis. Finally, we describe new, molecular approaches to treating human genetic diseases.
Grading: Standard Letter

BMB 5520 Biology of Aging (2 Credits)
D. Baker, J. Passos (Winter) – Studying the mechanisms underlying the process of aging promises to be one of the next great frontiers in biomedical science. Understanding the biology of aging is important not only for the long-term possibility of increasing life span, but for the more immediate benefits it will have on age-related diseases. As demographics of industrialized countries have changed, age-related diseases such as cancer, cardiovascular disease, stroke, osteoporosis, arthritis, and Alzheimer's disease have assumed epidemic proportions. A thorough understanding of the aging process is an important pre-requisite for designing rational therapeutic interventions for the treatment of these age-related disorders. We will focus on examining the biology of aging primarily through the examination of studies of a molecular, cellular, genetic, and demographic nature. Topics will include: Genomic Instability, Telomere Attrition, Epigenetic Alterations, Proteostasis Deficiency, Deregulated Nutrient Sensing, Mitochondrial Dysfunction, Cellular Senescence, Stem Cell Exhaustion, Epigenetics and reprogramming.
Grading: Standard Letter

BMB 5660 Epigenomics Journal Club (1 Credit)
A. Gaspar Maia (993: Fall, Winter, Spring) – Epigenetics, and its genome-wide applications, are rapidly emerging disciplines, seeking to define how genomes are regulated to give rise to distinct normal and diseased phenotypes. Students will gain a better understanding of Epigenomics concepts and methodologies through discussions of relevant reviews and original articles. The course covers scientific advances in DNA methylation, histone modifications, chromatin dynamics, and regulatory RNA molecules.
Grading: Sat / Unsat

BMB 6070 Cancer Biology II: Molecular Mechanisms of Cancer: Signal Transduction Pathways and Networks (3 Credits)
J. Hawse, M. Fernandez- Zapico (Even: Winter) – This course will provide a basic CORE of information on the molecular mechanisms through which cells receive and respond to external signals in the normal state, while highlighting how dysregulation of these signaling pathways contributes to tumorigenesis. Emphasis will be on the principles of cell signaling through specific cell surface receptors or within specific signaling networks. In addition, the molecular, genetic and biochemical strategies by which cell signaling pathways are being elucidated will be discussed. Topics to be covered include: the regulation of cell signaling pathways through cell surface receptors and hormone receptors, intracellular kinases and GTP-binding proteins, NF-kB, apoptosis, and DNA damage signaling.
Prerequisites: BMB 5000
Grading: Standard Letter

BMB 6100 Macromolecular Structure and Dynamics (2 Credits)
M. Shellenberg, G. Mer (Even: Winter) – This course will cover the principles and methods used to analyze and define the structure and dynamic motion of biological macromolecules that drive the cellular processes essential for life. Topics covered will include NMR spectroscopy, X-ray crystallography, Cryo-EM, and other solution-based structure analysis techniques.
Prerequisites: (BMB 5100, or CORE 6100)
Grading: Standard Letter

BMB 6175 Principles and Applications of X-ray Crystallography (3 Credits)
M. Schellenberg (Odd: Winter) - Lectures and discussion sessions will cover the principles and methods of macromolecule structure determination using X-ray crystallography. Topics covered will include protein crystallization, properties of crystals, X-ray diffraction, structure determination and analysis of crystal structures with an emphasis of validation and interpretation of crystals structures as they relate to biological systems. Lectures will be paired with discussion of literature examples and data processing workshops to emphasize learned material.
Prerequisites: (BMB 5100, or CORE 6100, or MGS 5030)
Grading: Standard Letter

BMB 6315 Metabolism Interest Group (1 Credit)
E. Kostallari (993: Fall, Winter, Spring) – This interactive course will take place through a presentation including a 20-minute project presentation and a 40-minute paper presentation. This course will help students develop their presentation skills and analyze the importance of a given paper in the field of metabolism.
Grading: Standard Letter

BMB 6390 Independent Study in Biochemistry and Molecular Biology (1-3 Credits)
J. Hawse (Fall, Winter, Spring, Summer) – Tutorials arranged on an individual basis in selected advanced topics in biochemistry and molecular biology. Students are expected to define a topic and specific reading list in consultation with a member of the faculty. Mastery of the subject matter is assessed by examination or by submission of a formal review of the subject area.
Grading: Sat / Unsat

BMB 6500 Biochemistry and Molecular Biology Journal Club (1 Credit)
J. Hawse (993: Fall, Winter, Spring) – Students of the Biochemistry and Molecular Biology program present a peer review article relevant to BMB, in some cases associated with the research of the seminar speaker coming the following week. Register in fall quarter only (1 cr. /yr.; total of 4 cr.). Attendance required fall, winter and spring at the journal club and the associated BMB Seminar. At least 70% attendance is required at both the journal club and seminar.
Grading: Sat / Unsat

BMB 6510 Cancer Biology Journal Club (1 Credit)
M. Fernandez-Zapico, J. Hawse (Fall) – This journal club will discuss current primary literature covering all aspects of cancer biology. The journal club will meet once per week and be conducted under the open discussion format with directed student and faculty presentations. During the fall quarter, journal articles of fundamental and historic interest in the area of cancer biology will be read and discussed. Topics to be covered include: cell cycle, oncogenes, tumor suppressors, growth factors, signal transduction, metastasis, DNA tumor viruses, and retroviruses.
Grading: Sat / Unsat

BMB 6515 Musculoskeletal Journal Club (1 Credit)
J. Westendorf (993: Fall, Winter, Spring) – Graduate students, postdoctoral fellows and residents present peer-reviewed articles that describe new and high impact work in musculoskeletal research fields. MCGSBS students from any track or program are welcome to attend and lead discussions in this interdisciplinary forum that spans molecular and cellular biology, biomechanics, endocrinology, orthopedics, osteoimmunology, physiology, and other disciplines. This is a shared course with the Biomedical Engineering and Physiology and track. Attendance required in consecutive fall, winter and spring quarters. Students must present and lead one discussion during one of the quarters and attend 75% of meetings over all three quarters to earn credit.
Grading: Sat / Unsat

BMB 6520 Current Topics in Aging Research (1 Credit)
D. Monroe (993: Fall, Winter, Spring) – Current topics in aging research utilizes the Kogod Center's "Aging Mondays" to expose students to a range of topics related to the basic biology of aging presented in four concurrent series: journal club, works-in-progress, NERDs and seminars presented by an international group of seminar speakers. Each series meets at noon on a different Monday of the month. There are no course prerequisites, but attendance requires preapproval by the course director. Presentation at the Aging JC or WIP during the quarter is required for credit.
Grading: Sat / Unsat

BMB 6660 Transcription, Chromatin, and Epigenetics (2 Credits)
K. Robertson, T. Ordog (Even: Fall) – This course will cover in depth mechanisms of transcriptional regulation within a modern conceptual framework focused on epigenetics. Topics will include chromatin structure and dynamics, nuclear structure and nuclear domains, and chromosomal territories. The application of epigenetics to human development and diseases will be discussed.
Prerequisites: (BMB 5100, or CORE 6100), and (BMB 5150, or CORE 6250)
Grading: Standard Letter

BMB 6665 Principles of Nucleic Acids Biochemistry (3 Credits)
J. Maher (Even: Winter) – The three objectives of this tutorial are 1) to familiarize advanced graduate students with biochemical and biophysical principles of nucleic acids and their interactions with proteins; 2) to introduce molecular viewing tools to facilitate atomic-level understanding of macromolecular structure, and 3) to apply these principles and tools to current biological problems and processes involving nucleic acids.
Prerequisites: MGS 5030
Grading: Standard Letter

BMB 6700 Metabolism and Metabolomics (3 Credits)
D. Povero, B. Fernandez Gil (Odd: Spring) – The Metabolism and Metabolomics course is a didactic experience designed to develop learners' intellectual abilities on human metabolic pathways, their cellular regulation in health and disease and tools and approaches used to investigate metabolic pathways and to analyze metabolomics data. The course will cover metabolism of carbohydrates, lipids, amino acids and nucleotides, their regulation by hormones, nutritional status, cellular stress, immune system and carcinogenesis. Learners will also have an opportunity to develop skills on the current tools and approaches to study metabolism systemically and at the cellular level. Through a diverse learning experience which includes lectures, discussions, pop-up questions, learning-based assessments, and shark-tank style presentations, this course will help learners answer the following questions: 1) what are the metabolic pathways; 2) how, when and why metabolic pathways are regulated? 3) what are the tools and approaches to study metabolism in cells and organ-systems? 4) how do we analyze and interpret metabolomics data? 5) how could we exploit metabolic pathways to identify novel therapeutic strategies for human diseases?
Grading: Standard Letter

BMB 6900 Biochemistry and Molecular Biology Thesis Proposal (2 Credits)
TBA (Fall, Winter, Spring, Summer) – Thesis proposal: The written thesis proposal matches the new format of NIH R01 grants and, hence, is limited to 8 pages, including illustrations but not including references. In the student's own words, the proposal should outline the rationale for the proposed project and how it is to be executed. The proposal is subdivided into the following sections: Abstract: Summary of your project (1 page). Specific Aims: Describe briefly the aims of your project and hypotheses (1 page). Research Strategy: This includes "Significance" - put your project into context with what is known about this area of biology and show the importance of the questions you are asking (~ 1-1.5 pages), "Innovation" - how is the project you are proposing novel and groundbreaking (~0.5-1 page) and "Approach" - describe what you plan to do and how you plan to do it. Include preliminary data for each aim that sets the scene and supports your hypotheses (3.5-4.5 pages). Register for course credit the quarter AFTER you have prepared your proposal and taken the oral exam. Submit note signed by your committee to the course director indicating that your thesis proposal was satisfactory.
Grading: Sat / Unsat