BIOCHEMISTRY AND MOLECULAR BIOLOGY

BCH 5205 Medical Metabolism 3 Credits
Grading Scheme: Letter Grade
Metabolism will be taught in the context of medical situations. Lecture material will cover basic concepts in carbohydrate, lipid, and nitrogen metabolism. Students will enhance their understanding of human metabolism by applying their knowledge to the analysis and discussion of clinical case studies and primary literature with the metabolism field.
Prerequisite: One undergraduate biochemistry course or BCH 5024.

BCH 5404 Fundamentals of Biochemistry & Molecular Biology 4 Credits
Grading Scheme: Letter Grade
A survey of the structure, function, and metabolism of amino acids, proteins, carbohydrates, lipids, and nucleic acids and an introduction to concepts in cell structure, replication, growth, and metabolic regulation.
Prerequisite: (CHM 2210 & CHM 2211) or (CHM 2212 & CHM 2213).

BCH 5413 Mammalian Molecular Biology and Genetics 3 Credits
Grading Scheme: Letter Grade
Biochemical and genetic approaches to understanding vertebrate and particularly mammalian molecular biology, moving from basic processes of replication, transcription, and protein synthesis to signal transduction, cell cycle, cancer, genomics, and developmental genetics.
Prerequisite: BCH 3025, 4014, CHM 3218, 4207, MCB 4303, or PCB 3063 or consent of instructor.

BCH 6040 Research Discussion in Biochemistry and Molecular Biology 1 Credit
Grading Scheme: S/U
Current research in biochemistry and molecular biology will be presented by departmental faculty and invited speakers.
Prerequisite: Required as students in Biochemistry and Molecular Biology. Open to students in other fields with permission of the instructor.

BCH 6206 Advanced Metabolism 3 Credits
Grading Scheme: Letter Grade
Reactions of intermediary metabolism, emphasizing their integrations, mechanisms, and control. Extensive examples from current literature.
Prerequisite: BCH 4024, CHM 4207, or consent of instructor. One of three core biochemistry courses.

BCH 6207 Advanced Metabolism: Role of Membranes in Signal Transduction and Metabolic Control 1 Credit
Grading Scheme: Letter Grade
Fundamentals of membrane biochemistry. Discussions of membrane structure, nutrient and ion transport, protein targeting, and signal transduction. Experimental methods and techniques used to gather and analyze data related to membrane biochemistry and its regulation.
Prerequisite: BCH 3025, 4024, CHM 3218, 4207, GMS 6001, or consent of instructor.

BCH 6208 Advanced Metabolism: Regulation of Key Reactions in Carbohydrate and Lipid Metabolism 1 Credit
Grading Scheme: Letter Grade
Key reactions in metabolic pathways of carbohydrate and lipid metabolism. Explores the experimental basis for current understanding of these processes. Understanding the interactions between major metabolic pathways and control of these pathways under different physiological conditions.
Prerequisite: BCH 3025, 4024, CHM 3218, 4207, GMS 6001, or consent of instructor.

BCH 6209 Advanced Metabolism: Regulation of Key Reactions in Amino Acid and Nucleotide Metabolism 1 Credit
Grading Scheme: Letter Grade
Understanding interactions among major metabolic pathways and control of these pathways under different physiological conditions. Structural basis of enzyme function and regulation.
Prerequisite: BCH 3025, 4024, CHM 3218, 4207, GMS 6001, or consent of instructor.

BCH 6415 Advanced Molecular and Cell Biology 3 Credits
Grading Scheme: Letter Grade
Molecular biology of pro- and eukaryotic organisms. Emphasizes understanding the experimental approaches that led to recent developments. Chromosome structure and organization, advances in recombinant DNA technology, DNA replication, RNA transcription and protein synthesis, and selected aspects of molecular regulation of gene expression.
Prerequisite: BCH 4024, CHM 4207, MCB 4303, or consent of instructor. PCB 3063 or a similar course in genetics recommended. One of three core biochemistry courses.

BCH 6740 Physical Biochemistry/Structural Biology 3 Credits
Grading Scheme: Letter Grade
Physical chemistry of biological molecules and techniques to study their properties. Approaches to structure determination.
Prerequisite: BCH 4024, CHM 4207, or consent of instructor. Course in physical chemistry recommended. One of three core biochemistry courses.

BCH 6741C Magnetic Resonance Imaging and Spectroscopy in Living Systems 3 Credits
Grading Scheme: Letter Grade
MR imaging methods used to study the structure of cells, tissues, and whole animals. MR spectroscopy methods for monitoring biochemistry in living animals. Preparing samples, operating the instruments, and analyzing the data.
Prerequisite: Students should have completed courses in chemistry and physics, or the equivalent. The course uses calculus throughout so students should have completed a course in calculus or the equivalent. No experience with electronics is required.

BCH 6744 Molecular Structure Determination by X-ray Crystallography 1 Credit
Grading Scheme: Letter Grade
Detailed theoretical and practical instruction on technique of x-ray crystallography used for three-dimensional structure determination of macromolecules in studies aimed at structure-function elucidation.
Prerequisite: BCH 6740 or equivalent or consent of instructor.

BCH 6744L Molecular Structure Determination by X-Ray Crystallography Laboratory 1 Credit
Grading Scheme: Letter Grade
Complement to BCH 744 lectures. Practical experience in sample preparation, operation of instrumentation, data acquisition analysis, phasing and refinement. Hands-on approach reinforces applicability of this methodology in analysis of functional properties of biological macromolecule.
Prerequisite: or coreq: BCH 6744: Molecular Structure Determination by X-ray Crystallography . ;
Corequisite: Coreq:

BCH 6745 Molecular Structure and Dynamics of NMR Spectroscopy 1 Credit
Grading Scheme: Letter Grade
Theoretical and practical introduction to macromolecular NMR spectroscopy. Basics of multidimensional NMR for structure and dynamics measurements. Hands-on training in modern NMR.
Prerequisite: BCH 6740 or equivalent or consent of instructor.

BCH 6745L Molecular Structure and Dynamics by NMR Spectroscopy Laboratory 1 Credit
Grading Scheme: Letter Grade
Complement to BCH 6745 lectures. Emphasizes practical applications of molecular structure and dynamics determination. Extensive use of computer software packages. Training in modern NMR instrumentation, data processing, and data analysis. Completed training sufficient for use of NMR instrumentation in Advanced Magnetic Resonance Imaging and Spectroscopy facility.
Prerequisite: or coreq: BCH 6745.
Corequisite: undefined

BCH 6746 Structural Biology: Macromolecular Structure Determination 1 Credit
Grading Scheme: Letter Grade
Experimental approaches to biological macromolecular structure determination. Emphasizes current understanding of protein-protein and protein-nucleic acid structure motifs.
Prerequisite: BCH 3025, 4024, CHM 3218, 4207, GMS 6001 or consent of instructor.

BCH 6747 Structural Biology/Advanced Physical Biochemistry: Spectroscopy and Hydrodynamics 1 Credit
Grading Scheme: Letter Grade
Applying spectroscopic techniques (circular dichroism, fluorescence, nuclear magnetic resonance) to determine the structure of biological macromolecules. Hydrodynamic approaches including light scattering, molecular diffusion, viscosity, and ultracentrifugation.
Prerequisite: BCH 3025, 4024, CHM 3218, 4207, GMS 6001, or consent of instructor.

BCH 6749C Numerical Methods in Structural Biology 1 Credit
Grading Scheme: Letter Grade
Introduction to mathematical and computational methods needed to understand current structural models, biophysical processes, data acquisition methods, and analysis of data acquired with current techniques.
Prerequisite: BCH 6740 or equivalent or consent of instructor.

BCH 6876 Recent Advances in Membrane Biology 1 Credit
Grading Scheme: S/U
Literature presented by students and faculty, discussed in depth. Emphasizes current developments, data, interpretation, and critical analysis.
Prerequisite: general biochemistry or consent of instructor.

BCH 6877 Recent Advances in Structural Biology 1 Credit, Max 8 Credits
Grading Scheme: S/U
Literature on structural biology presented by students and faculty, discussed in depth. Current developments, data interpretation, and critical analysis.
Prerequisite: general biochemistry or consent of instructor.

BCH 6905 Independent Studies in Biochemistry and Molecular Biology 1-5 Credits, Max 12 Credits
Grading Scheme: Letter Grade
Individual literature-based or experimental research problem.
Prerequisite: permission of instructor.

BCH 6906 Readings in Medical Biochemistry & Molecular Biology 1 Credit
Grading Scheme: Letter Grade
A one (1) credit online course in which primary literature articles in medical biochemistry and molecular biology will be assigned for reading and discussion. Homework questions and discussion board post will be used to determine student mastery of the material
Prerequisite: This course is only for students enrolled in the online certificate program.

BCH 6910 Supervised Research 1-5 Credits, Max 5 Credits
Grading Scheme: S/U
Supervised Research
Prerequisite: consent of instructor.

BCH 6936 Biochemistry Seminar 1 Credit, Max 20 Credits
Grading Scheme: Letter Grade
Research reports and discussions of current research literature given by graduate students, departmental faculty, and invited speakers.
Prerequisite: required of graduate students in biochemistry; open to others by special arrangement.

BCH 6971 Research for Master's Thesis 1-15 Credits
Grading Scheme: S/U
Research for Master's Thesis
Prerequisite: consent of instructor.

BCH 7410 Advanced Gene Regulation 1 Credit, Max 3 Credits
Grading Scheme: Letter Grade
Literature-based assessment of the most recent advances in factors governing eukaryotic gene regulation.
Prerequisite: GMS 6001 or consent of instructor.

BCH 7412 Epigenetics of Human Disease and Development 1 Credit
Grading Scheme: Letter Grade
BCH 6415 recommended. In-depth assessment of epigenetic mechanisms of mammalian gene regulation: DNA methylation, histone modifications, genomic imprinting, inherited genetic diseases, viral gene regulation, and epigenetic reprogramming in embryonic stem cells and cloning.
Prerequisite: GMS 6001.

BCH 7515 Structural Biology/Advanced Physical Biochemistry: Kinetics and Thermodynamics 1 Credit
Grading Scheme: Letter Grade
Fundamentals of chemical kinetics and thermodynamic analysis of equilibria. Emphasizes applying this knowledge to understand basic enzyme kinetics, pulse-chase kinetics, protein polymerization, DNA dynamics, protein-nucleic acid interactions, and cooperative ligand binding.
Prerequisite: BCH 4024, CHM 3218, 4207, GMS 6001, or consent of instructor.

GMS 5905 Special Topics in Biomedical Sciences 1-4 Credits, Max 4 Credits
Grading Scheme: Letter Grade
Analysis and discussion of contemporary topics and the development of biomedical sciences.