PH.120 (BIOCHEMISTRY AND MOLECULAR BIOLOGY)

Courses

Course location and modality is found on the BSPH website (https://publichealth.jhu.edu/courses/).

PH.120.600. Biochemistry I: Protein Structure and Enzyme Catalysis. 3 Credits.
Covers the physical and chemical properties of the amino acids, the various elements of protein structure, and the cooperative behavior of multimeric proteins. Explore the kinetics of enzyme-catalyzed reactions, and the active site mechanisms of representative classes of enzymes. Describes the molecular basis of action for selected enzyme inhibitor-based drugs.

PH.120.601. Biochemistry II: Major Metabolic Pathways. 5 Credits.
Examines the major metabolic pathways that are central to eukaryotic cell growth and maintenance.

PH.120.602. Concepts of Molecular Biology. 4 Credits.
Discusses synthesis of macromolecules, the genetic code, regulation of gene expression and gene function, and recent advances in biotechnology.

PH.120.603. Molecular Biology of Pandemic Influenza. 3 Credits.
Explores how molecular biology is used to understand how specific respiratory viruses create pandemics. Begins with an analysis of the virus that caused the great public health catastrophe, the 1918 Spanish Influenza Pandemic and then examines more recent pandemic viruses, including SARS-Cov-2. Focuses on the use of molecular techniques in defining why specific mutations increase the virulence and pandemic potential of a virus, the pathological response of a host's immune system to a virulent virus and pathological interactions between two different respiratory pathogens. Emphasizes how molecular, pathophysiological and immunological studies may be used to predict a virus' pandemic potential. Reviews how governmental responses affect the spread of a disease with pandemic potential, including the response to SARS-CoV-2.

PH.120.604. Introduction to Molecular Biology. 3 Credits.
Molecular biology deals with how nucleic acids and proteins interact within the cell to promote proper growth, division, and development. This course will provide an overview of these processes, including DNA replication, repair, transcription, splicing, protein synthesis, and gene regulation in different organisms. We will also explore many biological tools that have been developed from molecular biology processes, such as DNA sequencing and gene editing (CRISPR-Cas9).

PH.120.605. Genome Integrity. 3 Credits.
Provides students with a broad base in fundamental principles of genome integrity. Examines connections between genome integrity, organism fitness, and human diseases and disorders. Addresses 1) Homologous recombination, (2) Non-homologous end joining, (3) Mismatch repair, (4) Transposable elements, (5) Topoisomerases, (6) Structural maintenance of chromosomes and (7) Chromosome segregation.

PH.120.606. Cellular Stress in Physiology and Disease. 3 Credits.
Discuss molecular mechanisms through which eukaryotes maintain cellular homeostasis in response to stress. Stress response pathways are examined at the DNA, RNA, and protein levels; topics include stress and transcription, RNA processing, and protein quality control. Organelle-specific stress response, such as ER stress and mitochondrion stress responses, are also discussed. Additionally, molecular mechanisms of cellular responses to environmental stimuli, such as heat, hypoxic, oxidative, and starvation stressors, are examined.

PH.120.607. Premedical Seminars: Planning and Preparing for Medical School Application. 1 Credit.
Helps students prepare to apply to medical school. Covers specific topics to address the complex premedical journey, including planning the months/years leading up to the application, reviewing the application process, addressing the medical schools' expectations, medical school selection, writing the personal statement, requesting letters of evaluation, interviewing and more.

PH.120.608. Gene Editing, Therapy and Manipulation. 3 Credits.
Introduces genes and genetics, and their role in the genetic basis of human health and disease. Explores the current status of gene editing and gene therapy technologies both in the context of therapeutics and as tools in the life sciences. A large focus of the class centers on the impact of CRISPR on these technologies. Discuss the ethical implications of these technologies.

PH.120.609. Aspiring Physicians Enacting Change through Community Engagement: Introduction. 1 Credit.
Offers a unique opportunity to immerse yourself in an environment with multiple opportunities to promote health, science, and education in Baltimore. Covers a wide range of topics through seminars in close collaboration with Baltimore community organizations. Supports students in honing their core competencies that medical schools are looking for, including the following categories: (1) interpersonal, (2) intrapersonal, (3) thinking and reasoning, and (4) science. Supports premedical students but is designed for any student interested in promoting health, science, and education. Includes a seminar and an optional practicum component.

PH.120.610. Biochemistry I: Protein Structure and Enzyme Catalysis. 3 Credits.
Covers the physical and chemical properties of the amino acids, the various elements of protein structure, and the cooperative behavior of multimeric proteins. Explore the kinetics of enzyme-catalyzed reactions, and the active site mechanisms of representative classes of enzymes. Describes the molecular basis of action for selected enzyme inhibitor-based drugs.

PH.120.611. Aspiring Physicians Enacting Change through Community Engagement. 1 Credit.
Offers a unique opportunity to immerse yourself in an environment with multiple opportunities to promote health, science, and education in Baltimore. Covers a wide range of topics through seminars in close collaboration with Baltimore community organizations. Supports students in honing their core competencies that medical schools are looking for, including the following categories: (1) interpersonal, (2) intrapersonal, (3) thinking and reasoning, and (4) science. Supports premedical students but is designed for any student interested in promoting health, science, and education. Includes a seminar and an optional practicum component.

PH.120.612. The Chemical Biology of Drugs that Shape Public Health. 3 Credits.

PH.120.613. Nucleic Acid Chemistry. 3 Credits.
Discusses nucleic acid structure, and also describes techniques for manipulating and analyzing nucleic acids, including gel electrophoresis, PCR, and DNA sequencing. Reviews methods used to synthesize nucleosides, nucleotides and oligonucleotides, and chemical reactions that lead to modifications of nucleic acids. Covers topics including DNA-drug interactions, antisense and antigene oligonucleotides, ribozymes and deoxyribozymes, DNA cages, DNA origami, DNA nanostructures, and DNA nanodevices.

PH.120.614. Genetic Engineering for the Public's Health. 3 Credits.
Explores both the justice issues that underlie the application of cell and gene engineering to populations that would benefit, and the science behind how these cures are developed and subsequently delivered to a health care system. Includes an overview of the current technologies that have led to curative interventions for sickle cell disease and engineered immune cells for malignancy, the regulatory and financial issues that the drive cost of these advanced therapies, and the social justice issues of equitable access. Encourages students to synthesize these broad concepts and to propose new solutions that impact public health.

PH.120.615. Navigating Biomedical Career Paths. 1 Credit.

PH.120.616. Advanced Concepts in Biochemistry, Cell and Molecular Biology. 1 Credit.
Provides a platform for students, postdoctoral fellows and faculty to present and discuss scientific papers from the current literature that deal with mechanisms underlying disease along with accompanying methods. Explores additional aspects that are relevant to conducting and conveying laboratory research, including study design and statistical analysis, manuscript and grant review, policy and practice, and risk assessment.

PH.120.620. Fundamentals of Reproductive Biology. 3 Credits.

PH.120.622. Molecular and Cellular Mechanisms of Reproduction. 4 Credits.

PH.120.624. Cancer Biology. 3 Credits.
Explores some of the key molecular and cellular aspects of the biology of cancer. Includes topics: cancer genetics, DNA damage, and cell signaling pathways including RAS and Epidermal Growth Factor Receptors. Covers a select set of current research areas that aim to further the understanding and treatment of cancer. Emphasizes how these molecular mechanisms are regulated, contribute to oncogenesis, and can be targeted therapeutically.

PH.120.625. Introduction to Cancer Biology. 3 Credits.
This Cancer Biology course will educate students on the principles of cancer biology, including the various genetic and molecular changes normal cells undergo during transformation into malignant cancer cells. To this end, this course will help students to gain an understanding of cellular and molecular mechanisms that go awry, thereby providing optimal conditions for cancer. We will explore the role of mutations in cancer cells, and how they lead to the dysregulation of essential biological properties like programmed cell death, cell proliferation and differentiation. We will also focus on the interface of cancer and medicine. Classical treatment methods will be compared with newer treatment strategies like targeted therapies. We will also explore the challenges associated with diagnosing cancers, as well as ways in which to prevent cancer.

PH.120.626. Principles of Cell Biology. 3 Credits.
Provides students with a basic understanding of the structure and functions of eukaryotic cells. Introduces students to new facts and vocabulary pertinent to cell biology, as well as experimental methods used by scientists to define and understand cell structure and functions. Highlights relationships between defects in basic cell functions and human diseases. Classroom time is divided into 8 formal lecture sessions, 3 less formal review/discussion/problem solving sessions, and 3 closed-book, in-class exams.

PH.120.627. Stem Cells and the Biology of Aging and Disease. 3 Credits.
Exposes students to cutting-edge topics in stem cell biology through a combination of lectures and discussions based on primary literature. Topics include basic stem cell biology in a invertebrate and vertebrate systems, including germline, neural, and epithelial stem cells; the regulation of stem cells by physiology and aging; the connection between stem cells, telomerase, and cancer; and ethical issues pertaining to potential therapeutic applications of stem cells.

PH.120.630. Fellowship Grant Writing for Students and Postdoctoral Fellows in Biomedical Research. 2 Credits.
Provides students and postdoc trainees with an overview of the entire fellowship application process, including how to write an effective research proposal and specific aims, how to prepare a NIH style biosketch and how to formulate an effective personal biography. Discusses the peer review process, how fellowship applications are judged and scored. The students and postdocs will gather to form an in-class study section where trainees have the opportunity to review grants in the style of NIH study sections.

PH.120.644. BMB SCM Laboratory Rotations. 4 - 8 Credits.
All departmental ScM students spend one to three terms, respectively, participating in the research activities of departmental faculty's laboratories. Students select appropriate rotations in consultation with their academic advisor and the ScM Program Director. The objective is to provide the opportunity for interaction with several faculty members, so that a thesis laboratory may be identified. The course aims to broaden a student's knowledge of laboratory techniques and skills, expose the student to a variety of research areas and to develop the ability to carry out a research project.

PH.120.820. Thesis Research Biochemistry. 1 - 22 Credits.
Research BMB PhD and 2nd year ScM students

PH.120.821. BMB MHS Laboratory Research. 3 - 8 Credits.
Acquaints MHS students with basic research in the biomedical sciences through work under the guidance of a faculty member in the Department of Biochemistry and Molecular Biology, and provides an introduction to hands-on experience in laboratory research.

PH.120.822. Seminars in Research in Biochemistry and Molecular Biology. 1 Credit.
Integrates academic training with current research in biochemistry and molecular biology and the implications of this research in addressing major public health concerns. Offers weekly presentations held by researchers from JHU and other biomedical research institutions on the results of state-of-the-art investigations conducted in their laboratories, emphasizing experimental design and methodology.

PH.120.825. Advanced MHS Student Research. 5 Credits.
Builds upon existing basic research skills in biomedical sciences and emphasizes more independent hands-on research working under the guidance of a faculty member in the Department of Biochemistry and Molecular Biology or affiliated principle investigator. Provides further experience for future research pursuits at JHU and beyond.

PH.120.828. Teaching in Biochemistry and Molecular Biology. 1 - 22 Credits.
Teaching Assistant (TA) for PhD students in Biochemistry and Molecular Biology

PH.120.829. Summer Thesis Research. 12 Credits.

PH.120.830. Postdoctoral Research Biochemistry. 1 - 22 Credits.

PH.120.840. Special Studies and Research Biochemistry. 1 - 22 Credits.

PH.120.850. Biochemical Techniques. 6 Credits.

PH.120.852. Core Research Literature. 1 - 2 Credits.
Provides a complement to the BCMB core curriculum. Student reads research papers relating to a core lecture topic. Discussions are led by a student while a faculty member from Biochemistry or MMI act as facilitator. Helps students to develop skills in reading the primary literature and provides an introduction to the experimental paradigms underlying the concepts presented in the core course.

PH.120.853. Summer Biochemical Techniques. 6 Credits.

PH.120.860. Thesis Preparation. 2 Credits.
Students engage in one-on-one independent study with a departmental faculty member who will be the student's thesis supervisor. Prepares students for completing the MHS using independent reading of papers from current literature, combined with meetings with the thesis supervisor to discuss the reading and how to recognize this research to develop the MHS thesis.

PH.120.861. Special Topics in Biochemistry: X-Ray Crystallography-A Hands on Workshop. 3 Credits.
Enables students to carry out all key steps to successfully solve and refine a protein crystal structure. Theoretical aspects are followed by application to various problem sets. Topics include tricks for data collection, data processing and collection. Touches upon all standard techniques such as molecular replacement, SAD phasing and MAD phasing, both in theory and then applied in practical context with previously collected data. Identification of unknown ligand densities and model refinement lead to the last part of preparing publication quality figures using PyMol.

PH.120.870. Thesis in Biochemistry and Molecular Biology. 5 Credits.
In consultation with a faculty mentor from the Department of Biochemistry and Molecular Biology, students prepare a critical, scholarly paper on an assigned subject.

PH.120.872. Special Studies-Current Topics in BMB. 1 Credit.
Introduces students to the faculty and to current research being conducted in their respective laboratories within the Department of Biochemistry and Molecular Biology and by other training faculty of the Cancer Biology Training Program. Informs doctoral students about research opportunities in each laboratory and allows them to make informed decisions about their choices for laboratory rotations during their first year. Similarly, informs current MHS students who are considering the ScM Program during the second year about potential research opportunities in laboratories of BMB faculty. Provides time for faculty presentation, student questions and further discussion.