

Biochemistry & Molecular Biology (BCHB)

BCHB 1020 The Human Body:Health/Disease 3 Credits

The goal of this course is to provide students with a better understanding of the human body in health and disease. Topics to be reviewed will include: the heart disease and lung disease; the abdomen and diseases such as pancreatitis, ulcerative colitis, kidney stones, and urinary tract infections; the reproductive system and sexually transmitted diseases; limbs and sports injuries, including exercise routines and strength training; the brain and head trauma in sports such as football and soccer. Other topics will include the anatomy of back pain, breast cancer, and the promise of stem cells in treating disease – use and abuse. The course will encompass lectures and student presentations / discussion groups about ethical issues in medicine such as stem cells, performance enhancing drugs, and newer reproductive techniques. At the end of the course, students will have a better appreciation of the human body that will be an enduring frame of reference. Students will have the option to view an actual dissection of a human body during the term. By the end of the course, students should know: 1. The major organs in the chest, abdomen, and pelvis and their diseases. 2. The major muscle groups in the limbs and their function. 3. Sport injuries and other common injuries to the limbs. 4. Strength training. 5. Common head injuries in sports, such as concussion and chronic traumatic encephalopathy (CTE). 6. A better appreciation of ethical issues related to medicine. 7. The promise of adult stem cells in medicine to treat disease and even to produce designer babies.

Level: Undergraduate

Grading: Main Campus (UGrad, Grad)

BCHB 5110 FUNDAMENTALS OF BIOCHEMISTRY 4 Credits

Survey of fundamental concepts in biochemistry and molecular biology, with emphasis on metabolism.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 5130 CORE CONCEPTS:BIOCHEMISTRY 4 Credits

This is a survey course of core topics in biochemistry and molecular and cell biology, with emphasis on applications to biotechnology.

Prerequisites: None

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to students with a major in Biochemistry Molecular Biol, Biochemistry Molecular Biol, Biochemistry Molecular Biol, Biochemistry Molecular Biol, Biotechnology, Biotechnology, Biotechnology, Biotechnology, Microbiology Immunology, Microbiology Immunology, Microbiology Immunology or Microbiology Immunology.

BCHB 5140 Intro to Bioinformatics 1 Credit

The sequencing of the human genome that was completed in 2001 and the explosion of "omic data" has accelerated our understanding of basic genetics and how we think of biology. We are now in the "omic" era of molecular biology that has given birth to the new field of Bioinformatics. All this data can be used meaningfully for biological and clinical research only if we can extract the relevant functional information from them and convert biological data into knowledge of biological systems. Fortunately, by using bioinformatics we can make headway in understanding and extracting relevant biological information from these sequences. The aim of this course is to introduce the various tools and resources that are available as applicable to biomedical research. This course is highly experiential with both lectures and "hands-on" sessions. *Prerequisites:* None

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to students with a major in Biochemistry Molecular Biol, Biochemistry Molecular Biol, Biochemistry Molecular Biol, Biochemistry Molecular Biol, Biotechnology, Biotechnology, Biotechnology or Biotechnology.

Enrollment is limited to Graduate level students.

BCHB 5150 Intro To Bioinformatics 1 Credit

The sequencing of the human genome that was completed in 2001 and the explosion of "omic data" has accelerated our understanding of basic genetics and how we think of biology. We are now in the "omic" era of molecular biology that has given birth to the new field of Bioinformatics. All this data can be used meaningfully for biological and clinical research only if we can extract the relevant functional information from them and convert biological data into knowledge of biological systems. Fortunately, by using bioinformatics we can make headway in understanding and extracting relevant biological information from these sequences. The aim of this course is to introduce the various tools and resources that are available as applicable to biomedical research. This course is highly experiential with both lectures and "hands-on" sessions. *Prerequisites:* None

Level: Graduate, Undergraduate

Course attribute:

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 5350 PROGRAMMED CELL DEATH 2 Credits

This lecture and laboratory course familiarizes students with different pathways leading to apoptosis and their importance in development as well as in diseases such as cancer, autoimmune diseases and neurodegenerative diseases such as Alzheimer's, Parkinson's, and Ischemia. Prerequisites: None

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to students with a program in Biochemistry Molecular Biol, Biochemistry Molecular Biol, Biochemistry Molecular Biol, Biochemistry Molecular Biol, Biotechnology, Biotechnology, Biotechnology or Biotechnology.

Enrollment is limited to Graduate level students.

BCHB 5360 Cell Culture Appls: Biotech 2 Credits

This course provides biochemistry, biomedical, and biotechnology graduate students with a basic understanding and hands-on experience on modern applications of tissue/cell culture technology in the study of diverse topics in life sciences, including molecular biology, toxicology, tumor biology, pharmacology, and biotechnology.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 5400 MOLECULAR BASIS:CARCINOGENESIS 3 Credits

This course provides in-depth discussions of the fundamental aspects of the mechanisms of carcinogenesis, damage-responsive signal transduction, carcinogen-induced programmed cell death, genetic diseases associated with defective repair, and anti-signaling drug design in the intervention of the onset and progression of the carcinogenic process. Prerequisites: None for graduate students. Undergraduate students require instructor permission.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 5410 Structural Biology 3 Credits

The aim of this course is to integrate the chemical and physical sciences to provide the molecular basis of protein function using structural biology approaches as tools. For an understanding of biological function, a detailed knowledge of the three-dimensional structures of biological macro-molecules and their interactions with ligands is required. This course will provide the basic knowledge needed to understand "structure-function" relationships and concepts of drug design. Students will understand the effect of mutations in disrupting the three-dimensional structure and ultimately leading to diseases. Students will also be exposed to basic concepts of pharmacogenomics. The course is suitable for scientists wishing to update their knowledge of molecular structural biology, or as part of the background studies of research students, particularly those whose undergraduate studies were in a different area.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 5440 Essntls Biochem: Metabolism 1 Credit

Survey of basic concepts in biochemistry, with emphasis on metabolism.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 5450 Essentials/Prog Cell Death 1 Credit

This lecture course familiarizes students with different pathways leading to apoptosis and their importance in development as well as in diseases such as cancer, autoimmune diseases and neurodegenerative diseases such as Alzheimer's, Parkinson's, and Ischemia. This course has NO LAB component. Prerequisites: None

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 5460 Principles of Tissue Culture 1 Credit

This lecture course examines the uses of cell culture techniques for the study of diverse topics in life sciences, including Molecular Biology, Toxicology, and Pharmacology as well as other applications in biotechnology. This course has NO LAB component. Prerequisites: None

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 5540 Research Ethics Integrity

This course will review scientific ethics and integrity, plagiarism and how to submit documents to SafeAssign as well as other program specific ethical issues. Prerequisites: None

Level: Graduate, Undergraduate

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 5600 Intro to BioEngineering I 1 Credit

This didactic course will provide an overview of the field of bioengineering or biomedical engineering from different perspectives. This course will: • Provide a better understanding of the many different facets and dynamics of the biomedical engineering area in medicine.

• Provide the opportunity to explore the processes of inventing, designing, developing, and deploying innovative and value-based technologies for preclinical and translational medical applications. This class uses lectures, flipped classroom approaches where needed as well as student led discussions. Relevant topics include 3D bioprinting, organoids, organ-on a chip, biomaterials, devices, implants, sensors, and cell engineering.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

BCHB 5750 Immunotechniques in Biochem 2 Credits

This is an intensive hands-on laboratory-based course that familiarizes students with laboratory methods and immunological techniques commonly used in biomedical research. The course aims to develop expertise in various standard laboratory biochemical, molecular and cell biology techniques such as aseptic technique and cell culture, immunocytochemistry, immunohistochemistry, SDS-polyacrylamide gel electrophoresis and immunoblot analysis, magnetic activated cell sorting (MACS), RNA extraction, cell lysate and protein extraction, qPCR for gene expression analysis, etc. Permission of Instructor Required.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 5760 Core Methods of Biochemistry 3 Credits

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

BCHB 5780 Molecular Pathways of Aging 1 Credit

Molecular Pathways of Age-Related Diseases: Understanding aging is critically important. Since time immemorial humans have tried in vain to intervene in the aging process. How is aging biochemically defined? In this course, we examine current practice that accelerate aging, molecular pathways implicated in age-related diseases, as well as the molecular basis of interesting anti-aging/health span-extension therapies currently available or poised to be launched in the near future. We will review the biochemistry and molecular biology underlying transformational therapeutics that will have an impact on your health span, and detail interesting, and emerging therapeutic pathways.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

BCHB 5790 Gene Silencing GenomeEditing 1 Credit

Expression of each genes in eukaryotic cells is tightly regulated through various mechanism. Recently, researchers have developed several techniques to perturb specific gene expression either by manipulating at the RNA or DNA level. This course is designed to provide a comprehensive survey of different techniques currently used in biology to perturb specific gene expression. In this course, we will review organization of genes, gene expression, regulation of gene expression, techniques in gene silencing (siRNA, shRNA, miRNA, piRNA), genome editing (TALENs, ZFN, CRISPR, cDNA over expression) and applications of each techniques in medical sciences. n of each genes in eukaryotic cells is tightly regulated through various mechanism. Recently, researchers have developed several techniques to perturb specific gene expression either by manipulating at the RNA or DNA level. This course is designed to provide a comprehensive survey of different techniques currently used in biology to perturb specific gene expression. In this course, we will review organization of genes, gene expression, regulation of gene expression, techniques in gene silencing (siRNA, shRNA, miRNA, piRNA), genome editing (TALENs, ZFN, CRISPR, cDNA over expression) and applications of each techniques in medical sciences.

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

BCHB 5800 Mol Cell Biology of Viruses 1 Credit

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 5810 Computational Biochemistry 1 Credit

In the modern world, pharmaceutical and academic research increasingly rely on computational chemistry methods to study small and large biological systems. Computational chemistry plays a crucial role in medicine, biology, chemistry, physics, and materials science, providing essential tools for studying molecular interactions and developing new therapeutics. This course introduces key concepts and methods in computational chemistry along with their applications in biochemistry, molecular biology, and related fields. Students will explore both methodological and practical aspects through case studies, integrating computational techniques with real-world applications in drug discovery, medicinal chemistry, and environmental science. Students will learn how computational chemistry aids in disease research, particularly in therapeutic applications such as cancer drug discovery. Through a combination of lectures and hands-on practice, students will acquire the skills to analyze molecular systems, from small organic compounds to biological macromolecules. By the end of the course, students will understand how computational tools are used in disease and therapeutics research. Additionally, the course provides integrated knowledge and practical experience, preparing students to bridge the gap between computational chemistry and its biological applications.

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 7950 Intro Biochemistry Internship

Course offered to students to prepare them for internship.

Level: Graduate

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment is limited to students with a major in Biochemistry Molecular Biol, Biochemistry Molecular Biol, Biochemistry Molecular Biol or Biochemistry Molecular Biol.

Enrollment is limited to Graduate level students.

BCHB 7951 BIOCHEM/MOLEC/CELL BIOL INTRNS 4 Credits

This is the capstone course in which students will pursue defined objectives in a research laboratory on campus (GUMC) or off-campus at government agencies (NIH, FDA, USDA, NMRC, NIST) or biotechnology companies in the Washington DC metropolitan area. Internships can be in various topics in the Biomedical Sciences, including Biochemistry, Pharmacology, Cell Biology, Toxicology, Microbiology, Immunology, Neurosciences, and Oncology. Independent Study

Level: Graduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to students with a major in Biochemistry Molecular Biol, Biochemistry Molecular Biol, Biochemistry Molecular Biol or Biochemistry Molecular Biol.

Enrollment is limited to Graduate level students.

BCHB 7952 Biochem Internship Headstart

This course is taken by MS Biochemistry students who plan to get a headstart on their internship research projects in the summer. Spring-entry students admitted into the Georgetown University MS Biochemistry and Molecular Biology - AstraZeneca internship program have to register for this course in the summer.

Level: Graduate

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment limited to students in the MS-BCHB program.

Enrollment is limited to Graduate level students.

BCHB 9003 TUTORIAL:BIOCHEM/MOL BIOL 1-3 Credits

Tutorials with individual faculty. By permission of Instructor and Chair.

Level: Graduate, Undergraduate

Grading: Pass/Fail Default

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 9004 TUTORIAL: BIOCHEMISTRY 1-3 Credits

Tutorials with individual faculty. By permission of faculty and Chair.

See Instructor for summer offering

Level: Graduate, Undergraduate

Grading: Main Campus (UGrad, Grad)

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 9991 Continuous Registration

Level: Graduate, Undergraduate

Grading: No Grade

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 9992 Continuous Registration

Level: Graduate, Undergraduate

Grading: No Grade

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 9993 Continuous Registration

This section is used by master's students who have completed all degree requirements except incomplete course grades, or by master's and doctoral students who have completed all degree requirements, including defense of the doctoral dissertation, but have not yet graduated. Students may register for this course only with permission of the Graduate School. No registration fee is charged. A student enrolled in Continuous Registration – 993-01, will be certified as enrolled less than half-time.

Level: Graduate, Undergraduate

Grading: No Grade

Equivalent to BCMC 9993

Course registration restrictions:

Enrollment is limited to Graduate level students.

BCHB 9994 Continuous Registration

Level: Graduate, Undergraduate

Grading: No Grade

Equivalent to BCMC 9994

Course registration restrictions:

Enrollment is limited to Graduate level students.