

BIOCHEMISTRY AND BIOPHYSICS (BB)

BB 100, THE MOLECULES OF LIFE, 2 Credits

A brief introduction to molecular biology for nonspecialists. Subjects vary, but have included biochemical basis of the origin of life, biochemical genetics, biochemical aspects of memory and behavior, mutagenesis, bioenergetics and nutrition, and environmental biochemistry.

Equivalent to: BB 100H

BB 111, INTRODUCTION TO BIOCHEMISTRY AND BIOPHYSICS RESEARCH, 1 Credit

Designed to introduce biochemistry and biophysics students to departmental research opportunities and advisors.

BB 211, PROFESSIONAL DEVELOPMENT II: MOLECULAR, MICROBIAL, BIOHEALTH, 1 Credit

Develop awareness of the elements of professional development, identify strategic areas for growth, and design an exploration plan. Emphasis is placed on being able to analyze career opportunities to determine the best mix of technical and professional skills needed for success as a biological science professional. Graded P/N. CROSSLISTED as BB 211/ BHS 211.

Equivalent to: BHS 211

BB 220, *CANCER: SOCIETY'S MALIGNANT SHADOW, 3 Credits

Explores the social context of our modern understanding of the group of diseases called cancer. Stimulates critical thinking about how trends in prevention, diagnosis, treatment, and care are influenced by the way we view social categories such as race, gender, and socioeconomic class. Demonstrates that access to medical advances is informed by societal beliefs regarding the role of government and other authoritative institutions. (Bacc Core Course)

Attributes: CPDP – Core, Perspective, Difference/Power/Discrimination

BB 314, CELL AND MOLECULAR BIOLOGY, 4 Credits

Fundamental concepts of prokaryotic and eukaryotic cell biology. Emphasizes cell structure and function at the molecular level. Lec/rec.

Prerequisite: (((BI 211 with C- or better or BI 211H with C- or better) and (BI 212 [C-] or BI 212H [C-]) and (BI 213 [C-] or BI 213H [C-])) or ((BI 221 [C-] or BI 221H [C-]) and (BI 222 [C-] or BI 222H [C-]) and (BI 223 [C-] or BI 223H [C-])) or (BI 204 [C-] and BI 205 [C-] and BI 206 [C-])) and (CH 331 (may be taken concurrently) [C-] or CH 334 (may be taken concurrently) [C-])

Equivalent to: BB 314H, BI 314, BI 314H

Available via Ecampus

BB 314H, CELL AND MOLECULAR BIOLOGY, 4 Credits

Fundamental concepts of prokaryotic and eukaryotic cell biology. Emphasizes cell structure and function at the molecular level. Lec/rec.

Attributes: HNRS – Honors Course Designator

Prerequisite: (((BI 211 with C- or better or BI 211H with C- or better) and (BI 212 [C-] or BI 212H [C-]) and (BI 213 [C-] or BI 213H [C-])) or ((BI 221 [C-] or BI 221H [C-]) and (BI 222 [C-] or BI 222H [C-]) and (BI 223 [C-] or BI 223H [C-])) or (BI 204 [C-] and BI 205 [C-] and BI 206 [C-])) and (CH 331 (may be taken concurrently) [C-] or CH 334 (may be taken concurrently) [C-])

Equivalent to: BB 314, BI 314, BI 314H

BB 315, MOLECULAR BIOLOGY LABORATORY, 3 Credits

Laboratory projects exploring the transmission of genetic information from storage to function will introduce students to fundamental molecular biology concepts and techniques, including isolation of DNA, construction of recombinant plasmids, quantification of gene expression in model organisms, polymerase chain reaction, and analysis of protein expression and subcellular localization. Lec/lab.

Prerequisite: BB 314 with C- or better or BB 314H with C- or better

Equivalent to: BI 315

BB 317, ^SCIENTIFIC THEORY AND PRACTICE, 3 Credits

Teaches students the practice of biological science. Topics cover scientific theory, communications, ethics and critical evaluation. CROSSLISTED as BB 317/BI 317. (Writing Intensive Course)

Attributes: CWIC – Core, Skills, WIC

Prerequisite: (((BI 211 with C- or better or BI 211H with C- or better) and (BI 212 [C-] or BI 212H [C-]) and (BI 213 [C-] or BI 213H [C-])) or ((BI 221 [C-] or BI 221H [C-]) and (BI 222 [C-] or BI 222H [C-]) and (BI 223 [C-] or BI 223H [C-])))

Equivalent to: BI 317

BB 331, *INTRODUCTION TO MOLECULAR BIOLOGY, 3 Credits

Course dealing with the molecular basis of cellular function, with emphasis upon modern developments, and the foundation for practical applications of this knowledge. The course will involve the conceptual background necessary to appreciate the applications of molecular biology. Throughout the course opportunities will be given to discuss public policy issues and questions: What are the moral and practical problems that flow from identification of an individual as being at risk for a late-appearing genetic disorder, such as Huntington's disease or certain cancers? Does the scientific or public value of knowing the entire DNA sequence of the human genome justify a situation in which individual or small-scale research cannot be supported? What issues arise when the fruits of biological research, mostly publicly funded, are commercialized? Should a novel organism be patented? How can biotechnology be applied to environmental problems? (Bacc Core Course)

Attributes: CSST – Core, Synthesis, Science/Technology/Society

Prerequisite: CH 122 with D- or better or CH 202 with D- or better or CH 222 with D- or better or CH 225H with D- or better or ((CH 232 with D- or better or CH 232H with D- or better) or (CH 262 with D- or better or CH 262H with D- or better or CH 272 with D- or better))

Available via Ecampus

BB 332, *MOLECULAR MEDICINE, 3 Credits

Provides students an understanding of medical advances from a rapidly evolving molecular point of view. Advances in knowledge of the human genome arising from DNA sequencing efforts and major leaps in understanding of the regulating cellular growth and division are presented in an easy-to-understand fashion appropriate for students in all majors. Course discussions and assignments will cover implications of advances in molecular medicine from ethical, economic, technical and societal standpoints. The aim of the course is to present technical material in a way that non-scientists will understand and conversely to summarize ethical, economic, and philosophical considerations in a way that the scientists understand the implications of these technologies. (Bacc Core Course)

Attributes: CSST – Core, Synthesis, Science/Technology/Society

Recommended: Any biology course.

BB 345, INTRODUCTION TO BIOLOGICAL SEQUENCE ANALYSIS, 2 Credits

Introduction to computer-based analyses of biomolecular data, particularly nucleic acid and protein sequences, with the Python programming language. Topics include reading and writing of sequence files, subsequences, reverse complement, finding sequence patterns, subroutines, control structures, and parsing complex data files.

BB 350, ELEMENTARY BIOCHEMISTRY, 4 Credits

Service course for students desiring a short introduction to biochemistry. Four lectures weekly.

Prerequisite: CH 331 with D- or better and CH 332 (may be taken concurrently) [D-]

Available via *Ecampus*

BB 360, INTRODUCTION TO NEUROSCIENCE, 3 Credits

An introduction to the field of neuroscience. Topics include structure of neurons, outline of signaling in the central nervous system, Nernst equation, action potentials, synaptic transmission, chemical signaling in vision, disease and drugs.

Prerequisite: (((BI 211 with C- or better or BI 211H with C- or better) and (BI 212 [C-] or BI 212H [C-]) and (BI 213 [C-] or BI 213H [C-])) or ((BI 221 [C-] or BI 221H [C-]) and (BI 222 [C-] or BI 222H [C-]) and (BI 223 [C-] or BI 223H [C-]))) and (CH 233 [C-] or CH 233H [C-]) and (CH 263 [C-] or CH 263H [C-])

Available via *Ecampus*

BB 361, NEUROSCIENCE OF SENSORY AND MOTOR SYSTEMS, 3 Credits

Provides advanced knowledge and understanding of the structure and function of the sensory and motor systems and the interactions between them. These systems will be considered in the context of human physiology.

Prerequisite: BB 360 with C- or better

BB 399, SPECIAL TOPICS, 1-16 Credits

Equivalent to: BB 399H

This course is repeatable for 16 credits.

BB 399H, SPECIAL TOPICS, 1-16 Credits

Attributes: HNRS – Honors Course Designator

Equivalent to: BB 399

This course is repeatable for 16 credits.

BB 401, UNDERGRADUATE RESEARCH, 1-16 Credits

Equivalent to: BB 401H

This course is repeatable for 16 credits.

BB 403, THESIS, 1-16 Credits

This course is repeatable for 16 credits.

BB 405, READING AND CONFERENCE, 1-16 Credits

Equivalent to: BB 405H

This course is repeatable for 16 credits.

BB 405H, READING AND CONFERENCE, 1-16 Credits

Attributes: HNRS – Honors Course Designator

Equivalent to: BB 405

This course is repeatable for 16 credits.

BB 407, BIOCHEMISTRY/BIOPHYSICS SEMINAR, 1-16 Credits

Informal seminars presenting information about research problems and careers and research programs on campus in biochemistry or biophysics. Graded P/N.

Equivalent to: BB 407H

This course is repeatable for 99 credits.

BB 407H, BIOCHEMISTRY/BIOPHYSICS SEMINAR, 1-16 Credits

Informal seminars presenting information about research problems and careers and research programs on campus in biochemistry or biophysics.

Attributes: HNRS – Honors Course Designator

Equivalent to: BB 407

This course is repeatable for 99 credits.

BB 410, INTERNSHIP, 1-16 Credits

This course is repeatable for 16 credits.

BB 450, GENERAL BIOCHEMISTRY, 4 Credits

Sequence course for students with a limited background in physical chemistry. BB 450/BB 550, three lectures and one recitation. BB 451/BB 551, three lectures.

Prerequisite: CH 332 with D- or better or CH 336 with D- or better

Equivalent to: BB 450H

Available via *Ecampus*

BB 451, GENERAL BIOCHEMISTRY, 3 Credits

Sequence course for students with a limited background in physical chemistry. BB 450/BB 550, three lectures and one recitation. BB 451/BB 551, three lectures.

Prerequisite: BB 450 with D- or better or BB 450H with D- or better

Equivalent to: BB 451H

Available via Ecampus

BB 453, BIOCHEMISTRY AND MOLECULAR BIOLOGY LABORATORY TECHNIQUES, 4 Credits

Laboratory course for non-majors that introduces students to biochemistry and molecular biology techniques used to investigate the functional relationship between nucleic acid sequence, gene expression, and protein function.

Prerequisite: BB 451 with C- or better

BB 460, ADVANCED CELL BIOLOGY, 3 Credits

History and theory of cell biology; microscopy and other techniques to study cells and organelles; membranes; organelles; protein import; cell signaling; cytoskeleton; polarity; cell cycle; stem cells; pattern formation; cancer biology. Offered every other fall in odd years.

Prerequisite: BB 314 with C- or better or BI 314 with C- or better or BI 314H with C- or better or BB 451 with C- or better or BB 492 with C- or better

BB 481, MACROMOLECULAR STRUCTURE, 3 Credits

An introduction to structural biology, the discipline focused on understanding the structural properties of biological macromolecules—especially proteins and nucleic acids—and relating them to their function. Introduces students to the vocabulary and tools of this discipline, covering both the fundamental physico-chemical principles governing the structure and function of biological macromolecules and a selected set of widely used experimental and theoretical approaches to their characterization. This is done through lectures, and textbook and literature readings. Graduate students receive additional experience in scientific reading, writing and presentation through a literature-based term project.

Prerequisite: BB 450 with D- or better or BB 490 with D- or better

Available via Ecampus

BB 482, BIOPHYSICS, 3 Credits

Examines quantitative properties of biological systems and biological phenomena using concepts derived from mathematics and physics.

Prerequisite: BB 481 with D- or better and CH 440 [D-]

BB 483, ADVANCED BIOCHEMISTRY AND BIOPHYSICS: CAPSTONE, 3 Credits

Covers applications of advanced biophysical techniques, and how these fit within the larger context of biochemistry, biology and society. Explores techniques and their applications to macromolecules as well as the scientific process. Techniques discussed include in vitro, in vivo, and in silico methods, with an emphasis on biomolecular interactions.

Prerequisite: BB 482 with D- or better or BB 582 with D- or better

BB 484, CHROMATIN AND EPIGENETICS, 3 Credits

An in-depth look at 'chromatin' (the complex generated by DNA, RNA and complex protein) and how it behaves during gene activation and silencing. Specific examples of long-lasting gene regulation (across cell cycles) will be used to describe the concept of 'epigenetic' gene regulation by modification of DNA or proteins. The class will combine more traditional lectures with discussion periods where primary research papers will be analyzed. The target audience is third- and fourth-year students as well as graduate students.

Prerequisite: ((BI 314 with C- or better or BI 314H with C- or better or BB 314 with C- or better or BB 314H with C- or better) and (BI 315 [C-] or BB 315 [C-] or BB 493 [C-] or BB 493H [C-]))

BB 485, APPLIED BIOINFORMATICS, 3 Credits

Fundamental concepts needed to understand the software and methods used in bioinformatics. Includes contemporary techniques such as databases, gene and genome annotations, functional annotations, sequence alignment, motif finding, secondary structure prediction, phylogenetic tree construction, high-throughput sequence data, ChIP-Seq peak identification, transcriptome profiling by RNA-Seq, microRNA discovery and target prediction.

Prerequisite: BB 314 with C- or better or BB 314H with C- or better

Available via Ecampus

BB 486, ADVANCED MOLECULAR GENETICS, 3 Credits

Covers aspects of transmission genetics (Mendel's laws, mapping strategies) informed by the machineries required for genetic information storage, transcription, translation, and protein processing. Analyses of state-of-the-art primary literature and lectures give a perspective on important "model" organisms, including examples from among bacteria, plants, fungi, and animals.

Prerequisite: (BB 314 with C- or better or BB 314H with C- or better) and (BB 492 [C-] or BB 451 [C-])

BB 490, BIOCHEMISTRY 1: STRUCTURE AND FUNCTION, 3 Credits

Examines how the structure and function of biological macromolecules arises from the organic chemistry of their fundamental building blocks. The organic chemistry of biochemistry will be a focus, including the mechanisms by which enzymes catalyze biological reactions.

Prerequisite: (CH 332 with C- or better or CH 336 with C- or better) and ((BI 211 with C- or better or BI 211H with C- or better) and (BI 212 [C-] or BI 212H [C-] and (BI 213 [C-] or BI 213H [C-])) or ((BI 221 [C-] or BI 221H [C-] and (BI 222 [C-] or BI 222H [C-]) and (BI 223 [C-] or BI 223H [C-])))

BB 491, BIOCHEMISTRY 2: METABOLISM, 3 Credits

Sequence professional course to meet the requirements of majors in biochemistry and biophysics. The second course in a series, BB 491/BB 591 covers the mechanisms and regulation of the pathways by which cells break down fuel molecules, conserve some of the released energy in the form of reactive nucleotides, and use this energy to create biological building blocks from simpler metabolites.

Prerequisite: BB 490 with D- or better or BB 590 with D- or better

BB 492, BIOCHEMISTRY 3: GENETIC BIOCHEMISTRY, 3 Credits

Sequence professional course to meet the requirements of majors in biochemistry and biophysics. The third course in the series, BB 492/BB 592 focuses on genetic biochemistry, including the synthesis of nucleotides, DNA synthesis and repair, RNA synthesis and processing, and protein synthesis and modification.

Prerequisite: (BB 490 with D- or better or BB 590 with D- or better) and (BB 491 [D-] or BB 591 [D-])

BB 493, BIOCHEMISTRY LABORATORY MOLECULAR TECHNIQUES 1, 3 Credits

Laboratory course to accompany BB 450, BB 451 or BB 490, BB 491, BB 492. Lec/lab.

Prerequisite: (BB 451 with D- or better or BB 451H with D- or better) or BB 492 with D- or better

Equivalent to: BB 493H

BB 494, BIOCHEMISTRY LABORATORY MOLECULAR TECHNIQUES 2, 3 Credits

Laboratory to accompany BB 450, BB 451 or BB 490, BB 491, BB 492. Lec/lab.

Prerequisite: BB 493 with D- or better or BB 593 with D- or better or BB 315 with D- or better or BI 315 with D- or better

Equivalent to: BB 494H

BB 498, ASBMB CERTIFICATION EXAM, 0 Credits

A comprehensive, standardized test administered by the American Society of Biochemistry and Molecular Biology and used as a direct assessment of the discipline specific knowledge of seniors in the majors administered by the Biochemistry and Biophysics department. A pass will be given to all students who complete the exam. Contact the Biochemistry and Biophysics Program for more information.

BB 499, SPECIAL TOPICS, 0-16 Credits

Topics and credits vary.

This course is repeatable for 16 credits.

BB 501, RESEARCH, 1-16 Credits

This course is repeatable for 16 credits.

BB 503, THESIS, 1-16 Credits

This course is repeatable for 999 credits.

BB 505, READING AND CONFERENCE, 1-16 Credits

This course is repeatable for 16 credits.

BB 507, SEMINAR, 1-2 Credits

Section 1: Descriptions of campus research programs in biochemistry and biophysics, 1 credit fall. Graded P/N. Student presentations of current research literature, 1 credit winter and spring. Should be taken by all entering departmental graduate students. Section 2: Presentation of departmental research seminar, 2 credits any term. PhD candidates in biochemistry and biophysics present a departmental research seminar in the third or fourth year. One registers in the term the seminar is presented.

This course is repeatable for 16 credits.

BB 550, GENERAL BIOCHEMISTRY, 4 Credits

Sequence course for students with a limited background in physical chemistry. BB 450/BB 550, three lectures and one recitation. BB 451/BB 551 and BB 452, three lectures.

Recommended: CH 332

Available via Ecampus

BB 551, GENERAL BIOCHEMISTRY, 3 Credits

Sequence course for students with a limited background in physical chemistry. BB 450/BB 550, three lectures and one recitation. BB 451/BB 551 and BB 452, three lectures.

Recommended: BB 550

Available via Ecampus

BB 560, ADVANCED CELL BIOLOGY, 3 Credits

History and theory of cell biology; microscopy and other techniques to study cells and organelles; membranes; organelles; protein import; cell signaling; cytoskeleton; polarity; cell cycle; stem cells; pattern formation; cancer biology

Recommended: BB 314 or BI 314 or BI 314H or BB 492 or BB 451

BB 581, MACROMOLECULAR STRUCTURE, 3 Credits

An introduction to structural biology, the discipline focused on understanding the structural properties of biological macromolecules—especially proteins and nucleic acids—and relating them to their function. Introduces students to the vocabulary and tools of this discipline, covering both the fundamental physico-chemical principles governing the structure and function of biological macromolecules and a selected set of widely used experimental and theoretical approaches to their characterization. This is done through lectures, and textbook and literature readings. Graduate students receive additional experience in scientific reading, writing and presentation through a literature-based term project.

Recommended: BB 450 or BB 490

Available via Ecampus

BB 582, BIOPHYSICS, 3 Credits

Examines quantitative properties of biological systems and biological phenomena using concepts derived from mathematics and physics.

Prerequisite: BB 581 with D- or better

BB 583, ADVANCED BIOCHEMISTRY AND BIOPHYSICS: CAPSTONE, 3 Credits

Covers applications of advanced biophysical techniques, and how these fit within the larger context of biochemistry, biology and society. Explores techniques and their applications to macromolecules as well as the scientific process. Techniques discussed include in vitro, in vivo, and in silico methods, with an emphasis on biomolecular interactions.

Prerequisite: BB 582 with C or better

BB 584, CHROMATIN AND EPIGENETICS, 3 Credits

An in-depth look at 'chromatin' (the complex generated by DNA, RNA and complex protein) and how it behaves during gene activation and silencing. Specific examples of long-lasting gene regulation (across cell cycles) will be used to describe the concept of 'epigenetic' gene regulation by modification of DNA or proteins. The class will combine more traditional lectures with discussion periods where primary research papers will be analyzed. The target audience is third- and fourth-year students as well as graduate students.

Recommended: (BI 314 or BI 314H) and BI 315

BB 585, APPLIED BIOINFORMATICS, 3 Credits

Fundamental concepts needed to understand the software and methods used in bioinformatics. Includes contemporary techniques such as databases, gene and genome annotations, functional annotations, sequence alignment, motif finding, secondary structure prediction, phylogenetic tree construction, high-throughput sequence data, ChIP-Seq peak identification, transcriptome profiling by RNA-Seq, microRNA discovery and target prediction.

Recommended: BB 314 or BB 314H

Available via Ecampus

BB 586, ADVANCED MOLECULAR GENETICS, 3 Credits

Covers aspects of transmission genetics (Mendel's laws, mapping strategies) informed by the machineries required for genetic information storage, transcription, translation, and protein processing. Analyses of state-of-the-art primary literature and lectures give a perspective on important "model" organisms, including examples from among bacteria, plants, fungi, and animals.

Recommended: (BI 314 or BI 314H) and BI 315 and BB 492

BB 590, BIOCHEMISTRY 1: STRUCTURE AND FUNCTION, 3 Credits

Examines how the structure and function of biological macromolecules arises from the organic chemistry of their fundamental building blocks. The organic chemistry of biochemistry will be a focus, including the mechanisms by which enzymes catalyze biological reactions.

BB 591, BIOCHEMISTRY 2: METABOLISM, 3 Credits

Sequence professional course to meet the requirements of majors in biochemistry and biophysics. The second course in a series, BB 491/BB 591 covers the mechanisms and regulation of the pathways by which cells break down fuel molecules, conserve some of the released energy in the form of reactive nucleotides, and use this energy to create biological building blocks from simpler metabolites.

Prerequisite: BB 590 with C or better

BB 592, BIOCHEMISTRY 3: GENETIC BIOCHEMISTRY, 3 Credits

Sequence professional course to meet the requirements of majors in biochemistry and biophysics. The third course in the series, BB 492/BB 592 focuses on genetic biochemistry, including the synthesis of nucleotides, DNA synthesis and repair, RNA synthesis and processing, and protein synthesis and modification.

Prerequisite: BB 590 with C or better and BB 591 [C]

BB 593, BIOCHEMISTRY LABORATORY MOLECULAR TECHNIQUES 1, 3 Credits

Laboratory course to accompany BB 450, BB 451 or BB 490, BB 491, BB 492. Lec/lab.

Recommended: (BB 451 or BB 451H) or BB 492

BB 594, BIOCHEMISTRY LABORATORY MOLECULAR TECHNIQUES 2, 3 Credits

Laboratory to accompany BB 450, BB 451 or BB 490, BB 491, BB 492. Lec/lab.

Recommended: BB 493 or BB 593 or BB 315 or BI 315

BB 599, SPECIAL TOPICS, 0-16 Credits

Topics and credits vary.

This course is repeatable for 16 credits.

BB 601, RESEARCH, 1-16 Credits

This course is repeatable for 16 credits.

BB 603, THESIS, 1-16 Credits

This course is repeatable for 999 credits.

BB 605, READING & CONFERENCE, 1-16 Credits

This course is repeatable for 16 credits.

BB 607, SEMINAR, 1-2 Credits

Section 1: Descriptions of campus research programs in biochemistry and biophysics, 1 credit fall. Graded P/N. Student presentations of current research literature, 1 credit winter and spring. Should be taken by all entering departmental graduate students. Section 2: Presentation of departmental research seminar, 2 credits any term. PhD candidates in biochemistry and biophysics present a departmental research seminar in the third or fourth year. One registers in the term the seminar is presented.

This course is repeatable for 16 credits.

BB 650, SELECTED TOPICS IN BIOCHEMISTRY AND BIOPHYSICS, 3 Credits

Nonsequence courses designed to acquaint student with current research in biochemistry and biophysics. Courses include enzyme kinetics, cell cycle and cancer, neurochemistry, oxidative stress, cell adhesion and motility. Most courses offered alternate years.

This course is repeatable for 18 credits.

BB 651, SELECTED TOPICS IN BIOCHEMISTRY AND BIOPHYSICS, 3 Credits

Nonsequence courses designed to acquaint student with current research in biochemistry and biophysics. Courses include cell surfaces, enzyme kinetics, metabolism, neurochemistry, trace element metabolism, biological oxidations, and bioenergetics. Most courses offered alternate years.

This course is repeatable for 18 credits.

BB 652, SELECTED TOPICS IN BIOCHEMISTRY AND BIOPHYSICS, 3 Credits

Nonsequence courses designed to acquaint student with current research in biochemistry and biophysics. Courses include enzyme kinetics, metabolism, neurochemistry, trace element metabolism, biological oxidations, and bioenergetics. Most courses offered alternate years.

This course is repeatable for 18 credits.

BB 699, SPECIAL TOPICS, 0-16 Credits

This course is repeatable for 16 credits.