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. CROSSTLISTED as BB 211/
BHS 211.
Equivalent to: BHS 211

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
Available via Ecampus

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.
CROSSTLISTED 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 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 writing, reading 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

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 the series, BB 491/BB 492 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.