BCHE-BIOCHEMISTRY

BCHE 140. Introduction to Biochemistry
1 Credit (1)
A description of the nature of inquiry in biochemistry, especially with respect to the interaction of chemistry and biology. Both historical development and topics of current interest will be discussed. Graded S/U.

BCHE 241. Introduction to Research in Biochemistry
1-3 Credits
Techniques and procedures of biochemical research. May be repeated for a maximum of 3 credits.
Prerequisites: 8 credits of chemistry and 3.0 GPA in chemistry.

BCHE 341. Survey of Biochemistry
4 Credits (3+3P)
Basic principles of biochemical processes and the structure/function of the major classes of biomolecules, with introductions to metabolism and the central dogma of biochemistry. The chemical and biological properties of major biomolecules (DNA, proteins, May be repeated up to 4 credits.
Prerequisite(s): C- or better in CHEM 2115 or CHEM 314.

BCHE 395. Biochemistry I
3 Credits (3)
Principles governing chemistry and physics of life processes with emphasis on the relationships between molecular structure and cell function. Basic principles of biochemical processes, enzymology, and the structure/function of the major classes of biomolecules with introductions to metabolism. Introduction to catabolic metabolism. May be repeated up to 3 credits.
Prerequisite: C- or better in CHEM 314.
Learning Outcomes
1. Understand the structure, reactivity, and metabolic function of the presented biological molecules and apply that knowledge to biomolecules encountered in future experiences. Examples include the 20 common amino acids, carbohydrate molecules of glycolysis, carboxylic acids of the citric acid cycle, lipid components of biological membranes, and many catalytic enzymes.
2. Understand the theory and application of many of the experimental techniques of Biochemistry.
3. Understand biochemical regulation and the interconnectedness of metabolic processes. A large fraction of contemporary biochemical research is devoted to delineating biochemical regulation. Details of biochemical regulation will be interwoven with material presented throughout the semester, stressing the principles of regulation that are common in many organisms.
4. Understand enzyme kinetics and enzyme mechanism.

BCHE 396. Biochemistry II, Lecture and Laboratory
4 Credits (2.5+3P)
Introduction to anabolic metabolism and hormonal regulation. Biochemical principles of the mechanism and regulation of replication, transcription, recombination and translation in prokaryotes and eukaryotes. Introduction to DNA-based information technology. Taught with BCHE 396 H. May be repeated up to 4 credits.
Prerequisite: C- or better in BCHE 395.
Learning Outcomes
1. Recognize the essential biochemical reactions and enzymatic mechanisms required for nucleic acid, amino acid, and fatty acid synthesis.
2. Learn the biochemical reaction mechanisms associated with key elements of the central dogma of molecular biology.
3. Identify the reactions and enzymes required for DNA maintenance and replication, transcription and RNA polymerization, and the translation of mRNA to primary amino acid sequence and protein synthesis.
4. Conduct experiments safely.
5. Select and manipulate plasmids to achieve desired recombinant DNA for experimentation.
6. Obtain relevant DNA sequence information from public databases.
7. Transform and isolate plasmid DNA to be used for cloning procedures.
8. Design DNA specific primers for PCR reactions.
9. Perform restriction digest and ligation reactions. 1
10. Analyze DNA sequence to validate the outcome of recombinant DNA experimentation. 1
11. Demonstrate scientific dissemination skills by attending scientific seminars or review primary literature and provide summary via written or oral presentation.

BCHE 396 H. Biochemistry II Honors, Lecture and Laboratory
4 Credits (2.5+3P)
Introduction to anabolic metabolism and hormonal regulation. Biochemical principles of the mechanism and regulation of replication, transcription, recombination and translation in prokaryotes and eukaryotes. Introduction to DNA-based information technology. Taught with BCHE 396 with additional work required. May be repeated up to 3 credits.
Prerequisite: C- or better in BCHE 395.
Learning Outcomes
1. Recognize the essential biochemical reactions and enzymatic mechanisms required for nucleic acid, amino acid, and fatty acid synthesis.
2. Learn the biochemical reaction mechanisms associated with key elements of the central dogma of molecular biology.
3. Identify the reactions and enzymes required for DNA maintenance and replication, transcription and RNA polymerization, and the translation of mRNA to primary amino acid sequence and protein synthesis.
4. Conduct experiments safely.
5. Select and manipulate plasmids to achieve desired recombinant DNA for experimentation.
6. Obtain relevant DNA sequence information from public databases.
7. Transform and isolate plasmid DNA to be used for cloning procedures.
8. Design DNA specific primers for PCR reactions.
9. Perform restriction digest and ligation reactions. 1
10. Analyze DNA sequence to validate the outcome of recombinant DNA experimentation. 1
11. Demonstrate scientific dissemination skills by attending scientific seminars or review primary literature and provide summary via written or oral presentation.

BCHE 424. Experimental Biochemistry I
3 Credits (1.25+6P)
Laboratory techniques required for experimentation with recombinant DNA such as nucleic acid isolation and purification, polymerase chain reaction (PCR), sequence analysis, and directed mutagenesis using genetic material from both prokaryotic and eukaryotic organisms.

Prerequisite(s): C- or better in BCHE 395, and BCHE 396 or GENE 315.

Learning Outcomes

1. Conduct experiments safely
2. Select and manipulate plasmids to achieve desired recombinant DNA for experimentation
3. Obtain relevant DNA sequence information for gene of interest from public databases
4. Make buffers and reagents necessary for transforming and isolating plasmid DNA from E. coli
5. Transform and isolate plasmid DNA to be used for cloning of gene of interest
6. Design primers for PCR to enrich gene of interest from genomic DNA
7. Analyze DNA sequence and choose appropriate restriction enzymes for cloning gene of interest
8. Design primers for PCR to incorporate restriction sites at the ends of gene of interest
9. Perform restriction digest on plasmid DNA and PCR products 1
10. Perform ligation reaction to combine gene of interest with plasmid DNA 1
11. Analyze sequence of plasmid containing gene of interest to validate the outcome of experimentation

BCHE 425. Experimental Biochemistry
3 Credits (1.25+6P)

Introduction to fundamental techniques used to explore structure and function of biological macromolecules such as proteins, carbohydrates, lipids, and nucleic acid. Course covers analyzing and reporting experimental data; enzymology; quantitative methods to determine biological molecules; basic principles of electrophoresis, chromatography, and spectroscopic immunochemistry. May be repeated up to 3 credits.

Prerequisite: C- or better in BCHE 395.

Learning Outcomes

1. Understand and implement various methods of protein purification as well as qualitative and quantitative analysis of protein preparations
2. Become proficient in absorbance and fluorescence spectroscopy.
3. Determine ligand binding parameters.
4. Understand and measure enzyme kinetics and inhibition.
5. Perform basic protein crystallization and structure determination.
6. Develop skills in scientific writing and presentation.

BCHE 432. Physical Biochemistry
3 Credits (3)

This course focuses on the theoretical principles of biophysical techniques and how they are applied to biological problems. Primary literature is used heavily to explain concepts and applications along with periodic demonstrations of biophysical techniques using department instruments. Students taking this course will be expected to present primary literature highlighting the applications of various techniques. May be repeated up to 3 credits. CHEM 431, or CHEM 433.

Prerequisite: One semester of undergraduate physical chemistry, e.g.

Learning Outcomes

1. Understand the theoretical principles of spectroscopic and biophysical techniques.
2. Understand the appropriate applications for various instruments.
3. Be able to interpret spectroscopic and biophysical data.
4. Understand and describe biophysical literature.
5. Be able to describe biophysical studies to a diverse audience of scientists and non-scientists.

BCHE 440. Biochemistry Seminar
1 Credit (1)

Introduction to current literature in biochemistry and molecular biology. Selected topics in the field will be presented by the faculty. Students will present written and oral reports from literature searches. Restricted to: BCHE majors.

Prerequisite(s): BCHE 395.

BCHE 441. Advanced Research in Biochemistry
1-3 Credits

Investigation of biochemical problems and the development of special techniques. May be repeated for a maximum of 3 credits.

Prerequisites: consent of instructor, 16 credits of chemistry and 3.0 GPA in chemistry for nonmajors.

BCHE 451. Special Topics
1-3 Credits

Same as CHEM 451. May be repeated for a maximum of 12 credits.

Prerequisite: consent of instructor.

BCHE 455. Independent Studies
1-3 Credits

Independent studies directed by consulting faculty.

Prerequisite: consent of instructor.

BCHE 542. Biochemistry I
3 Credits (3)

Relationship between macromolecular structure and function. Basic enzymology. Energy metabolism.

Prerequisite(s): CHEM 314 and CHEM 431 or CHEM 433; or BCHE 395 or equivalent.

BCHE 545. Molecular and Biochemical Genetics
3 Credits (3)

An accelerated treatment of the molecular basis of gene expression. Discussion of chemical, enzymological, and genetic techniques of molecular biology. Same as BIOL 545.

Prerequisite: BCHE 542 or equivalent.

BCHE 546. Biochemistry II
3 Credits (3)

Intermediary metabolism: catabolic and anabolic pathways of carbohydrates, lipids, amino acids, and nucleic acids, including their regulation.

Prerequisite: BCHE 542 or BCHE 395 with consent of instructor.

BCHE 598. Special Research Programs
1-3 Credits

May be repeated for a maximum of 6 credits. Same as CHEM 598. Graded S/U.

BCHE 599. Master's Thesis
15 Credits

May be repeated for a maximum of 6 credits. Same as CHEM 599.

BCHE 600. Research
1-15 Credits

May be repeated for a maximum of 20 credits. PR/U grading. Same as CHEM 600.

BCHE 647. Physical Biochemistry
3 Credits (3)

Fundamental applications of physical chemistry to the investigation of biological metabolites and biological macromolecules, including proteins, oligo-nucleotides, and molecular arrays with an emphasis on

understanding biological functions based on chemical structures. Taught with BCHE 432. May be repeated up to 3 credits.
Prerequisite: C- or better in CHEM 430 or CHEM 433 or BCHE 542.

Learning Outcomes

1. Understand the theoretical principles of spectroscopic and biophysical techniques.
2. Understand the appropriate applications for various instruments.
3. Be able to interpret spectroscopic and biophysical data.
4. Understand and describe biophysical literature.
5. Be able to describe biophysical studies to a diverse audience of scientists and non-scientists.

BCHE 649. Topics in Biochemistry
1-3 Credits
Selected topics of current interest designated by title and credit. May be repeated for a maximum of 3 credits.

BCHE 700. Doctoral Dissertation
20 Credits
May be repeated for a maximum of 20 credits. Graded PR/U. Same as CHEM 700.