BIOL-202 – Introduction to Biochemistry

University Arts and Science

Effective Term & Year: Fall 2022
Course Outline Review Date: 2026-09-01

Program Area: Math and Sciences

Description:

BIOL 202 focuses on fundamental concepts in biochemistry including protein structure and function, enzyme kinetics, DNA-based technologies, and bioenergetics. Lectures will emphasize the intimate relationship between protein structure and function, and new technologies that are being used in the field of biochemistry. Topics include cellular energetics, enzyme kinetics, protein structure and function, glycobiology, current DNA-based technologies, and ATP metabolism, Laboratory exercises emphasize data collection and analysis and technical writing skills. Lab topics include enzyme kinetics, SDS PAGE, and bioinformatics.

Program Information:

This course can be used as either a required course or an elective in an Associate of Science degree, with transfer to several degree programs at other institutions. It is recommended for second-year university transfer students wishing to major in biology or biochemistry.

Delivery Methods: On-campus (Face-to-Face)

Credit Type: College of the Rockies Credits

Credits: 3

Course type/s: Lab Sciences, Sciences

Instructional Activity and Hours:

Activity	Hours
Classroom, Directed Studies or Online Instruction	45

Seminar/Tutorials	
Laboratory/Studio	45
Practicum/Field Experience	
Co-op/Work Experience	
Other	
Total	90

Course Requisites:

- Complete all of the following
  - Completed the following:
    - BIOL201 – Cell Biology (3)
  - Completed or concurrently enrolled in:
    - CHEM202 – Organic Chemistry 2 (3)

Flexible Assessment: Yes

In some cases students may be able to apply for recognition of prior learning outside the classroom. This flexible assessment process provides equivalent course credit. It is a rigorous process that may include external evaluation, worksite assessment, demonstration, standardized test, self-assessment, interview, products/portfolio, and challenge exam, or other measures as appropriate. Tuition fees apply. Contact an education advisor for more information.

Course Transfer Credit:

For information about receiving transfer credit for courses taken at either British Columbia or Alberta institutions, please see https://www.bctransferguide.ca/ or https://transferalberta.alberta.ca . For more transfer credit information, please visit https://www.cotr.bc.ca/Transfer

All requests for course transfer credit from institutions in British Columba or elsewhere should go to the College of the Rockies Enrolment Services office.

Textbook Resources:

Textbook selection varies by instructor and may change from year to year. At the Course Outline Effective Date the following textbooks were in use:

Stryer, L, Berg, JM, Tymoczko, JL, Gatto Jr., 2019. GJ. Biochemistry 9th Ed. WH Freeman

Please see the instructor's syllabus or check COTR's online text calculator https://textbook.cotr.bc.ca/ for a complete list of the currently required textbooks.

Learning Outcomes:

Upon the successful completion of this course, students will be able to:

- use bioinformatics tools to search for human structural or transport proteins in the protein data bank, identify orthologs of a given protein, and identify any motifs or domains that are present. Students will identify key amino acid sequences within the protein as well as possible or previously identified detrimental amino acid mutations that may affect the structure and function of the protein;
- describe the thermodynamics and process of protein folding including the role of chaperones and relate it to examples of human diseases, such as amyloidosis;
- illustrate the principles of protein-ligand interactions, cooperative binding, and the Hill coefficient using the oxygen storage protein, myoglobin, and the oxygen transport protein, hemoglobin, as examples and relate these proteins to fetal versus maternal circulation, high-altitude living, and carbon monoxide poisoning;
- perform an enzyme kinetic experiment to illustrate the principles of Michaelis-Menten kinetics, including substrate-enzyme interactions, enzyme inhibitors, and catalytic rate;
- critically analyze and summarize the important findings of an article that uses a current method in DNA technology such as CRISPR-Cas9, Next Generation Sequencing, use of DNA microarrays, and/or protein-protein interactions; and
- identify the enzymes and reaction mechanisms of the glycolysis pathway and determine how these steps are affected in response to hypoxic stress
- identify the enzymes and reaction mechanisms of the citric acid cycle
- identify the complexes of the electron transport chain and describe the transfer of electrons between each complex
- highlight the relationship between structure and function of ATP synthase and demonstrate

This course should help students:

- comprehend and interpret detailed scientific and/or technical information from text;
- search for information in the professional literature;
- critically evaluate information for accuracy, relevance and importance;
- think critically and act logically to evaluate situations;
- apply problem-solving skills;
- assess and apply potential mathematical strategies for suitability and effectiveness;
- work effectively with others in a laboratory situation;
- receive, comprehend and interpret a sequence of instructions;
- plan and sequence a number of overlapping activities;
- use equipment requiring careful procedures; and
- draw reasonable conclusions from observations.

Course Topics:

LECTURE TOPICS:

- Foundations of Biochemistry
- Amino Acid Structure and Classification
- Three-Dimensional Structure of Proteins
- Protein Function
- Enzymes: Introduction and Function
- Enzyme Kinetics
- Enzyme Mechanisms and Catalytic Regulation: Serine Proteases
- Carbohydrates: Structure and Classification
- Nucleic Acids: Structure and Function
- DNA-Based Information Technologies
- Bioinformatics and Genomics
- Lipids and Cell Membranes
- Bioenergetics
  Glycolysis: Stages, Fermentation, and Regulation
  Citric Acid Cycle: TCA Reactions and Function of the Pyruvate Dehydrogenase Complex
- Oxidative Phosphorylation: The Respiratory Chain and Regulatory Mechanisms
- Oxidative Phosphorylation: ATP Synthase (Structure, Subunits, and Rotational Catalysis).

LAB LEARNING OUTCOMES:

- Create an electron lab notebook that includes all of the student’s thoughts, results, and conclusions about their experiments via prose, graphing, images, and videos including safety information and modifications to the lab protocol.
- Test the calibration of micropipettes.
- Create an appropriate buffer solution for a biochemistry experiment using the Henderson-Hasselbalch equation
- Determine the maximum absorbance for a given substance using a spectrophotometer.
- Identify an unknown amino acid using a spectrophotometer.
- Use the Bradford and Lowry assays to determine the concentration of a protein in solution.
- Perform an enzyme kinetic experiment to illustrate the principles of Michaelis-Menten kinetics, including substrate-enzyme interactions, enzyme inhibitors, and catalytic rate.
- Perform an ammonium sulfate precipitation to extract a protein from solution and run it on an SDS-PAGE gel.
- Perform a silica gel column chromatography of a pigmented material such as spinach leaves.
- Use restriction endonucleases to digest DNA samples and run them on an agarose gel.
- Design, implement, troubleshoot, and present the results of a lab based on a specific interest or leading from one of the labs performed in the course.

LAB TOPICS:

- Biological Buffers
- Spectrophotometer
- Amino Acid Titration
- Protein Extraction
- SDS-PAGE
- Enzyme Kinetics
- Silicon Column Chromatography
- Polymerase Chain Reaction

See instructor’s syllabus for the detailed outline of weekly readings, activities and assignments.

Evaluation and Assessments

Assessment Type: On-Campus (face-to-face)

Assessment Type	% of Total Grade
Midterm(s)/Unit Exam(s)	20%
Course Assignments	10%
Final Exam	30%
Lab Reports/Assignments	40%
Total	100%

Grade Scheme

A+	A	A-	B+	B	B-	C+	C	C-	D	F
>=90	89-85	84-80	79-76	75-72	71-68	67-64	63-60	59-55	54-50	<50

Pass requirements: None

Evaluation Notes: A grade of “D” grants credit, but may not be sufficient as a prerequisite for sequential courses.

Exam Attendance:

Students must attend all scheduled exams at the appointed time and place. Instructors may approve an alternate exam to accommodate an illness or personal crisis. Department heads will consider other written requests. Any student who misses a scheduled exam without prior approval will receive a “0” on the exam.

Academic Policies:

College of the Rockies policies related to courses can be found at

https://cotr.bc.ca/about-us/college-policies/ and include the following:

- Policy 2.4.3 Students with Documented Disabilities
- Policy 2.4.4 Student Conduct (plagiarism, other cheating, behavioral misconduct)
- Policy 2.5.8 Academic Performance
- Policy 2.5.3 Grade Appeal
- Policy 2.4.9 Student Concerns Re Faculty

Course Changes:

The College of the Rockies updates course outlines regularly to meet changing educational, employment and marketing needs. The instructor will notify students in writing of any updates to this outline during the semester. The instructor reserves the right to revise, add or delete material while meeting the learning outcomes of this course outline.