COLLEGE OF THE ROCKIES

# Introduction to Biochemistry - BIOL 202

University Studies Program

## Course Outline

**COURSE IMPLEMENTATION DATE:** **January 1984**
**OUTLINE EFFECTIVE DATE:** **January 2021**
**COURSE OUTLINE REVIEW DATE:** **September 2026**

**GENERAL COURSE 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:** This course is delivered face to face.

**COTR Credits:** 3

**Hours for this course:** 90 hours

**Typical Structure of Instructional Hours:**

| Instructional Activity | Duration |
|---|---|
| Lecture Hours | 45 |
| Seminars / Tutorials | |
| Laboratory / Studio Hours | 45 |
| Practicum / Field Experience Hours | |
| Other Contact Hours | |
| **Total** | 90 |

**Practicum Hours (if applicable):**

| Type of Practicum | Duration |
|---|---|
| On-the-job Experience | N/A |
| Formal Work Experience | N/A |
| Other | N/A |
| **Total** | |

© College of Rockies

**Course Outline Author or Contact:**
Lynnette Kuervers, BSc, PhD

Signature

---

**APPROVAL SIGNATURES:**

Department Head
Erin Aasland Hall
E-mail: aaslandhall@cotr.bc.ca

Department Head Signature

Dean of Business and University Studies
Darrell Bethune
E-mail: bethune@cotr.bc.ca

Dean Signature

EDCO

Valid from: January 2021 – September 2026

Education Council Approval Date

---

**COURSE PREREQUISITES AND TRANSFER CREDIT:**

**Prerequisites:** BIOL 201

**Corequisites:** CHEM 202

**Prior Learning Assessment (FA):**

Credit can be awarded for this course through FA ☑ Yes ☐ No

Learners may request formal recognition for flexible assessment at the College of the Rockies through one or more of the following processes: External Evaluation, Worksite Assessment, Demonstration, Standardized Test, Self-assessment, Interview, Products/Portfolio, Challenge Exam. Contact an Education Advisor for more information.

**Transfer Credit:** For transfer information within British Columbia, Alberta and other institutions, please visit http://www.cotr.bc.ca/Transfer

Students should also contact an academic advisor at the institution where they want transfer credit.

**Prior Course Number:** N/A

---

**© College of Rockies**

**Textbooks and Required 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 [http://go.cotr.bc.ca/tuition/tCalc.asp](http://go.cotr.bc.ca/tuition/tCalc.asp) for a complete list of the currently required textbooks.*

---

**LEARNING OUTCOMES:**

Upon the successful completion of this course, student 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

**© College of Rockies**

- draw reasonable conclusions from observations.

---

**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.

**© College of Rockies**

- 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 ASSESSMENT:**

| Assignments | % Of Total Grade |
|---|---|
| **Lecture** | |
| Midterm(s)/Unit Exam(s) | 20% |
| Course Assignments | 10% |
| Final Exam | 30% |
| **Lab** | |
| Lab Reports/Assignments | 40% |
| Total | 100% |

*Please see the instructor's syllabus for specific classroom policies related to this course, such as details of evaluation, penalties for late assignments, and use of electronic aids.*

---

**EXAM POLICY:**

Students must attend all required scheduled exams that make up a final grade at the appointed time and place.

Individual instructors may accommodate for illness or personal crisis. Additional accommodation will not be made unless a written request is sent to and approved by the appropriate Department Head prior to the scheduled exam.

Any student who misses a scheduled exam without approval will be given a grade of "0" for the exam.

**© College of Rockies**

**COURSE GRADE:**

Course grades are assigned as follows:

| **Grade** | A+ | A | A- | B+ | B | B- | C+ | C | C- | D | F |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mark** (Percent) | ≥ 90 | 89-85 | 84-80 | 79-76 | 75-72 | 71-68 | 67-64 | 63-60 | 59-55 | 54-50 | < 50 |

A grade of "D" grants credit, but may not be sufficient as a prerequisite for sequential courses.

---

**ACADEMIC POLICIES:**

*See [www.cotr.bc.ca/policies](www.cotr.bc.ca/policies) for general college policies related to course activities, including grade appeals, cheating and plagiarism.*

---

**© College of Rockies**