

COURSE SYLLABUS



COURSE TITLE: CHEM-255: Biochemistry

CLASS SECTION: 001

TERM: 2025W

COURSE CREDITS: 3

DELIVERY METHOD(S): In Person

Camosun College campuses are located on the traditional territories of the Ləkʷəŋən and W̱SÁNEĆ peoples. We acknowledge their welcome and graciousness to the students who seek knowledge here.

Learn more about Camosun's [Territorial Acknowledgement](#).

Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable explanation in advance, you will be removed from the course and the space offered to the next waitlisted student.

INSTRUCTOR DETAILS

NAME: Armando Jardim, Ph.D.

EMAIL: jardima@camosun.ca

OFFICE: F348D, Fisher Building, Lansdowne Campus

HOURS: Monday 8:30-9:20, Tuesday 9:30-10:30, Wednesday 2:30-3:30, Friday 9:30-10:30

LECTURES:

Tuesday 8:30 – 9:20 am Wilna Thomas 201

Wednesday 8:30 – 9:20 am Ewing 344

Thursday 8:30 – 9:20 am Wilna Thomas 201

Friday 8:30 – 9:20 am Ewing 344

LABORATORY:

Thursday 11:30 – 1:20 pm in F360 (**Laboratory component – compulsory attendance**)

Feel free to contact me by email, including in the evenings and on weekends, to correspond by email or to arrange an appointment.

As your course instructor, I endeavour to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me. Camosun College is committed to identifying and removing institutional and social barriers that prevent access and impede success.

CALENDAR DESCRIPTION

This course concerns fundamental aspects of biomolecules and biochemical processes and their relevance to biotechnology and health. Topics include: noncovalent interactions, buffers, structure-function relationships in biomolecules, enzymology, lipids and membranes, bioenergetics; carbohydrate, lipid, amino acid and

nucleotide metabolism, DNA synthesis, gene expression, protein synthesis and prevalent biochemistry laboratory techniques.

PREREQUISITE(S):

All of:

- CHEM 121

CO-REQUISITE(S):

All of:

- C in CHEM 230

COURSE LEARNING OUTCOMES / OBJECTIVES

Upon completion of this course a student will be able to:

1. Describe the fundamental characteristics of proteins, including enzymes, carbohydrates, lipids, and the nucleic acids, DNA and RNA.
2. Describe the chemical and biochemical principles governing the structure-function relationships of biomolecules and membranes.
3. Describe the underlying themes of key biochemical processes, including metabolism, bioenergetics, gene expression and protein synthesis.
4. Describe and evaluate the important aspects of the biochemical framework of cellular function at a molecular level, and the chemical bases thereof.
5. Use the basic vocabulary of biochemistry.
6. Explain the significance of biochemistry in clinical and veterinary medicine, laboratory analyses, nutrition, agriculture, and biotechnology.
7. Isolate specific proteins using gel-permeation, ion-exchange, and affinity-based column chromatography methods.
8. Analyze proteins by SDS-polyacrylamide electrophoresis.
9. Conduct polymerase chain reaction amplification of DNA molecules.
10. Utilize agarose gel electrophoresis for analysis of DNA samples.
11. Critically analyze the results obtained using each of the biochemical experimental techniques described above.
12. Work with an awareness of the basic safety considerations and general procedures associated with a biochemistry laboratory.

REQUIRED MATERIALS

**Course Textbook: Fundamentals of Biochemistry, Life at the Molecular Level. Sixth Edition
VOET, D., VOET, J., PRATT, C.W., HEILMAN, D., and WOSKI, S. (2024) 6 edition. WILEY.**

This textbook is required for this course. It may be purchased from the Lansdowne Campus bookstore. Chapter study guides are included in the course pack also containing the laboratory manual (please see below). Links to relevant web-based learning resources are presented in the textbook. A collection of relevant lecture slides, largely based on this textbook, are available as a separate course pack (please see below).

Chem 255 Laboratory Manual & Course Study Guides.

This course pack contains experimental procedures with introductory material that, along with the textbook, provide an understanding of the biochemical techniques employed in the laboratory component of the course. This course pack also includes chapter study guides for optimal use of the textbook and lecture notes. This course pack is required material and is available through D2L.

Chem 255 Lecture Slides Course Package.

This required material has proven to be vital in promoting optimal lecture-based learning, in-class discussion, and salient notetaking. The course powerpoint slides can be downloaded from D2L.

Safety glasses

Safety glasses are required when handling hazardous chemicals, and are recommended when handling laboratory glassware. Each student is required to provide her or his own pair of safety glasses. Students lacking safety glasses when they are required will not be permitted in the laboratory. Prescription glasses will suffice.

Lab coats

Lab coats are required for all experimental work in the laboratory. Each student is required to provide her or his own lab coat.

Disposable plastic gloves

Disposable, plastic, 'non-allergenic' gloves will be available in the laboratory and are to be used when appropriate to protect the skin from potentially hazardous chemicals or to protect biochemicals from degradative enzymes found on the skin.

Calculator

A scientific calculator is required at times in the laboratory, in lecture, and during term tests and the final exam. Each student is required to provide her or his own calculator. Cell phone-based, tablet-based or computer based calculators, or graphing calculators, cannot be used during term tests or the final exam.

COURSE SCHEDULE, TOPICS, AND ASSOCIATED PREPARATION / ACTIVITY / EVALUATION

The following schedule and course components are subject to change with reasonable advance notice, as deemed appropriate by the instructor.

WEEK or DATE RANGE	ACTIVITY or TOPIC	OTHER NOTES
Week 1 Jan 6-10	Course introduction and orientation; Defining biochemistry - the central life science; Perspective on the origins and early developments in biochemistry; 'Biochemically relevant' elements, major ions & trace elements; organic compounds, functional groups & linkages; Metric conversions; Noncovalent interactions; Buffers & buffering; pH & pKa; Henderson-Hasselbalch equation. Thursday Lab, January 9 - Introduction to experimental biochemistry and laboratory safety.	Please refer to D2L for helpful information on preparation and follow-up.

WEEK or DATE RANGE	ACTIVITY or TOPIC	OTHER NOTES
Week 2 Jan 13-17	Buffer calculations; The blood buffer system; Laboratory buffers; Introduction to proteins and amino acids; Structures, chemical characteristics, and properties of amino acids; Amino acid derivatives; Ionization (pH – pKa relationships); Hydrophathy; Peptide bonds and peptide bond groups; Amino acid analysis. Thursday Lab, January 16: Mini Experiment Buffer preparation; <i>Making a Tris-HCl buffer.</i>	Please refer to D2L for helpful information on preparation and follow-up.
Week 3 Jan 20-24	Protein sequence determination; Peptide mapping; Putative protein sequences from gene sequences; Comparative protein sequence analysis; Introduction to proteins and proteomics; Predicting 3-D protein structure; Implications of peptide bond groups; The nature of alpha-helices; Thursday Lab, January 23: <i>Experiment 1. Separation of Proteins by Gel Permeation Column Chromatography</i>	Please refer to D2L for helpful information on preparation and follow-up.
Week 4 Jan 27-31	Secondary structure of proteins, α -helix, β -sheet, loops, turns, motifs, domains, and folds in tertiary and quaternary structures; Implications of quaternary structures; Protein machines; Protein folding, stability, denaturation and renaturation; Quaternary protein structure-function relationships; Quaternary structures of fibrous proteins; protein purification. Thursday Lab, January 30: <i>Experiment 2. Purification of Proteins by Ion-Exchange Column Chromatography.</i> <i>Experiment 3. Affinity Column Chromatography, Part 1.</i>	Please refer to D2L for helpful information on preparation and follow-up.
Week 5 Feb 3-7	General properties and classes of enzymes; Introduction to enzyme kinetic constants. Pseudo-first order reactions; Determination and interpretation of the rate constants K_m , k_{cat} & k_{cat}/K_m ; Michaelis-Menton equation. Thursday Lab, February 6 <i>Experiment 3. Isolation of Concanavalin A by Affinity Chromatography, Part 2. Discussion of Results & Comparative Review of Chromatography Principles & Techniques.</i>	Please refer to D2L for helpful information on preparation and follow-up.
Week 6 Feb 10-14	Concepts in reversible and irreversible enzyme inhibition; Kinetics of enzyme inhibition; Interpretation of Lineweaver-Burk Plots; Allosteric and covalent regulation of enzyme activity; Chemical mechanisms of enzyme catalysis; Proximity effects in enzyme catalysis. Midterm 1 review <u>Thursday Lab Period, February 13th Midterm Test 1. 11:30 pm to 1:20 pm in F360</u>	Please refer to D2L for helpful information on preparation and follow-up.

WEEK or DATE RANGE	ACTIVITY or TOPIC	OTHER NOTES
Week 7 Feb 17-21	Family Day and Reading Break	
Week 8 Feb 24-28	Transition state stabilization in enzyme catalysis; Mechanism of chymotrypsin activity; Cofactors: coenzymes and essential ions; Biochemical structures and roles of vitamin-derived and metabolite-derived coenzymes, protein purification and structure determination Thursday Lab February 27: Experiment 4. <i>SDS-Polyacrylamide Gel Electrophoresis (SDS-PAGE): Separation & Identification of Proteins, and Determination of Protein Molecular Weight, Part 1. Theory & Preparation of a Polyacrylamide Gel for the Separation of Proteins.</i>	Please refer to D2L for helpful information on preparation and follow-up.
Week 9 Mar 3-7	Vitamins and health; Protein coenzymes; Vitamin-like compounds; Carbohydrate biochemistry: Roles and structures of monosaccharides, disaccharides, polysaccharides, and proteoglycan complexes; Glycoproteins and glycolipids; The nature of lipids; Classes of lipids. Thursday Lab, March 6: Experiment 4 - <i>SDS-PAGE Part 2, Protein Electrophoresis and Staining for Detection of Separated Proteins.</i>	Please refer to D2L for helpful information on preparation and follow-up.
Week 10 Mar 10-14	Lipid biochemistry: Fatty acids; Phospholipids; Plasmalogens; Sphingolipids; Sources of, and intake recommendations, for SFA, MUFA and PUFA; Sterols and steroids; Nature of membranes; Membrane proteins; Membrane transport; Transmembrane signal transduction; Anabolic and catabolic metabolic reactions; Central metabolism; Metabolic flux; High energy compounds and bioenergetics. Thursday Lab, March 13: Experiment 4. <i>SDS-PAGE Part 3, Analyses of SDS-PAGE Results & Further Principles and Theory.</i>	Please refer to D2L for helpful information on preparation and follow-up.
Week 11 Mar 17-21	Nucleotide metabolism; Purine and pyrimidine biosynthetic pathways; Nucleosides & nucleotides; DNA structure. DNA replication, RNA structure and mRNA processing. Polymerase Chain Reaction (PCR); Site-Specific Mutagenesis; and Sanger enzymatic DNA sequencing. Midterm test 2 review. <u>Thursday Lab Period, March 20 Midterm Test 2 11:30 to 1:20 pm in F360</u>	Please refer to D2L for helpful information on preparation and follow-up.
Week 12 Mar 24-28	Glycolytic pathway; Metabolic fates of pyruvate and glucose-6-phosphate; Regulation of glycolysis; Gluconeogenesis; Cori Cycle; Glucose-Alanine Cycle; Pentose Phosphate Pathway; Glycogen Metabolism; Carbohydrate metabolism during fasting; Macronutrient utilization at rest and during exercise Thursday Lab, March 27 Experiment 5. Steady-State Enzyme Kinetic Analysis of Horseradish Peroxidase	Please refer to D2L for helpful information on preparation and follow-up.

WEEK or DATE RANGE	ACTIVITY or TOPIC	OTHER NOTES
Week 13 Mar 31- Apr 4	Lipid metabolism; Lipoprotein metabolism; Beta-oxidation; Ketogenesis; Fatty acid synthesis; Regulation of fatty acid synthesis and oxidation; Cholesterol synthesis. Amino acid metabolism; Assimilation of ammonia; Amino acid catabolism and anabolism; Renal glutamine metabolism; Thursday Lab, April 3: Experiment 7. Polymerase Chain Reaction (PCR) Amplification of Kanamycin Resistance Gene	Please refer to D2L for helpful information on preparation and follow-up.
Week 14 Apr 7-11	Pyruvate dehydrogenase complex; Citric acid cycle (aka Krebs Cycle; TCA Cycle); PDH regulation; Electron transport & oxidative phosphorylation; Glycerol phosphate and malate-aspartate shuttle systems. Metabolic Pathways Chart project; Final exam orientation. Thursday Lab, April 10: Review for Final	Please refer to D2L for helpful information on preparation and follow-up.
	Final Exam The date & time of the final exam will be posted by the College during the 2025W semester.	Please refer to D2L for helpful information on preparation.

Students registered with the Centre for Accessible Learning (CAL) who complete quizzes, tests, and exams with academic accommodations have booking procedures and deadlines with CAL where advanced notice is required. Deadlines can be reviewed on the [CAL exams page](http://camosun.ca/services/accessible-learning/exams.html). <http://camosun.ca/services/accessible-learning/exams.html>

EVALUATION OF LEARNING

DESCRIPTION	WEIGHTING
Metabolic Pathways Chart Project This assignment is described in detail in a handout to be provided once topics of intermediary metabolism arise formally in the course. Each individual is required to hand in the results of her or his own work. This metabolic pathways chart is due on the final day of class.	5%
Quizzes Quizzes are designed for review of lecture materials and to help students master major concepts in biochemistry. These quizzes will be held during the first 15 minutes of the laboratory section. Four quizzes will make up 20% of the final grade.	20%

DESCRIPTION	WEIGHTING
<p>Term Test 1 This term test covers relevant material from approximately the first third of the course. The delineation of material that students are responsible for, including that from the laboratory section of the course, will be provided in class about one week prior to the date of the test. This is a 110-minute test that will be written during the lab period on Thursday Lab Period, February 13th Midterm Test 1. 11:30 pm to 1:20 pm in F360 in F360. If this term test is missed due to illness, or a similarly justifiable reason, with accompanying documentation the percentage value of that term test will be added to the value of the final exam.</p>	15%
<p>Term Test 2 This term test covers relevant material from approximately the second third of the course. The delineation of material that students are responsible for, including that from the laboratory section of the course, will be provided in class about one week before the date of the test. This is a 110-minute test that will be written during the lab period on Thursday Lab Period, March 20 Midterm Test 2 11:30 to 1:20 pm in F360 in F360. If this term test is missed due to illness, or a similarly justifiable reason, with accompanying documentation the percentage value of that term test will be added to the value of the final exam.</p>	15%
<p>Laboratory Experiments Laboratory participation and performance contributes 7.5% to the final grade. Attendance in the lab periods is mandatory. No laboratory experiment can be missed without an acceptable reason submitted in writing, such as a letter from a MD. Pre-lab assignments and flowcharts also contribute to a total of 7.5% of the final grade. <i>Please come to each lab period prepared for the experiment.</i> Understanding of the principles, scientific and technical bases, and results of each experiment is subject to examination on term tests and the final exam.</p>	15%
<p>Final Exam The final exam is a comprehensive exam that includes components from the laboratory section of the course. The value this exam contributes to the final grade is 35%. The time and location of the final exam will be published by the College during the semester. Attendance at the final exam is mandatory. Appropriate documentation must accompany an explanation for absence if an incomplete grade (I grade) is warranted.</p>	30%
TOTAL	100%

If you have a concern about a grade you have received for an evaluation, please come and see me as soon as possible. Refer to the [Grade Review and Appeals](http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf) policy for more information.
<http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf>

COURSE GUIDELINES & EXPECTATIONS

Students may **not** use recording devices in the classroom without the prior permission of the instructor or the Centre for Accessible Learning. The instructor's permission is not required when the use of a recording device is sanctioned by the College's Centre for Accessible Learning in order to accommodate a student's disability, *and* when the instructor has been provided with an instructor notification letter which specifies the use of a recording device. Such recordings made in the classroom are for the student's personal use only, and distribution of recorded material is prohibited. Recordings made during the course would include statements, questions and comments made by students in the class, and these are not to be disseminated or repeated in

any manner based on the recordings. Otherwise, please have cell phones turned off and put away while in lectures. *Thank you.*

SCHOOL OR DEPARTMENTAL INFORMATION

Camosun College is a scent-free institution. Please refrain from wearing scents. Thank you.

STUDENT RESPONSIBILITY

Enrolment at Camosun assumes that the student will become a responsible member of the College community. As such, each student will display a positive work ethic, assist in the preservation of College property, and assume responsibility for their education by researching academic requirements and policies; demonstrating courtesy and respect toward others; and respecting expectations concerning attendance, assignments, deadlines, and appointments.

SUPPORTS AND SERVICES FOR STUDENTS

Camosun College offers a number of services to help you succeed in and out of the classroom. For a detailed overview of the supports and services visit <http://camosun.ca/students/>.

Academic Advising	http://camosun.ca/advising
Accessible Learning	http://camosun.ca/accessible-learning
Counselling	http://camosun.ca/counselling
Career Services	http://camosun.ca/coop
Financial Aid and Awards	http://camosun.ca/financialaid
Help Centres (Math/English/Science)	http://camosun.ca/help-centres
Indigenous Student Support	http://camosun.ca/indigenous
International Student Support	http://camosun.ca/international/
Learning Skills	http://camosun.ca/learningskills
Library	http://camosun.ca/services/library/
Office of Student Support	http://camosun.ca/oss
Ombudsperson	http://camosun.ca/ombuds
Registration	http://camosun.ca/registration

Technology Support

<http://camosun.ca/its>

Writing Centre

<http://camosun.ca/writing-centre>

If you have a mental health concern, please contact Counselling to arrange an appointment as soon as possible. Counselling sessions are available at both campuses during business hours. If you need urgent support after-hours, please contact the Vancouver Island Crisis Line at 1-888-494-3888 or call 911.

COLLEGE-WIDE POLICIES, PROCEDURES, REQUIREMENTS, AND STANDARDS

Academic Integrity

Students are expected to comply with all College policy regarding academic integrity; which is about honest and ethical behaviour in your education journey. The following guide is designed to help you understand your responsibilities: <https://camosun.libguides.com/academicintegrity/welcome>

Please visit <https://camosun.ca/sites/default/files/2021-05/e-1.13.pdf> for Camosun's Academic Integrity policy and details for addressing and resolving matters of academic misconduct.

Academic Accommodations for Students with Disabilities

Camosun College is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging appropriate academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a documented disability and think you may need accommodations, you are strongly encouraged to contact the Centre for Accessible Learning (CAL) and register as early as possible. Please visit the CAL website for more information about the process of registering with CAL, including important deadlines: <https://camosun.ca/cal>

Academic Progress

Please visit <https://camosun.ca/sites/default/files/2023-02/e-1.1.pdf> for further details on how Camosun College monitors students' academic progress and what steps can be taken if a student is at risk of not meeting the College's academic progress standards.

Course Withdrawals Policy

Please visit <https://camosun.ca/sites/default/files/2021-05/e-2.2.pdf> for further details about course withdrawals. For deadline for fees, course drop dates, and tuition refund, please visit <https://camosun.ca/registration-records/tuition-fees#deadlines>.

Grading Policy

Please visit <https://camosun.ca/sites/default/files/2021-05/e-1.5.pdf> for further details about grading.

Grade Review and Appeals

Please visit <https://camosun.ca/sites/default/files/2021-05/e-1.14.pdf> for policy relating to requests for review and appeal of grades.

Medical / Compassionate Withdrawals

Students who are incapacitated and unable to complete or succeed in their studies by virtue of serious and demonstrated exceptional circumstances may be eligible for a medical/compassionate withdrawal (see [Medical/Compassionate Withdrawals policy](#)). Please visit <https://camosun.ca/services/forms#medical> to learn more about the process involved in a medical/compassionate withdrawal.

Sexual Violence

Camosun is committed to creating a campus culture of safety, respect, and consent. Camosun's Office of Student Support is responsible for offering support to students impacted by sexual violence. Regardless of when or where the sexual violence occurred, students can access support at Camosun. The Office of Student Support will make sure students have a safe and private place to talk and will help them understand what supports are available and their options for next steps. The Office of Student Support respects a student's right to choose what is right for them. For more information see Camosun's Sexualized Violence Policy: <https://camosun.ca/sites/default/files/2021-05/e-2.9.pdf> and camosun.ca/services/sexual-violence-support-and-education.

To contact the Office of Student Support: oss@camosun.ca or by phone: 250-370-3046 or 250-370-3841

Student Misconduct (Non-Academic)

Camosun College is committed to building the academic competency of all students, seeks to empower students to become agents of their own learning, and promotes academic belonging for everyone. Camosun also expects that all students to conduct themselves in a manner that contributes to a positive, supportive, and safe learning environment. Please review Camosun College's Student Misconduct Policy at <https://camosun.ca/sites/default/files/2021-05/e-2.5.pdf> to understand the College's expectations of academic integrity and student behavioural conduct.

Looking for other policies?

The full suite of College policies and directives can be found here: <https://camosun.ca/about/camosun-college-policies-and-directives>

Changes to this Syllabus: Every effort has been made to ensure that information in this syllabus is accurate at the time of publication. The College reserves the right to change courses if it becomes necessary so that course content remains relevant. In such cases, the instructor will give the students clear and timely notice of the changes.