



UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF BIOLOGICAL SCIENCES
COURSE OUTLINE

1. Course: **BCEM 393 - INTRODUCTION TO BIOCHEMISTRY**

Lecture Sections: L01: MWF 11:00-11:50 ST 140 WINTER 2019

LABORATORIES:

Please note that labs run on a two-week cycle. That is, you will only attend a BCEM 393 lab every two weeks. Please ensure that you attend the correct lab section in the correct week.

Week 1 of the two-week cycle:

Section No.	Day	Time	Room
01 & 02	M	12:30, 16:00	BI 136
03, 04, 05	T	09:00, 12:30, 16:00	BI 136
06, 07	W	12:30, 16:00	BI 136
08, 09, 10	R	09:00, 12:30, 16:00	BI 136
11, 12	F	12:30, 16:00	BI 136

Week 2 of the two-week cycle:

Section No.	Day	Time	Room
13, 14	M	12:30, 16:00	BI 136
15, 16, 17	T	09:00, 12:30, 16:00	BI 136
18, 19	W	12:30, 16:00	BI 136

Labs will begin during the week of January 14, 2018. If your lab section falls in week 1 of the two-week cycle, your first laboratory section will be held during the week of January 14, 2018. If your lab section falls in week 2 of the two-week cycle, your first laboratory session will be held during the week of January 21, 2018). The laboratory manual will be available for download from the course's D2L site.

Course Coordinator; Dr. R.A. Edwards

Instructors: Dr. R.A. Edwards BI 443 403-220-5350 redwards@ucalgary.ca
Dr. R. Turner BI 487 403-220-4308 turnerr@ucalgary.ca

LAB TECHNICIANS: Ms. Jennifer Kearley BI 136

TA's: A schedule of the office hours for the GTAs in this course as well as office hour location is also available from the D2L site.

D2L Site – W2019BCEM393L01:BCEM 393 L01 (Winter 2019)

Biological Sciences Department BI 186; (403) 220-3140; biosci@ucalgary.ca

2. **Prerequisites:** Biology 311 or Medical Sciences 341 (BHSc students only); and Chemistry 351

See section 3.5.C in the Faculty of Science section of the online Calendar

(<http://www.ucalgary.ca/pubs/calendar/current/sc-3-5.html>)

3. **Grading:** The University policy on grading and related matters is described sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Quizzes (5 quizzes x 1% each)	5%		
Laboratories (5 labs x 3% each)	15%		
Midterm Exam	35%	March 2, 2019 1-4pm	ST 135, 140, 148
Final Exam	45%		

There will be a final exam scheduled by the Registrar's office. The final exam is cumulative.

Each piece of work (assignments, laboratory reports, midterm test or final examination) submitted by the student will be assigned a percentage score. The student's average percentage score for the various components listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade, bearing in mind that a grade of F will result if the student does not pass the laboratory component.

Letter Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Min. Percent Required	92	86	82	78	74	70	66	62	58	54	50

In order to pass the course, students will be required to complete 5 lab reports and pass the laboratory component of the course by achieving 50% or more on the laboratory component. If a student's final exam percentage is at least 5% greater than the student's midterm percentage, then the final exam weight will be increased from 45% to 50% of the final grade and the midterm weight will be decreased from 35% to 30%.

4. **Missed Components of Term Work:** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize himself/herself with these regulations. See also [Section E.6](#) of the University Calendar. If you need to provide documentation to support an absence, the following information from the Calendar outlines the regulations:

Supporting Documentation and the Use of a Statutory Declaration

<https://www.ucalgary.ca/pubs/calendar/current/n-1.html>

Students may be asked to provide supporting documentation for an exemption/special request. This may include, but is not limited to, a prolonged absence from a course where participation is required, a missed course assessment, a deferred examination, or an appeal. Students are encouraged to submit documentation that will support their situation. Supporting documentation may be dependent on the reason noted in their personal statement/explanation provided to explain their situation. This could be medical certificate/documentation, references, police reports, invitation letter, third party letter of support or a statutory declaration etc. The decision to provide supporting documentation that best suits the situation is at the discretion of the student. Students cannot be required to provide specific supporting documentation, such as a medical note.

Students can make a Statutory Declaration as their supporting documentation (available at ucalgary.ca/registrar). This requires students to make a declaration in the presence of a Commissioner for Oaths. It demonstrates the importance of honest and accurate information provided and is a legally binding declaration. Several registered Commissioners for Oaths are available to students at no charge, on campus. For a list of locations to access a Commissioners for Oaths, visit ucalgary.ca/registrar.

Falsification of any supporting documentation will be taken very seriously and may result in disciplinary action through the Academic Discipline regulations or the Student Non-Academic Misconduct policy.

If you miss the final exam due to medical reasons, please contact the Registrar's Office. Please see http://www.ucalgary.ca/registrar/exams/deferred_final for reasons that will be accepted to defer a final exam as well as the procedure to apply for a deferred exam.

5. **Scheduled out-of-class activities:** Dates and times of approved class activities held outside of class hours.

Midterm Exam: SAT. MARCH 2; 1:00 PM - 4:00 PM ST 140 and ST 148

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY. If you have a clash with this out-of-class-time-activity, please inform your instructor as soon as possible so that alternative arrangements may be made for you.

6. **Textbook:**

We will be using the following textbook:

Biochemistry: A Short Course. By John L. Tymoczko, Jeremy M. Berg, & Lubert Stryer, W.H. Freeman. 3rd Edition

The 3rd edition of *Biochemistry: A Short Course* is recommended; however the 2nd edition will be adequate. You can choose to purchase either a hardcover, a binder-ready, or an electronic version of the textbook.

Laboratory manual and reports:

The laboratory manual will be available from the D2L course site for download. The laboratory manual describes the reports you are expected to submit for each laboratory. These reports will be submitted to the box designated for submission 7 days (168 hours) after the beginning of your laboratory session in which you did the experiment.

Online course components:

Quizzes will be done on-line using the D2L site. There will be 6 on-line quizzes. Your quiz mark will be derived from the best 5 of these 6 quizzes. They will be open for 7 days each. The quiz will open at 3 p.m. on the days indicated on the

schedule below and close 168 hours later at 3:00 p.m. You can try each quiz twice. The higher of the two marks will be averaged into your mark. These are low stakes quizzes - they are each worth only 1% of your final composite grade. Use them as a learning tool. You are encouraged to study your notes and the textbook before trying a quiz and then to try the first of these two attempts closed book (without using your textbook or notes). From that first attempt note what areas require further study, study them, and then attempt the quiz a second time with your textbook and notes open. The starting date for each of the quizzes is given in the tentative schedule below.

These quizzes are worth only 1% each. They are designed to help you prepare for the exams by assessing your understanding of the concepts we will be studying this semester. Further details about these quizzes will be given before the quiz in the announcements given in lecture.

7. **Examination Policy:** Non-programmable calculators are allowed on tests or examinations. The midterm and final exams will consist of multiple choice and written questions. The midterm exam will examine material uncovered from the beginning of the course until 1 March. Although the final exam will be cumulative, there will be greater emphasis placed on material uncovered after 1 March.

Students should also read the Calendar, [Section G](#), on Examinations.

8. **Writing across the curriculum statement:** In this course, the quality of the student's writing in laboratory reports will be a factor in the evaluation of those reports. See also [Section E.2](#) of the University Calendar.

9. **Human & Living Organism Studies Statements:**
Students will not participate as subjects or researchers in human studies.

See also [Section E.5](#) of the University Calendar.

STUDIES IN THE BIOLOGICAL SCIENCES INVOLVE THE USE OF LIVING AND DEAD ORGANISMS. Students taking laboratory- and field-based courses in these disciplines can expect involvement with and experimentation on such materials. Students perform dissections on dead or preserved organisms in some courses. In particular courses, students experiment on living organisms, their tissues, cells, or molecules. Sometimes field work requires students to collect a variety of living materials by many methods, including humane trapping.

All work on humans and other animals conforms to the Helsinki Declaration and to the regulations of the Canadian Council on Animal Care. The Department strives for the highest ethical standards consistent with stewardship of the environment for organisms whose use is not governed by statutory authority. Individuals contemplating taking courses or majoring in one of the fields of study offered by the Department of Biological Sciences should ensure that they have fully considered these issues before enrolling. Students are advised to discuss any concern they might have with the Undergraduate Program Director of the Department.

Students are expected to be familiar with [Section SC.4.1](#) of the University Calendar.

10. **Reappraisal Of Grades:**

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible in writing to the Course coordinator/instructor within **15 days** of either being notified about the mark, or of the item's return to the class, whichever of these two is sooner. If the student is not satisfied with the outcome, the student shall immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a re-assessment of the work if, and only if, the student has sufficient academic grounds. See sections [I.1](#) and [I.2](#) of the University Calendar
- b. **Final Exam:** The student shall submit the request to Enrolment Services. See [Section I.3](#) of the University Calendar.

11. Other Important Information For Students:

- a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, Mental Health Services Website) and the Campus Mental Health Strategy website (Mental Health).
- b. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see www.ucalgary.ca/wellnesscentre or call 403-210-9355.
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at 403-220-2208 .
- d. **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under Section K. Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. **These are only examples.**
- e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on assembly points.
- f. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at [procedure-for-accommodations-for-students-with-disabilities.pdf](#). Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head, Undergraduate of the Department of Biological Sciences, Heather Addy by email addy@ucalgary.ca or phone 403 220-6979. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See Section E.4 of the University Calendar.
- g. **Safewalk:** Campus Security will escort individuals day or night (See the Campus Safewalk website). Call 403-220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- h. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see Legal Services website.
- i. **Student Union Information:** VP Academic, Phone: 403-220-3911 Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: 403-220-3913 Email: sciencerep@su.ucalgary.ca. Student Ombudsman, Email: suvpaca@ucalgary.ca.
- j. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.
- k. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction (USRI) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

Department Approval _____ ORIGINAL SIGNED _____ Date _____

Associate Dean's Approval for
out of regular class-time activity: _____ ORIGINAL SIGNED _____ Date: _____

OVERVIEW OF THE COURSE:

In the lecture and laboratory components of the course, we will explore the structure and function of carbohydrates, amino acids, proteins, lipids, coenzymes, enzymes, and nucleic acids. We will use this knowledge to create a framework to gain a deep understanding of carbohydrate metabolism, energy transduction, and the biosynthesis of nucleic acid and proteins. A more detailed list of topics is in the tentative lecture schedule found at the end of this document.

LABORATORIES

The experiments you will be doing in the laboratory will make use of techniques commonly used in clinical and research laboratories to study biological molecules and metabolic pathways. For example you will measure the concentrations of biomolecules, measure enzyme activities, and separate proteins in solution, use electrophoresis to monitor the purity of a protein, cleave nucleic acids, and determine what molecules can cross a lipid bilayer. You will have the opportunity to develop technical skills, as well as increase your understanding of the principles of the methodology used. In several of the experiments you will ask and answer real scientific questions. You will become more proficient at carefully and consistently recording observations (especially of numerical data) and also gain significant experience analyzing and interpreting data. In addition your written technical communication skills will be improved.

There are six laboratory sessions in this course and attending at least 5 of them is required. If you do not attend a laboratory session, then you will receive a zero for that lab and are not permitted to submit a report for that experiment. If you miss more than one laboratory session, you must provide the course coordinator with valid documentation (e.g. Statutory Declaration) of a valid excuse for your absence. If you miss more than one laboratory session with valid excuses, you will be required to do a make-up lab session(s) as arranged by the lab coordinator.

Your experience in the laboratory will help to consolidate many of the concepts taught in lecture. Before each laboratory session read the lab manual for that lab and complete any pre-lab exercises required. Some labs will have a “Lab Lecture” to introduce and reinforce the relevant concepts for that lab. Your knowledge of the content of the lab manual and lab lectures as well as the principles and techniques used in labs themselves will be examined along with the lecture and textbook topics in both the midterm and the final exams.

MIDTERM AND FINAL EXAMS

The midterm and final exams will consist of multiple choice and written questions. The midterm exam will examine material uncovered from the beginning of the course until 1 March. Although the final exam will be cumulative, there will be greater emphasis placed on material uncovered after 1 March.

COURSE LEARNING OUTCOMES:

By the end of this course, you should be able to:

- compare and contrast the roles of van der Waals forces, charge-charge interactions, hydrogen bonds, and hydrophobic interactions in protein and macromolecular structure and indicate how the roles of these forces differ from those of covalent bonds;
- describe the role and preparation of buffers in biological systems
- describe the structures and the physicochemical properties of the amino acids, carbohydrates (monosaccharides, disaccharides and polysaccharides), lipids (fatty acids, triglycerides, glycerophospholipids, and sphingolipids) and nucleic acids (DNA and RNA);
- distinguish the four levels of protein structure and describe the folding and forces leading to these structures;
- contrast the function of myoglobin and hemoglobin using differences in protein structure;
- list, discuss, use and evaluate the major techniques used in separating proteins, including ammonium sulfate precipitation, column chromatography, and SDS-PAGE;
- describe and experimentally examine how enzymes catalyze reactions, and how inhibitors and allosteric regulators can affect their function using the principles of protein structure, Michaelis-Menten kinetics, and Eadie-Hofstee plots;
- distinguish between aerobic and anaerobic carbohydrate metabolism, and describe the reactants and products, the flow of energy and matter in these pathways, the reaction purpose(s), the conditions under which they occur, and their regulatory mechanisms;
- describe how the processes of replication, repair, transcription, and translation lead to high fidelity synthesis of nucleic acids and proteins; and,
- use basic biochemical laboratory methods, work effectively in diverse teams and provide constructive peer feedback to teammates.

BCEM393 – Introduction to Biochemistry Winter 2019

Dates	Lectures	Chap.	Instructor
11 Jan (Fri)	Course Introduction & Water	1	RAE-1
14 Jan (Mon)	1# LAB Lecture (amino acids in proteins) LAB Cycle #1 Begins		RAE-2
16 Jan (Wed)	Acids/Bases/Buffers	2	RAE-3
18 Jan (Fri)	Amino Acids *QZ-1*	3	RAE-4
21 Jan (Mon)	Lipids – 1	11	RJT-1
23 Jan (Wed)	Lipids – 2	11	RJT-2
25 Jan (Fri)	Micelles, Bilayers, and Membranes	12	RJT-3
28 Jan (Mon)	2nd LAB Lecture (lipids + begin protein purification) LAB Cycle #2 Begins	5	RAE-5
30 Jan (Wed)	Protein Purification	5	RJT-4
1 Feb (Fri)	Oligopeptides & polypeptides *QZ-2*	5	RJT-5
4 Feb (Mon)	Carbs - monosaccharides & oligosaccharides	10	RAE-6
6 Feb (Wed)	Carbs – Polysaccharides	10	RAE-7
8 Feb (Fri)	3rd LAB Lecture (carbs + finish protein purification)	10	RAE-8
11 Feb (Mon)	Protein Structure - 1 LAB Cycle #3 Begins	4	RJT-6
13 Feb (Wed)	Protein Structure – 2	4	RJT-7
15 Feb (Fri)	Enzymes - General and Classes *QZ-3*	6	RJT-8
Alberta Family Day and Reading Week			
25 Feb (Mon)	Enzymes – Kinetics	7	RJT-9
27 Feb (Wed)	Enzymes – Regulation	7	RJT-10
1 Mar (Fri)	Synopsis and Review		RAE-RJT
2 Mar (Sat)	3 hour Midterm Exam (examines topics through 1 March)		
4 Mar (Mon)	Enzymes - Inhibition & Mechanisms LAB CYCLE #4 Begins	8	RAE-9
6 Mar (Wed)	Haemoglobin an Allosteric Protein	9	RAE-10
8 Mar (Fri)	Metabolism: Basic Concepts	15	RJT-11
11 Mar (Mon)	Glycolysis & Fermentation *QZ-4*	16	RJT-12
13 Mar (Wed)	Gluconeogenesis	17	RJT-13
15 Mar (Fri)	Bridge Reaction	18	RJT-14
18 Mar (Mon)	Krebs Cycle LAB CYCLE #5 Begins	19	RJT-15
20 Mar (Wed)	Electron Transport Chain	20	RJT-16
22 Mar (Fri)	Shuttles, pmf, and ATP Synthase	21	RJT-17
25 Mar (Mon)	Metabolic Pathways and Concepts *QZ-5*		RJT-18
27 Mar (Wed)	Nucleic Acids Structure	33	RAE-11
19 Mar (Fri)	Replication	34	RAE-12
1 April (Mon)	LAB #6 Lecture (nucleic acids) LAB CYCLE #6 Begins	41	RAE-13
3 April (Wed)	DNA Repair	35	RAE-14
5 April (Fri)	Prokaryotic Transcription *QZ-6*	36	RAE-15
8 April (Mon)	Eukaryotic Transcription & RNA Processing	37&38	RAE-16
10 April (Wed)	The Genetic Code & begin Translation	39&40	RAE-17
12 April (Fri)	Translation	40	RAE-18

3 Hour Final Exam Scheduled by the Registrar