



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 2018

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 15, 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 15, 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 22, 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
Dr. I. Lewis BI 442 403-220-4366 ian.lewis2@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 – W2018BCEM393L01:BCEM 393 L01 and L02 (Winter 2018)

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:

Online quizzes	10%		
Laboratories	18%		
Midterm Exam	30%	March 3, 2018	ST 135, 140, 148
Final Exam	42%		

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

In order to pass the course, students will be required to **pass the laboratory component** of the course by achieving 58% or more on the laboratory component.

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

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 miss a laboratory exercise, an in-class assignment, an on-class quiz or the midterm exam for medical reasons, the only documentation that will be accepted in BCEM 393 is a completed **Physician/Counsellor Statement Form**, which can be downloaded from the following website: <http://www.ucalgary.ca/registrar/PDFs/physcoun.pdf>. This form must be completed by your physician or counsellor and brought to Dr. Edwards within 48 hours of the date that you missed the lab, assignment, quiz or exam.

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 3; 1:00 PM - 4:00 PM ST 135, ST 140, 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

This textbook is **required** for your learning and both new copies (as well as a few used copies) are available from the bookstore. You can choose to purchase either a hardcover or binder-ready version of the textbook. The 3rd edition is recommended; however the 2nd edition will be adequate.

Laboratory manual:

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 by 70 hours after the end of your laboratory section. The 48-hour period Saturday plus Sunday counts as only one day (24 hours) (e.g., the report of an experiment conducted on the Friday 16:00-18:50 lab session would be submitted by Tuesday at 16:50). If the submission time falls on a weekend then the report must be submitted by 10:00 am Monday morning (e.g., the report of an experiment conducted in the Wednesday lab session would be submitted by Monday at 10:00 a.m.).

Online course components:

Quizzes will be done on-line using the D2L site. There will be 10 on-line 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 at 3 p.m. seven days later. You can try each quiz twice. The higher of the two marks will be averaged into your mark. These are low stakes quizzes - each quiz will be 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.

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:** No electronic or written aids (e.g. cell phones, tablets, computers, notes, textbooks) will be allowed during writing of any exams. Only non-programmable calculators will be permitted to answer quantitative questions on exams, if applicable, and permission to do this will be clearly indicated on the examination paper. 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 studies statement:** If you agree, your course work may be used for research purposes. Your responses will remain anonymous and confidential. Grouped data (no individual responses) may be used in academic presentations and publications. Participation in such research is voluntary and will not influence grades in this course. Students' signed consent forms will be withheld from instructors until after final grades are submitted. More information will be provided at the time student participation is requested. See also [Section E.5](#) of the University Calendar.

ETHICS IN THE BIOLOGICAL SCIENCES

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.

10. OTHER IMPORTANT INFORMATION FOR STUDENTS:

- (a) **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.
- (b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- (c) **Student Accommodations:** 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 http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf.

Students needing an Accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to the Associate Head of Biological Sciences, Dr. H. Addy by email addy@ucalgary.ca or phone 403-220-3140.

- (d) **Safewalk:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call 403-220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot paybooths.
- (e) **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). As one consequence, 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 also <http://www.ucalgary.ca/secretariat/privacy>.
- (f) **Student Union Information:** VP Academic Phone: 403 220-3911 Email: suvpaca@ucalgary.ca
SU Faculty Rep. Phone: 403-220-3913 Email: science1@su.ucalgary.ca, science2@su.ucalgary.ca and science3@su.ucalgary.ca
Student Ombuds Office: 403-220-6420 Email: ombuds@ucalgary.ca; <http://ucalgary.ca/provost/students/ombuds>
- (g) **INTERNET and ELECTRONIC COMMUNICATION DEVICE Information. The use of your cell phone in class must be restricted to answering in-class questions using the Top Hat Monocle system.** Importantly, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.
- (h) **U.S.R.I.:** At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference - please participate in USRI Surveys.

Department Approval _____ ORIGINAL SIGNED _____ Date _____

Associate Dean's Approval for
out of regular class-time activity: _____ ORIGINAL SIGNED _____ Date: _____
C393 co W18; 1/10/2018 1:39 PM

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 analysing and interpreting data. In addition your written technical communication skills will be improved.

There are six laboratory sessions in this course and attendance 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(s); unless, you provide the course coordinator with valid documentation (e.g. Physician/Counselor Statement Form) 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).

Your experience in the laboratory will help to consolidate many of the concepts taught in lecture. Before each laboratory session there will be a "Lab Lecture" to introduce and reinforce the relevant concepts for that lab. Your knowledge of the content of the 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 2 March. Although the final exam will be cumulative, there will be greater emphasis placed on material uncovered after 2 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 20 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 sulphate 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 and Michaelis-Menten kinetics;
- distinguish between aerobic and anaerobic carbohydrate metabolism, and describe the reactants and products, 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,
- work effectively in diverse teams and provide constructive peer feedback to teammates.

BCEM393 – Introduction to Biochemistry Winter 2018

Dates	Lectures	Chapter	Instructor
8 Jan (Mon)	Course Introduction	1	RAE
10 Jan (Wed)	Water/Acids/Bases/Buffers	2	RAE
12 Jan (Fri)	Amino acids *QZ*	3	RAE
15 Jan (Mon)	1 st LAB Lecture (intro + amino acids in proteins) ⇒ Lab Cycle #1 Begins		RAE
17 Jan (Wed)	Lipids -1	11	RJT
19 Jan (Fri)	Lipids -2 *QZ*	11	RJT
22 Jan (Mon)	Micelles & Bilayers & Membranes	12	RJT
24 Jan (Wed)	Oligopeptides & polypeptides	4	RJT
26 Jan (Fri)	2 nd LAB Lecture (lipids + purify-prot) ⇒ Lab Cycle #2 Begins Mon *QZ*		RAE
29 Jan (Mon)	Protein Structure-1	4	RJT
31 Jan (Wed)	Protein Structure-2	4	RJT
2 Feb (Fri)	Protein Purification *QZ*	5	RJT
5 Feb (Mon)	Carbs – monosaccharides & oligosaccharides	10	RAE
7 Feb (Wed)	Carbs – polysaccharides	10	RAE
9 Feb (Fri)	3 rd LAB Lecture (carbs + purify-protein) ⇒ Lab Cycle #3 Begins Mon *QZ*		RAE
12 Feb (Mon)	Enzymes – classes & general	6	RJT
14 Feb (Wed)	Enzymes – Kinetics	7	RJT
16 Feb (Fri)	Enzymes – Regulation *QZ*	7	RJT
	Alberta Family Day and Reading Week		
26 Feb (Mon)	Enzymes – Mechanisms & Inhibitors	8	RJT
28 Feb (Wed)	Hemoglobin an Allosteric Protein	9	RJT
2 Mar (Fri)	Synopsis and Review	1-12	RJT+RAE
3 Mar (Sat)	3 hour Midterm Exam (examines topics through 2 March)		RAE
5 Mar (Mon)	4 th LAB Lecture (enzyme kinetics & Digestion) ⇒ Lab Cycle #4 Begins	14	RAE
7 Mar (Wed)	Metabolism: Basic Concepts	15	IAL
9 Mar (Fri)	Glycolysis & Fermentation	16	IAL
12 Mar (Mon)	Gluconeogenesis *QZ*	17	IAL
14 Mar (Wed)	Bridge Reaction & Krebs Cycle	18 +19	IAL
16 Mar (Fri)	5 th LAB Lecture (metabolism) ⇒ Lab Cycle #5 Begins on Mon		RAE
19 Mar (Mon)	Electron Transport Chain *QZ*	20	IAL
21 Mar (Wed)	Proton-Motive Force	21	IAL
23 Mar (Fri)	Nucleic Acids Structure	33	IAL
26 Mar (Mon)	DNA Replication *QZ*	34	IAL
28 Mar (Wed)	DNA Repair	35	IAL
30 Mar (Fri)	Good Friday – No Labs or Lectures		
2 April (Mon)	6 th LAB Lecture (nucleic acids) ⇒ Lab Cycle #6 Begins *QZ*	41	RAE
4 April (Wed)	Transcription – Prokaryotes	36	IAL
6 April (Fri)	Transcription – Eukaryotes	37	IAL
9 April (Mon)	RNA processing	38	IAL
11 April (Wed)	Genetic Code & Translation	39 + 40	IAL
13 April (Fri)	Synopsis and Review		IAL+RAE

3 Hour Final Exam Scheduled by the Registrar