



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

1. **Course: Biochemistry 341 - BIOCHEMISTRY OF LIFE PROCESSES**

Lecture Section:	L01	MWF	13:00-13:50	ENE 241	WINTER 2018
Lab Sections:	B01	M	14:00-16 :50	BI 117	
	B02	T	09:30-12 :20	BI 117	
	B03	T	14:00-16.50	BI 117	
	B04	T	17:30-20:20	BI 117	
	B05	M	17:30-20:20	BI 117	
	B07	M	09:00-11:50	BI 117	

Course Coordinator: Dr. M.E. Fraser

Instructors:	Dr. M.E. Fraser	BI 413	403-220-6145	<a href="mailto:frasm@ucalgary.ca">frasm@ucalgary.ca</a>
	Dr. R.A. Edwards	BI 443	403-220-5350	<a href="mailto:redwards@ucalgary.ca">redwards@ucalgary.ca</a>

Desire 2 Learn (D2L) course name: BCEM 341 L01 - (Winter 2018) - Biochemistry of Life Processes  
Biological Sciences Department BI 186; (403) 220-3140; [biosci@ucalgary.ca](mailto:biosci@ucalgary.ca)

2. **Prerequisites:** 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>)

**NOTE Credit for both Biochemistry 341 and 393 will not be allowed.**

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:

<b>Midterm Exam I</b>	<b>20%</b>	<b>Feb 9/18</b>	<b>In-Class</b>
<b>Midterm Exam II</b>	<b>20%</b>	<b>Mar 16/18</b>	<b>In-Class</b>
<b>Laboratory work (6 labs x 3% per lab)</b>	<b>18%</b>		
<b>Quizzes (6 x 1% each)</b>	<b>6%</b>		
<b>Final examination</b>	<b>36%</b>		

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

**A mark of  $\geq 58\%$  is the minimal passing grade for the lab component of this course. Attendance at labs is mandatory.**

Each piece of work (quizzes, laboratory work, 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 failing grade will result if the student does not pass the laboratory work.

Grade Scale

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.3](#) of the University Calendar
5. **Scheduled out-of-class activities: Not applicable.**
6. **Required Text:** [Biochemistry: A Short course](#), Tymoczko, Berg, and Stryer, 3<sup>rd</sup> edition.  
\*[Laboratory exercises](#): will be uploaded on Desire 2 Learn, as will be lecture notes.

7. **Examination Policy:** Non-programmable calculators will be allowed for exams. The use of camera devices, MP3 Players and headphones, wireless earbuds or wireless access devices such as smart phones, smart watches, iOS and/or Android, etc., during the examination will not be allowed. 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 and on exams will be a factor in the evaluation. See also [Section E.2](#) of the University Calendar.
9. **Human studies statement:** indicating whether students in the course may be expected to participate as subjects or researchers. 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:

**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.

- (a) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- (b) **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](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](mailto:addy@ucalgary.ca) or phone 403-220-3140.

- (c) **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 pay booths.
- (d) **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>.
- (e) **Student Union Information:** VP Academic Phone: 403 220-3911 Email: [suypaca@ucalgary.ca](mailto:suypaca@ucalgary.ca)  
SU Faculty Rep. Phone: 403-220-3913 Email: [science1@su.ucalgary.ca](mailto:science1@su.ucalgary.ca), [science2@su.ucalgary.ca](mailto:science2@su.ucalgary.ca) and [science3@su.ucalgary.ca](mailto:science3@su.ucalgary.ca);  
Student Ombuds Office: 403-220-6420 Email: [ombuds@ucalgary.ca](mailto:ombuds@ucalgary.ca); <http://ucalgary.ca/provost/students/ombuds>
- (f) **Internet and Electronic Device Information:** You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, 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.
- (g) **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](http://www.ucalgary.ca/usri)). Your responses make a difference - please participate in USRI Surveys.

Department Approval \_\_\_\_\_ ORIGINAL SIGNED \_\_\_\_\_ Date \_\_\_\_\_

### BCEM341 Winter 2018: Tentative Lecture Schedule

Date	Topic	Instructor	
Jan.	8	Introduction to the Course and Lipids	MEF1
	10	Lipids in Membranes	MEF2
	12	Carbohydrates – Monosaccharides	MEF3
	15	Carbohydrates – Linking Monosaccharides	MEF4
	<b>15+16</b>	<b>Lab 1: Lipids (Quiz on Lipids)</b>	MEF
	17	Amino Acids – Structures and Properties	MEF5
	19	Peptides and Proteins - Peptide Bond and Primary Structure	MEF6
	22	Peptides and Proteins - Secondary Structure	MEF7
	24	Peptides and Proteins - Tertiary and Quaternary Structure	MEF8
	26	Carbohydrates Attached to Proteins and Proteins that Bind Carbohydrates	MEF9
	29	Membranes, including Membrane Proteins; Transport across Membranes	MEF10
	<b>29+30</b>	<b>Lab 2: Food Chemistry (Proteins and Carbs in Beer) (Quiz on Amino Acids)</b>	MEF
	<b>31</b>	Basic Concepts about Enzymes	MEF11
Feb.	2	Enzyme Kinetics	MEF12
	5	Enzyme Kinetics – Allosteric Enzymes	MEF13
	7	Enzyme Mechanisms and Inhibitors	MEF14
	9	In Class: First Midterm – 12 lectures, 2 labs (Jan. 8 – Feb. 2)	MEF1-MEF12
	11	Classes of Enzymes. Example of a Hydrolase: Chymotrypsin	MEF15
	<b>12+13</b>	<b>Lab 3: Enzymatic Activity of <math>\beta</math>-Galactosidase (Quiz on Carbohydrates)</b>	MEF
	14	Example of an Allosteric Protein: Hemoglobin	MEF16
	16	Digestion: Turning a Meal into Cellular Biochemicals	MEF17
	<b>18-25</b>	<b>Reading Week *** No Lectures***</b>	
	26	Basic Concepts of Metabolism	RAE1
	28	Fermentation	RAE2
Mar.	2	Glycolysis and Regulation	RAE3
	5	Gluconeogenesis	RAE4
	<b>5+6</b>	<b>Lab 4: A Metabolically Reversible Reaction</b>	RAE
	7	Bridge Reaction & Overview of the Citric Acid Cycle	RAE5
	9	The Citric Acid Cycle	RAE6
	12	Ox Phos: The Electron Transport Chain	RAE7
	14	Ox Phos: ATP Synthesis	RAE8
	16	In Class: Second Midterm – 11 lectures and 2 labs (Feb. 5 – Mar. 9)	MEF 13-17, RAE 1-6
	19	Nucleic Acids: Base Pairing, the Double Helix and DNA packaging	RAE9
	<b>19+20</b>	<b>Lab 5: Metabolism</b>	RAE
	21	DNA Replication	RAE10
	23	DNA Repair and Recombination	RAE11
	26	Transcription of DNA = Synthesis of RNA	RAE12
	28	Recombinant DNA Techniques	RAE13
	30	<b>Good Friday *** No Lecture***</b>	
Apr.	2	Gene Expression in Eukaryotes	RAE14
	<b>2+3</b>	<b>Lab 6: DNA Cleavage &amp; Electrophoresis</b>	RAE
	4	RNA Processing in Eukaryotes	RAE15
	6	The Genetic Code and tRNA	RAE16
	9	Translation of RNA	RAE17
	11	Synopsis	
	13	Review	

**Final Exam Scheduled by the Registrar**

## Learning outcomes

General – BCEM 341 is a course for chemistry and kinesiology majors wishing to familiarize themselves with all aspects of biochemistry in one term. There is a laboratory component that integrates with the lecture material.

**By the end of this course, successful students will be able to:**

1. Compare the structures of the major classes of biological molecules, i.e. lipids, carbohydrates, proteins and nucleic acids, and relate these to their cellular roles.
2. Explain how individual enzymes catalyze biochemical reactions so that the reactions take place at the rate needed for life; and analyze an enzyme kinetically in a laboratory setting.
3. Classify the enzyme reactions in the metabolic pathway “glycolysis” into one of six classes and calculate overall energy yields for anaerobic metabolism of glucose.
4. Compare the anaerobic energy yields with those obtained when glucose is completely combusted to CO<sub>2</sub> and H<sub>2</sub>O in mitochondria during oxidative phosphorylation.
5. Explain how hydrogen bonding and stacking interactions of nucleic acid bases, as well as ribo and deoxyribo sugars enable polymers of nucleic acids to have different structures and functions within the cell.
6. Explain the process of DNA replication, RNA transcription and translation of RNA into proteins that can be post-translationally modified.
7. Explain how errors in the DNA code can give rise to mutations that are either lethal or non-lethal.
8. Demonstrate skills frequently used in biochemistry laboratories:
  - Dispense small volumes accurately using mechanical pipettors.
  - Perform serial dilutions.
  - Measure absorbance by visible spectroscopy.
  - Use standard curves for quantification.
  - Use chromatography and electrophoresis to separate biochemical molecules.
  - Distinguish qualitative from quantitative experiments.
  - Work as a team.
  - Communicate biochemical experiments in written reports.