



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 239	WINTER 2017
Lab Sections:	B01	T	09:30	BI 117	
	B02	T	14:00	BI 117	
	B03	T	17:30	BI 117	
	B04	M	14:00	BI 117	
	B05	M	17:30	BI 117	

Course Coordinator: Dr. E. Lohmeier-Vogel

Instructors:	Dr. E. Lohmeier-Vogel	BI 039	403-220-8281	lohmeier@ucalgary.ca
	Dr. M.E. Fraser	BI 413	403-220-6145	frasm@ucalgary.ca

Desire 2 Learn (D2L) course name: BCEM 341 L01 - (Winter 2017) - Biochemistry of Life Processes
Biological Sciences Department BI 186; (403) 220-3140; 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:

Laboratory work (6 labs x 4% per lab)	24%	
Quizzes (5 x 1% each)	5%	
First midterm examination	17%	In Class
Second midterm examination	18%	In Class
Third midterm examination	18%	In Class
Final examination	18%	

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	Overall course mark cutoff
A+	93%
A	86%
A-	82%
B+	78%
B	74%
B-	70%
C+	66%
C	62%
C-	58%
D+	54%
D	50%
F	<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:**
REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY.
6. **Required Text:** Biochemistry: A Short course, Tymoczko, Berg, and Stryer, 3rd edition.

*Laboratory exercises: will be uploaded on Desire 2 Learn, along with 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.

STUDIES IN THE BIOLOGICAL SCIENCES INVOLVE THE USE OF LIVING AND DEAD ORGANISMS. Students are expected to be familiar with <http://www.ucalgary.ca/pubs/calendar/current/sc-5-1.html> of the on-line calendar. See also <http://www.ucalgary.ca/pubs/calendar/current/e-5.html>.

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.

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.

- (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 (FOIPP). 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
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>
- (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). Your responses make a difference - please participate in USRI Surveys.

BCEM341 Winter 2017: Tentative Lecture Schedule

Date	Topic	Instructor	
Jan.	9	Introduction to the Course and Lipids	ELV/MEF1
	11	Lipids in Membranes	MEF2
	13	Carbohydrates – Monosaccharides	MEF3
	16	Carbohydrates – Linking Monosaccharides	MEF4
	16+17	Lab 1: Lipids (Quiz on Lipids)	MEF
	18	Amino Acids – Structures and Properties	MEF5
	20	Peptides and Proteins - Peptide Bond and Primary Structure	MEF6
	23	Peptides and Proteins - Secondary Structure	MEF7
	25	Peptides and Proteins - Tertiary and Quaternary Structure	MEF8
	27	Basic Concepts about Enzymes	MEF9
	30	Enzyme Kinetics	MEF10
	30+31	Lab 2: Food Chemistry (Proteins and Carbs in Beer) (Quiz on Amino Acids)	MEF
Feb.	1	First Midterm Test on Lectures 1-8	MEF
	3	Enzyme Kinetics – Allosteric Enzymes	MEF11
	6	Enzyme Mechanisms and Inhibitors	MEF12
	6+7	Lab 3: Enzymatic Activity of β-Galactosidase (Quiz on Carbohydrates)	MEF
	8	Classes of Enzymes. Example of a Hydrolase: Chymotrypsin	MEF13
	10	Example of an Allosteric Protein: Hemoglobin	MEF14
	13	Membranes, including Membrane Proteins; Transport across Membranes	MEF15
	15	Carbohydrates Attached to Proteins and Proteins that Bind Carbohydrates	MEF16
	17	Basic Concepts of Metabolism	MEF17
	19-26	Reading Week *** No Lectures***	
	27	Second Midterm Test, Focusing on Lectures 9-17	MEF
	27+28	Lab 4: Protein Precipitation Studies	ELV
Mar.	1	Metabolism (overview); Digestion and uptake of carbohydrates	ELV18
	3	Glycolysis reactions 1 \rightarrow 7	ELV19
	6	Glycolysis reactions 8 \rightarrow 10, fate of pyruvate	ELV20
	8	Allosteric regulation of glycolysis and intro to aerobic metabolism	ELV21
	10	The pyruvate dehydrogenase complex and TCA cycle	ELV22
	13	Regulation of the TCA cycle; oxidative phosphorylation (intro)	ELV23
	13+14	Lab 5: Aerobic and Anaerobic Metabolism	
	15	The respiratory complexes (in detail)	ELV24
	17	ATP synthesis and energetics and aerobic energetics	ELV25
	20	Bases, nucleosides, nucleotides and nomenclature	ELV26
	22	Watson-Crick base pairing and B-DNA structure	ELV27
	24	Third Midterm Test, Focusing on Lectures 18-25	ELV
	27	RNA structure, DNA packaging	ELV28
	27+28	Lab 6: Purification of DNA	ELV
	29	Enzymes that synthesize nucleic acids	ELV29
	31	<i>E. coli</i> replication,	ELV30
Apr.	3	<i>E. coli</i> replication (cont), <i>E. coli</i> transcription	ELV31
	5	<i>E. coli</i> transcription (cont), regulation of transcription	ELV32
	7	Post transcriptional modification of RNA, the Genetic Code	ELV33
	10	Translation in <i>E. coli</i>	ELV34
	12	Overflow lecture	ELV35

Final Exam Scheduled by the Registrar (50 min) focusing on lectures 26-34

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. Purify and quantitate lipids, carbohydrates, amino acids and protein content from beer in order to estimate total caloric values.
3. 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.
4. Classify the enzyme reactions in the metabolic pathway “glycolysis” into one of six classes and calculate overall energy yields for anaerobic metabolism of glucose to two lactic acid molecules.
5. Compare the anaerobic energy yields with those obtained when glucose is completely combusted to CO₂ and H₂O in mitochondria during oxidative phosphorylation.
6. Explain how hydrogen bonding and stacking interactions of nucleic acid bases, as well as ribo and deoxyribo sugars enable nucleic acids polymers to have different structures and functions within the cell.
7. Explain the process of DNA replication, RNA transcription and translation of RNA into proteins that can be post-translationally modified.
8. Explain how errors in the DNA code can give rise to mutations that are either lethal or non-lethal.
9. Purify genomic DNA from calf thymus without the use of commercial kits and analyze its viscosity in the presence and absence of nucleases.
10. Communicate the results of biochemical experiments in written reports.