



UNIVERSITY OF
CALGARY

DEPARTMENT OF BIOLOGICAL SCIENCES
COURSE OUTLINE

1. **Course:** BIOCHEMISTRY 443 – METABOLISM AND BASIC NUCLEIC ACID BIOCHEMISTRY

Lecture Section(s):	L01	MWF	11:00-11:50	ENA 101	Fall 2017
LABS:	B01, B02	M	13:00, 17:30	BI 136	
	B03, B04	T	13:00, 17:30	BI 136	
	B05, B06	W	13:00, 17:30	BI 136	
	B07, B08	R	13:00		

TA contact information and office hours will be uploaded on D2L

Course Coordinator: Dr. E. Lohmeier-Vogel

Instructor(s): Dr. E. Lohmeier-Vogel BI 039 220-8281 lohmeier@ucalgary.ca

LAB TECHNICIAN: Spomenka Curic BI 136

Course website or Desire 2 Learn (D2L): BCEM 443 L01 - (Fall 2017) - Metabolism and Basic Nucleic Acid Biochemistry

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

2. **Prerequisites:** One of Chemistry 353 or 355; and Biochemistry 341 or 393
See section 3.5.C in the Faculty of Science section of the online Calendar
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:

Laboratory 5 reports worth 4% each	20 %		
Critical review exercise	4%		
Midterm Examination I (2 hours)	24 %	Oct. 10	ST 148
Midterm Examination II (2 hours)	24 %	Nov. 14	ST 148
Final Examination (2 hours)	28 %		

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

A passing grade is required for the laboratory component of BCEM443. For labs, a fail (F grade) will be considered to be 64% or lower in the lab component. Attendance in the labs (and submission of lab reports and the assignment paper) is mandatory in BCEM 443. You need to pass the labs to pass the course.

Each piece of work (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 failing grade (F) will result if the student does not pass the laboratory component.

Final Grade Scale :

A+: 95 or higher	C+: 66 and under 70
A : 86 and under 95	C : 62 and under 66
A- : 82 and under 86	C- : 56 and under 62
B+: 78 and under 82	D+: 50 and under 56
B : 74 and under 78	D : 45 and under 50
B- : 70 and under 74	F : <45

The last day of Fall Lectures is Friday, December 08, 2017 and the final examination period is December 11-21, 2017.

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

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

MT Exam 1: Tuesday, October 10; 19:00 – 21:00; ST 148
MT Exam 2: Tuesday, November 14; 19:00 – 21:00; 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. **Course Materials: RequiredText*:** "Lehninger Principles of Biochemistry" by D.L. **Nelson** and M.M. Cox. Freeman 6th Edition. NOTE: This text is the same as was used in BCEM 393 in the winter of 2017.

This text will be stocked by the Bookstore and should be available at the start of classes filed under the last name of the first author (Nelson) in section **N**.

Other information: Lecture notes and laboratory exercises will be uploaded onto the Blackboard site for BCEM 443. Please print off this material before class (or lab) time.

7. **Examination Policy:** Only non-programmable calculators are allowed for use on the exams. Students are responsible to 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. **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) **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 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

(e) **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

(f) <http://www.ucalgary.ca/secretariat/privacy>.

(g) 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>

(h) 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.

(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: _____
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COURSE OUTCOMES

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

1. Purify and characterize nucleic acids before or after treatment with nucleases and restriction endonucleases. The role of various chemicals currently used in commercial purification kits will be taught so students can troubleshoot protocols on their own.
2. Predict how the chemistry of nucleic acid building blocks affects nucleic acid structure and stacking interactions.
3. Predict how hormones insulin and glucagon coordinately regulate carbohydrate metabolic pathways in different human organs.
4. Analyze blood glucose and/or liver glycogen content of samples obtained from rats in either the fed or fasted state and compare data statistically with a population of rats of the same state.
5. Understand the metabolic pathways by which lipids are synthesized in the liver and exported as lipoprotein particles to adipose and peripheral tissues (and back again during reverse cholesterol transport).
6. Describe the repeating strategies employed in enzyme mechanisms in various pathways of nitrogen metabolism (urea cycle and amino acid biosynthesis and degradation).
7. Interpret and communicate the results of biochemical experiments in complete laboratory reports with clarity and conciseness.

BIOCHEMISTRY 443

FALL 2017 TENTATIVE LECTURE SCHEDULE

Lecture#	Date	Topic
1	September 11	Course introduction and background review of NAs (nucleic acids)
2	13	Review of NAs (cont), nucleases, protein denaturation, purification of DNA
3	15	Purification of DNA (cont), purification of RNA + plasmid DNA
4	Lab # 1 (Sept 18→21)	18 Electrophoresis and detection of NAs, organic chemistry of purine and pyrimidine, NA bases
5	20	Nucleosides, nucleotides, naming
6	22	Dinucleotides, oligonucleotides, naming
7	25	B-DNA structure, stacking interactions and DNA-protein interactions
8	27	Denaturation of NAs (pH and temperature)
9	29	Renaturation of DNA, Cot curves and the human genome,
10	Lab # 2 (Oct 2→5)	October 2 Other DNA structures, Higher order DNA structure and enzymology
11	4	Supercoiling and topoisomerases, nucleosomes, chromatin
12	6	RNA structure (ribosomal, transfer and messenger)
	9	Thanksgiving holiday (no lecture)
	10	Midterm 1; 7-9 pm
13	11	Digestion and uptake of dietary carbohydrates
14	13	Insulin signaling and glycogen synthesis
15	16	Glycogen degradation (glucoagon signaling), phosphorylase a, debranching
16	18	The fate of glucose-1-P, regulation of glycogen metabolism in muscle and liver,
17	20	Glycolysis review and regulation in muscle (allosteric)
18	Lab # 3 (Oct 23→27)	23 Glycolysis regulation in liver (hormonal)
19	25	Gluconeogenesis in liver and the Cori cycle (muscle/liver), carbohydrate nutrition.
20	27	The pentose phosphate pathway (PPP)
21	30	Regulation of the PPP and review of aerobic metabolism
22	November 1	Mitochondrial transport processes, the problem with cytoplasmic NADH
23	3	Mitochondrial shuttles and transaminases, regulation of aerobic metabolism
24	6	Lipid overview, citrate transport and fatty acid biosynthesis (FAS) from citrate in the liver,
25	Lab # 4 (Nov 6→9)	8 Regulation of FAS, elongation and desaturation
	10-13	Reading Days (no lectures)
	14	Midterm 2; 7-9 pm;
26	15	TAG biosynthesis, obesity trends

27		17	Phospholipid biosynthesis
28		20	Sphingolipids and cholesterol biosynthesis and regulation.
29		22	VLDL export from liver, bile salts
30		24	Lipase overview, the digestion and storage of dietary fat and the mobilization of fat from adipose tissue for energy production
31	Lab # 5 (Nov 27→30)	27	Beta-oxidation of fatty acids
32		29	Ketone body biosynthesis, coordinate regulation of fatty acid biosynthesis and degradation
33		December 1	Nitrogen metabolism
34		4	The Urea cycle
35		6	Amino acid biosynthesis
36		8	Amino acid biosynthesis (cont)... and wrap-up
			Final exam – date scheduled by the Registrar