UNIVERSITY OF CALGARY
FACULTY OF SCIENCE

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

COURSE OUTLINE

1. **Course:** BCEM 543, Enzymology - Fall 2020

   Lecture 01: MWF 10:00 - 10:50 - Online

Instructor	Email	Phone	Office	Hours
Dr Kenneth Ng	ngk@ucalgary.ca	403 220-4320	BI 430B	TBA

Online Delivery Details:

Some aspects of this course are being offered in real-time via scheduled meeting times. For those aspects you are required to be online at the same time.

A. Lecture notes and video casts will be posted to D2L for individual and group study and discussion.

B. Zoom sessions during specific scheduled class sessions will be used for discussion and questions:

B1. Introduction lecture September 9

B2. Team discussion assignments on Sept. 18, Oct. 2, Oct. 21, Oct. 30 and Nov. 23

B3. Optional, drop-in midterm exam preparation question/answer sessions on Oct. 5 and Nov. 4

B4. Optional, drop-in team presentation preparation question/answer sessions on Nov. 25, 27 and 30

B5. Team presentation discussion sessions on Dec. 2, 4 and 7

C. Assignments will be submitted by uploading to D2L drop boxes:

C1. Team discussion assignments on Sept. 18, Oct. 2, Oct. 21, Oct. 30 and Nov. 23

C2. Team presentation worksheet on Nov. 27

C3. Team presentation slide deck on Nov. 30

C4. Post-team discussion worksheet on Dec. 9

D. Midterm exams will be distributed on D2L 15 minutes before the start of class time, and completed exams will be due for submission to D2L dropboxes 24 hours after the exams are distributed:

D1. Midterm exam 1 on Oct. 7

D2. Midterm exam 2 on Nov. 6

Course Site:

D2L: BCEM 543 L01-(Fall 2020)-Enzymology

Note: Students must use their U of C account for all course correspondence.

2. **Requisites:**

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

   Prerequisite(s):
   Biochemistry 341 or 393.

3. **Grading:**

The University policy on grading and related matters is described in F.1 and F.2 of the online University Calendar.

In determining the overall grade in the course the following weights will be used:

Component(s)	Weighting %	Date
Individual pre-team discussion assignments	10%	9/18, 10/2, 10/21, 10/30, 11/23
Team discussion assignments	10%	9/18, 10/2, 10/21, 10/30, 11/23
Midterm Exam 1	15%	Oct. 7
Midterm Exam 2	15%	Nov. 6
Team presentation preparation worksheet	10%	Nov. 27
Team presentation powerpoint slide deck	20%	Nov. 30
Team presentation discussions and peer evaluations	10%	Dec. 2, 4, 7
Post-presentation worksheet and self-reflection	10%	Dec. 9

(There will NOT be a final examination scheduled by the Registrar.)

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component 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.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	92 %	86 %	82 %	78%	74%	70 %	66 %	62%	58%	54 %	50 %

4. **Missed Components Of Term Work:**

The university has suspended the requirement for students to provide evidence for absences. Please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations.

In the event that a student legitimately fails to submit any online assessment on time (e.g. due to illness etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date. Absences not reported within 48 hours will not be accommodated. If an excused absence is approved, then the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the course.

5. **Scheduled Out-of-Class Activities:**

There are no scheduled out of class activities for this course.

6. **Course Materials:**

In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security, and malware updates;
- A current and updated web browser;
- Webcam/Camera (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Stable internet connection.

For more information please refer to the UofC ELearning online website.

7. **Examination Policy:**

   There will be TWO midterm exams administered through the course D2L website. You will have 24 hours to complete each exam, including the full scheduled class period on the day each exam is assigned. Exams will have a combination of multiple choice and short answer questions. The first midterm exam will be available to download from D2L on Oct 7, 15 minutes before your scheduled class time, and the second midterm exam will be available to download from D2L on Nov 4, 15 minutes before your scheduled class time.

   IMPORTANT: It is the student's responsibility to ensure that they have adequate computer and internet access to write the exams. Students will be required to begin their exams promptly at the start of their scheduled class on the day of the exam. If a student encounters any technical issues starting an exam, they MUST document the issue by taking a photo, screenshot, or video, and they must contact the instructor immediately so that either additional time can be provided to access the exam or alternative arrangements made. **Students claiming to experience such difficulties who do not contact their instructor providing evidence of technical difficulties within 15 minutes of the scheduled start of the exam will not be allowed to write the exam and will receive a grade of zero (0) on the exam.** If a student's exam is suspended during the exam (lost internet connection, internet browser crashes etc.), they MUST provide evidence (photo/ screenshot/video) and contact the instructor immediately. Students will then be granted reentry to suspended exams if they began the exam on time, provided evidence of the suspension, and still have time remaining to complete their exam.

   The exams are open book. You may access your lecture notes or other resources during exams, but you are specifically prohibited from working with or contacting any other individuals while you complete the exam. Violation of these rules is considered academic misconduct with penalties as described in the University Calendar section K.

   Students should also read the Calendar, Section G, on Examinations.

8. **Approved Mandatory And Optional Course Supplemental Fees:**

   There are no mandatory or optional course supplemental fees for this course.

9. **Writing Across The Curriculum Statement:**

   For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also Section E.2 of the University Calendar.

10. **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.

11. **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 to the Course coordinator/instructor within **ten business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall submit the Reappraisal of Graded Term work form to the department in which the course is offered within 2 business days of

receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. 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.

12. **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:** For more information, see www.ucalgary.ca/wellnesscentre or call 403-210-9355.

c. **Sexual Violence:** 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. The complete University of Calgary policy on sexual violence can be viewed at (https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf)

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. **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.

f. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). 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.

g. **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: ombuds@ucalgary.ca.

h. **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.

i. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions

governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or non-academic misconduct, in addition to any other remedies available at law.

BCEM 543 Fall 2020 TENTATIVE SCHEDULE (there may be minor changes)

September 9 Introduction and Binding 1
September 11 Binding 2

September 14 Binding 3
September 16 Catalysis 1
September 18 Team assignment 1 (4%)

September 21 Catalysis 2
September 23 Catalysis 3
September 25 Catalysis 4

September 28 Catalysis case study 1
September 30 Catalysis case study 2
October 2 Team assignment 2 (4%)

October 5 Midterm exam 1 review questions
October 7 Midterm exam 1 (15%)
October 9 Chemical kinetics 1

October 12 Thanksgiving holiday
October 14 Chemical kinetics 2
October 16 Enzyme kinetics 1

October 19 Enzyme kinetics 2
October 21 Team assignment 3 (4%)
October 23 Enzyme kinetics 3

October 26 Enzyme kinetics 4
October 28 Enzyme kinetics case study 1
October 30 Team assignment 4 (4%)

November 2 Enzyme kinetics case study 2
November 4 Midterm exam 2 review questions
November 6 Midterm Exam 2 (15%)

November 7-15 Term break (Remembrance Day)

November 16 Enzyme regulation 1
November 18 Enzyme regulation 2
November 20 Enzyme regulation 3

November 23 Team assignment 5 (4%)
November 25 Team presentation prep session (drop-in)
November 27 Drop-in presentation prep session and individual presentation worksheet DUE (10%)

November 30 Drop-in presentation prep session and team presentation slide deck DUE (20%)
December 2 Team discussion session 1
December 4 Team discussion session 2

December 7 Team discussion session 3
December 9 Post-team discussion worksheet DUE (10%)

Reserve Reading List – BCEM 543 F2020

	*	AUTHOR	TITLE	PUBLISHER/DATE/EDITION	CALL NUMBER
1.	1	Bugg, T.D.H.	Introduction to Enzyme and Coenzyme Chemistry, 3rd Ed.	John Wiley, 2012 ISBN 9781119995951	QP601.B94 2012
2.	3	Stein, R.L.	Kinetics of Enzyme Action: Essential Principles for Drug Hunters	John Wiley. 2011 ISBN 978-0-470-41411-8	QP601 .S5685 2011

3.	1	Frey, P.A. & Hegeman, A.D.	Enzymatic Reaction Mechanisms	Oxford University Press, 2007 ISBN 9780195122589	QP601.F725 2007
4.	3	Copeland, R.A.	Enzymes: a practical introduction to structure, mechanism, and data analysis	John Wiley, 2000 ISBN: 0471359297	QP601 .C664 2000
5.	3	Cook, P.F. & W.W. Cleland	Enzyme Kinetics and Mechanism	Garland Science, 2007 ISBN 0-8153-4140-7	QP601.3 .C66 2007
6.	3	Creighton, T.E.	Proteins: Structures and Molecular Properties	W.H. Freeman 2nd Ed. 1993 ISBN 0-7167-2317-4	QP 551.C73 1993
7.	3	Fersht, A.	Structure and Mechanism in Protein Science	W.H. Freeman 1999 ISBN 0-7167-3268-8	QD 431.25.S85 F47 1999
8.	2	Jencks, W.P.	Catalysis in Chemistry and Enzymology	Dover Publications 1969 ISBN 0-486-65460-5	QD 501.J44 1969
9.	2	Copeland, R.A.	Evaluation of enzyme inhibitors in drug discovery : a guide for medicinal chemists and pharmacologists	John Wiley, 2013 ISBN 9781118540404	QD271 .M46 V.46 2005
10.	2	Petsko, G.A. & D. Ringe	Protein Structure and Function	New Science Press 2004 ISBN 0-87893-663-7	QP551 .P44 2004
11.	2	Silverman, R.P.	The Organic Chemistry of Enzyme-Catalyzed Reactions	Academic Press 2002 ISBN 0-12-643731-9	QP601 .S55 2002

*Number of copies on reserve. Electronic access to books 1, 2, 3, 4 and 9 are also available through EbookCentral (http://kksng.weebly.com/bcem543.html).

Course Outcomes:

- Compare and contrast the roles of hydrogen bonds, electrostatic interactions and hydrophobic interactions in the binding of substrates, transition states and inhibitors to enzymes
- Use free energy diagrams to explain the effects of water on the energetics of noncovalent binding interactions in enzymes
- Refer to examples of well-studied chemical model systems and enzymes to compare and contrast the roles of proximity, covalent catalysis, acid-base catalysis and transition-state stabilization as mechanisms explaining enzyme catalysis.
- Apply the basic concepts and equations of chemical kinetics to quantitatively describe the kinetics of elementary reactions and more complex mechanisms
- Explain the molecular basis of the rapid-equilibrium and steady-state assumptions central to the derivation of equations used for initial rate experiments in enzyme kinetics
- Apply equations to quantitatively describe and compare the effects of substrate inhibition, reversible and irreversible inhibition and time-dependent inhibition on enzyme kinetics
- Apply equations to quantitatively describe and compare the kinetics of random and ordered bisubstrate enzyme mechanisms
- Compare and contrast the assumptions, strengths and limitations of theoretical models used to explain the behavior of cooperativity and allosteric regulation in enzymes
- Refer to theoretical models to explain the molecular structural and kinetic basis of enzyme regulation in well-studied model enzyme systems
- Apply the central concepts underlying enzyme catalysis, kinetics and regulation to solve problems through discussion and reflection in small groups

Electronically Approved - Sep 03 2020 14:48

Department Approval

Electronically Approved - Sep 03 2020 19:07

Associate Dean's Approval