



**REVISED COURSE OUTLINE FOR REMOTE LEARNING**

To account for the necessary transition to remote learning from March 13 onward, adjustments have been made to assessment deadlines and requirements so that all coursework tasks are in line with the necessary and evolving health precautions for all involved (students and staff). If you are unable to meet the deadlines or requirements specified, please connect with your course instructor to work out alternative dates/assessments.

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

Lecture 01: MWF 12:00 - 12:50 - Remote Learning (check with your instructor or coordinator for details)

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

**Course Site:**

D2L: BCEM 543 L01-(Winter 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 393 or 443.

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
In-class and Online Assignments	20%	
Midterm Exam	40%	Sat. March 7
Presentation preparation worksheets (submitted through D2L)	10%	Mar. 27 & April 1
Group presentation powerpoint slide deck (submitted through D2L)	15%	Fri. April 3
Oral questioning and peer evaluations (Zoom meeting)	5%	April 6 & April 8
Post-presentation worksheet and self-reflection (submitted through D2L)	10%	Wed. April 15

(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
<b>Minimum % Required</b>	92 %	86 %	82 %	78%	74%	70 %	66 %	62%	58%	54 %	50 %

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

The University has suspended requirements for students to provide evidence for reasons for absences so please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations. Please let your instructor know immediately if you are ill and cannot meet the deadlines specified.

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

The following out of class activities are scheduled for this course.

Activity	Location	Date and Time	Duration
MT Exam	TBA	Saturday, March 7, 2020 at 12:00 pm	3 Hours

**REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY.** If you have a conflict with the out-of-class-time-activity, please contact your course coordinator/instructor no later than **14 days prior** to the date of the out-of-class activity so that alternative arrangements may be made.

6. **Course Materials:**

There are no additional course materials required for this course.

7. **Examination Policy:**

No aids are allowed on tests or examinations.

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:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see [www.ucalgary.ca/wellnesscentre](http://www.ucalgary.ca/wellnesscentre) or call [403-210-9355](tel:403-210-9355).
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. 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](mailto:svsa@ucalgary.ca)) or phone at [403-220-2208](tel:403-220-2208).
- 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. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- f. **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](mailto:addy@ucalgary.ca) or phone [403-220-6979](tel: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.
- g. **Safewalk:** Campus Security will escort individuals day or night (See the [Campus Safewalk](#) website). Call [403-220-5333](tel:403-220-5333) for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- h. **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.
- i. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](tel:403-220-3911) Email: [suvpaca@ucalgary.ca](mailto:suvpaca@ucalgary.ca). SU Faculty Rep., Phone: [403-220-3913](tel:403-220-3913) Email: [sciencerep@su.ucalgary.ca](mailto:sciencerep@su.ucalgary.ca). [Student Ombudsman](#), Email: [ombuds@ucalgary.ca](mailto:ombuds@ucalgary.ca).
- j. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned

off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.

- k. **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.
- l. **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 Winter 2020 TENTATIVE SCHEDULE (there may be minor changes)

January 13 Introduction and Binding 1  
January 15 Binding 2  
January 17 Binding 3

January 20 Catalysis 1  
**January 22 In-class assignment 1 (4%)**  
January 24 Catalysis 2

January 27 Catalysis 3  
January 29 Catalysis 4  
January 31 Catalysis case study

February 3 Catalysis case study  
**February 5 In-class assignment 2 (4%)**  
February 7 Catalysis case study

February 10 Chemical kinetics  
February 12 Enzyme kinetics 1  
February 14 Enzyme kinetics 2

#### **February 15-23 Winter Break -- NO LECTURES**

February 24 Enzyme kinetics 3  
**February 26 In-class assignment 3 (4%)**  
February 28 Enzyme kinetics case study

March 2 Enzyme kinetics case study  
**March 4 In-class assignment 4 - part A (2%)**  
**March 6 Review**

#### **March 7 Midterm Exam (40%) (Out-of-class, Saturday, Location ST135)**

March 9 Enzyme kinetics  
March 11 Enzyme kinetics  
**March 13 Cancelled**

**March 16 Cancelled**  
**March 18 Cancelled**

March 20 Enzyme kinetics case study (online) + **Online Assignment 4 part B (2%) (due on March 23)**

March 23 Presentation prep session during class time + Enzyme regulation 1 (online)  
March 25 Presentation prep session during class time + Enzyme regulation 2 (online)  
March 27 Presentation prep session during class time + **Presentation Worksheet 1 DUE at 9 pm (5%)**

March 30 **Enzyme regulation Online Assignment 5 (4%) (due on April 1)**

**April 1** Presentation prep session during class time + **Presentation Worksheet 2 DUE at 9 pm (5%)**  
**April 3** Presentation prep session during class time + **Presentations DUE at 9 pm (15%)**

**April 6** Team questions and discussion Zoom Session 1 during class time (5%)  
**April 8** Team questions and discussion Zoom Session 2 during class time  
**April 10** Good Friday

**April 13** Easter Monday

April 15 Zoom session for questions/discussion during class time (**Post-presentation reports DUE at 9 pm**) (10%)

Reserve Reading List – BCEM 543 W2018

	*	AUTHOR	TITLE	PUBLISHER/DATE/EDITION	CALL NUMBER
1.	1	Bugg, T.D.H.	Introduction to Enzyme and Coenzyme Chemistry, 3 <sup>rd</sup> 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 2 <sup>nd</sup> 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 - Mar 20 2020 15:28

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**Department Approval**

Electronically Approved - Mar 20 2020 15:36

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**Associate Dean's Approval for alternate final examination arrangements or remote learning and out of regular class-time activity**