

BIOCHEM 4C03 – Inquiry in Biochemistry 2024 WINTER Term

Instructor: Dr. Russell E. Bishop (bishopr@mcmaster.ca)

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Course Description

Broader aspects of biochemistry such as those relating to food, drugs, health and environment discussed in small groups. Group and individual projects, seminars and lectures as appropriate to the subject matter.

Prerequisite(s): Registration in Level IV or above of an Honours Biochemistry program

Antirequisite(s): BIOCHEM 4B06 A/B, [4F09 A/B](#), 4P03, 4R12 A/B, [4T15 A/B](#), [4Z03](#), [ISCI 4A12 A/B](#)

Materials & Fees

Required Materials/ Resources: There is no required materials.

Course and Learning Objectives

Learning Objectives

The objective of the course is to teach students how to derive the equations of steady-state enzyme kinetics. We will start by reviewing how to derive enzyme kinetic equations using the rapid equilibrium and steady-state assumptions for unireactant (one substrate, one product) enzymes. With that achieved, we will branch out to explore the more realistic case of bireactant (two substrate, two product) enzymes. We will learn that the three common bireactant steady-state kinetic mechanisms (Ping Pong Bi Bi, Ordered Bi Bi, and Theorell-Chance) account for only 3 of 8 possible mechanisms. The remaining five are known as Iso mechanisms, which depend on the isomerization of stable enzyme forms. The Iso mechanisms include Iso Ordered Bi Bi, Iso Theorell-Chance, Di-Iso Ping Pong and two Mono-Iso Ping Pong variations. The 5 Iso mechanisms are not well characterized like the 3 common mechanisms. Our goal is to provide a complete accounting of the 8 steady-state bireactant kinetic mechanisms by including the Iso mechanisms.

Since most of the activities will take place in groups, students should also gain experience of teamwork and personal interactions in the working environment.

Course Overview and Assessment

Time of lectures, meetings and student presentations:

There is a single in-person session every Wednesday from 8:30 am to 11:20 am. The course starts on Jan 10 and ends on April 3, 2024. The midterm recess occurs between Feb 19 and Feb 23. No lectures or meetings with the students will occur during the midterm recess. The schedule for the lecture periods serves primarily to reserve a time and place for students to meet with the instructor or teaching assistants. A draft schedule of events and due dates for assignments is shown below.

Wed	8:30 am - 11:20 am; MDCL 1110
10-Jan	Introduction Lecture
17-Jan	Group Meeting
24-Jan	Group Meeting
31-Jan	Group Presentation One/Uni Uni Mechanisms
7-Feb	Group Meeting
14-Feb	Group Meeting
21-Feb	Mid-term recess
28-Feb	Group Presentation Two/Bi Bi Product Inhibition
6-Mar	Group Meeting
13-Mar	Group Meeting
20-Mar	Group Meeting
27-Mar	Group Meeting
3-Apr	Group Presentation Three/Bi Bi Distribution Equations

This lecture schedule is based upon current university and public health guidelines and may be subject to changes during the term. Any changes to the schedule or course delivery will be communicated on the course announcements section on Avenue to Learn. Please check the announcements prior to attending class.

Group Assignment: Available at A2L

Course Communication:

Communication between the instructor or teaching assistants with the students will occur via Avenue to Learn (A2L), and McMaster Email. Students should check their email daily to ensure that they do not miss any events scheduled at dates/times and locations other than those noted in the schedule above.

Course Information and Requirements:

Students are randomly grouped and assigned a set of kinetic mechanisms, Dr. Bishop will give a lecture to explain unireactant enzyme kinetic derivations using the rapid equilibrium and steady-state assumptions. and will learn how to derive the corresponding equations in the three stages of the course. During the group presentation days, you will have an opportunity to present your results to the class and to learn from the other students about the other mechanisms. Assigned group leaders are responsible for uploading the presentation files on behalf of the group.

The initial student presentation will be of an introductory nature, comparing the rapid equilibrium and steady-state equations for unireactant enzymes and their basic modes of inhibition (competitive, uncompetitive, and non-competitive).

The presentations should not exceed 20 minutes in duration with 5 minutes for questions and comments from the audience. Audience participation is required. Generally, a single Powerpoint “slide” will take at least 1 minute to present. Due to time constraints on scheduling, each student presentation will be strictly limited to the periods cited above. Powerpoint files should be uploaded to A2L (discussion folder) 8:30 am on the day of presentation.

It is up to each group to decide how many people will be giving the presentation and the non-presenting members (if any) will be responsible for answering questions. Please contact the instructor if you have any concerns in giving a presentation.

Assessments Overview:

Grade Item	Deadline Dates	Weight (%)
First presentation ppt	Jan 31, 8:30 am	20
Second presentation ppt	Feb 28, 8:30 am	30
Third presentation ppt	April 3, 8:30 am	50

Students will submit their presentations (A2L) by the time identified above. The mark for late upload of the presentations or grant proposal will be reduced by 2.0% for each hour following the due time.

Schedule of Events:

January 10: First lecture. The instructor will describe the course objectives, organization and student evaluations.

January 17: Dr. Bishop will give a lecture to explain unireactant enzyme kinetic derivations using the rapid equilibrium and steady-state assumptions. Reading materials will be available on A2L. Groups will be assigned specific kinetic mechanisms.

January 24: Dr. Bishop will give a lecture to explain unireactant enzyme inhibition using the rapid equilibrium and steady-state assumptions.

January 31: Students will upload their first presentation ppt to A2L by 8:30 am. Student presentations take place this week.

February 7 and 14: Dr. Bishop will give lectures to explain bireactant kinetic mechanisms for both the common and Iso mechanisms with a focus on deriving the equations for product inhibition.

February 21: Midterm Recess

February 28: Students will upload their second presentation ppt to A2L by 8:30 am. Student presentations take place this week.

March 6, 13, 20, and 27: Dr. Bishop will give lectures to explain bireactant enzyme kinetic derivations for both the common and Iso mechanisms with a focus on deriving the distribution equations.

April 3: Students will upload their third presentation ppt to A2L by 8:30 am. Student presentations take place this week.

Requests for Relief for Missed Academic Term Work

[McMaster Student Absence Form \(MSAF\)](#): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”.

Academic Accommodation of Students with Disabilities

Students with disabilities who require academic accommodation must contact [Student Accessibility Services \(SAS\)](#) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University’s [Academic Accommodation of Students with Disabilities](#) policy.

Academic Accommodation for Religious, Indigenous Or Spiritual Observances (Riso)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](#) policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

Academic Integrity

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

It is your responsibility to understand what constitutes academic dishonesty.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the [Academic Integrity Policy](#).

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

Authenticity / Plagiarism Detection

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For

more details about McMaster's use of Turnitin.com please go to the [McMaster Office of Academic Integrity's](#) webpage.

Conduct Expectations

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all our living, learning and working communities. These expectations are described in the [Code of Student Rights & Responsibilities \(the "Code"\)](#). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

Copyright and Recording

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

Research Ethics -N/A

Extreme Circumstances

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.