

ENZYMولوجY (Spring 2021)
Chem 4630, Chem 6630, Biol 4630, Biol 6630

Instructor: Dr. Giovanni Gadda, ggadda@gsu.edu

Teaching Assistant: Ms. Joanna Quaye, NSC 510

Prerequisites for undergraduate level:

Organic Chemistry (CHEM 2400), Biochemistry I (CHEM 4600/6600) – C or higher

Lecture: MW 5:30–6:45 PM, online; students are strongly encouraged to attend classes synchronously at the time and date when they are offered live. Lectures will be recorded and posted in iCollege (with some delay due to the WebEx software) for asynchronous usage. Students are encouraged to review the topics that will be covered in the lectures before attending class.

Office Hours: MW 6:45 – 7:30 PM (through WebEx/iCollege, with priority when an appointment is previously requested by email). Office hour sessions are public and open to all students who want to attend. Office hours sessions will NOT be recorded.

To have priority treatment, send an email ahead of time to schedule an appointment at these hours. Students are required to have their lecture notes.

In order to save precious student's time, it is best to ask questions in a virtual meeting during office hours rather than through the use of email. The most effective approach is for the student to send an email to the instructor to book a priority seat in the office hours while specifying in the email the general topic without any details. An example is: "*Dear Dr. Gadda, I have a question about the meaning of the K_m value; I would like to meet with you and discuss about it during office hours on Monday. Best, Jane/Joe Doe*". Experience taught us that having a conversation is the most effective way to clarify doubts and getting a good grasp of topics, rather than spending extended time and effort going back and forth by using emails. In this fashion, student's time and efforts can be considerably saved.

Text: 1) Enzyme Kinetics and Mechanism, Paul F. Cook and W. W. Cleland; 2007; Garland Science Publishing; ISBN: 0815341407.

Required Reading: 1) Kuyper, B.J. (1991) Bringing up scientists in the art of critiquing research. *Bioscience*, 41:248-250 – it will be provided.
2) Peer-reviewed journal articles (TBA) to cover some topics.
3) Various handouts.
Required readings will be available in iCollege.

Course Objective: To become knowledgeable on fundamental concepts in enzyme mechanisms and kinetics, the common methods for studying enzymes, and the current developments in the field. To develop skills in critically reading and assessing published journal articles and the scientific literature.

Course Requirements: Students are strongly encouraged to attend synchronously all class sessions.

Graduate students: 3 take-home exams (100 pts each; total 300 pts)
1 lecture (oral) presentation (100 pts)
2 written critiques will be counted (50 pts each; total 100 pts)

Total pts. 500

Undergraduate students: 3 take-home exams (100 pts each; total 300 pts)
2 written critiques will be counted (50 pts each; total 100 pts)

Total pts. 400

Take-home problem sets: Problem sets must be turned in before the beginning of class on the dates they are due.

Lecture presentations:

1. Students, working in pairs, will prepare a lecture presentation on a method/approach taken from a peer-reviewed journal article chosen from a pool suggested by the instructor.
2. The length of the lecture presentation will be 30 minutes, including Q&A, unless otherwise announced in iCollege.
3. Each group, working together, will prepare 15 PowerPoint slides and write up the lecture presentation's narrative in a Word document. The word document will contain explicit citations to the slides. Example, "As shown in slide 12, ...", or "... (slide 12) ...".
4. Each lecture presentation should consist of the following elements:
 - a. background and introduction to the article presented (1-2 slides)
 - b. list of the techniques employed in the study (1-2 slide)
 - c. list of the results obtained and overall conclusions (2 slides)
 - d. a detailed lecture on a method of choice used in the study (10 slides). Material for this portion can be taken from sources outside the presented article, with proper citation
5. Each slide must have the name of the student presenting it.

6. The PowerPoint and Word files will be uploaded onto iCollege by the presenting students before 5:30 PM on the day before the scheduled date for the presentation. Files will have filenames like: "Lecture group #.docx", Lecture group #.ppt".
7. It is the students' responsibility to ensure an equal workload, both in terms of content and time, in the lecture presentation. It is important to split the portion on the method of choice equally between the group members.
8. Presenting students will be lecturing on WebEx during scheduled class time and will be available for Q&A with other students and the instructor(s). Lectures will be recorded and posted on iCollege.
9. Class participation with intelligent questions on the topics covered in the student lecture presentations will be rewarded with extra credit points.

Written critiques: Students will write a 1-2 pages critique of the article presented in class using the *Bioscience* article as a guide. The written critiques will be uploaded on iCollege by the student before class (5:30 PM on the scheduled day). Up to 4 written critiques could be turned in for grading (2 will be counted for the final grading).

Important Note:

Failure to turn in any assignment on time (take-home problem sets, written critiques, or any other extra assignment) will result in a 5% penalty of the grade for each day of delay.

All students, irrespective of whether they present, are responsible for reading and preparing to discuss each article presented during the semester.

Coursework and Grading:

The grading will be based on the following criteria:

- a) Accuracy of answer and reasoning
- b) Adequacy of answer or presentation and written critique, i.e., the reasoning for the basis of the answer must be clear
- c) All results must be presented with proper units, e.g., time, concentration, etc.
- d) Discussion participation, e.g., points/issues raised, questions, answers, etc.

Projected Grading Scale: A+: 95%, A: 90%, A-: 87%, B+: 84%, B: 80%, B-: 77%, C+: 74%, C: 70%, C-: 67%, D: 60%, F: <60%

Cheating:

A student who cheats, plagiarizes, or violate policies on academic honesty, on an assignment **will receive a zero** for that assignment. The Department of Chemistry follows the Academic Conduct Policies and Procedures published in the "Georgia State University Code of Conduct" handbook, available at

<https://codeofconduct.gsu.edu/>. Any offense will be referred to the Dean of Students for appropriate action.

All tests taken must represent the student's individual, unaided efforts.

Group discussions, the use of books and journal articles, and other relevant material that can help to study topics relevant to the questions in the assignments, are strongly encouraged. Students are encouraged to work together in groups and extensively discuss assignments and how to best answer the assignments' questions.

It is strongly recommended, however, that at the moment of writing the answers for the assigned tests, each student works individually and independently without external aids, i.e., other students, books, webpages, etc.

Miscellaneous:

March 2 is the last day to withdraw from the class and receive a "W".

The University requires that faculty members must, on a date after the mid-point of the course to be set by the Provost (or his designee):

1. Give a WF to all those students who are on their rolls but no longer taking the class and
2. Report the last day the student attended or turned in an assignment.

TENTATIVE LECTURE SCHEDULE

This schedule is a general guide and might be modified as needed

NOTE: All students are required to independently review the Michaelis-Menten approach to study enzyme kinetics (with the related equation, plot, and the three conditions that are required to use this approach) and the Henderson-Hasselbalch equation for the description of the ionization of weak acids and bases (relationships between pH and pK_a). These fundamental topics will NOT be covered in lectures.

Date	#	Lecture Topic	Instructor & Student's Action
January 11	1	Introduction to the course + general concepts	
January 13	2	Modern enzymology in the 21 st century	
January 20	3	What are enzymes, and how they work	
January 25	4	Principles and mechanisms of enzyme catalysis (1)	
January 27	5	Principles and mechanisms of enzyme catalysis (2)	
February 1	6	Effective catalyst's concentration	
February 3	7	Initial velocity studies: essential kinetic tools	Instructor posts Take-home Exam 1 on iCollege (covers lectures 1-7) at 7:00 PM
February 8	8	Initial velocity studies: kinetic parameters' significance	Student uploads completed Take-home Exam 1 on iCollege before 5:30 PM
February 10	9	Reversible enzyme inhibition	
February 15	10	Initial velocity studies in the presence of added products	
February 17	11	Enzymes with multiple substrates (1)	Instructor posts Take-home Exam 2 on iCollege (covers lectures 1-11) at 7:00 PM
February 22	12	Enzymes with multiple substrates (2)	Student uploads completed Take-home Exam 2 on iCollege before 5:30 PM
February 24	13	Product inhibition and its applications	
March 1	14	How to derive analytical rate equations (1)	
March 3	15	How to derive analytical rate equations (2)	
March 8	16	Rapid reaction kinetics: essential kinetic tools	
March 10	17	Rapid reaction kinetics: applications (1)	
March 22	18	Rapid reaction kinetics: applications (2)	
March 24	19	Kinetic isotope effects for the study of kinetic mechanism	Instructor posts pool of papers to choose for lecture presentations on iCollege at 7:00 PM
March 29	20	Kinetic isotope effects as probes of reaction mechanism	
March 31	21	pH effects of kinetic parameters and isotope effects (1)	5:00 PM – deadline for graduate students to choose the paper and group (# 1/8) for the lecture presentation
April 5	22	pH Dependence of kinetic parameters and isotope effects (2)	Instructor posts schedule for graduate students lecture presentations on iCollege at 7:00 PM
April 7	23	TBA	
April 12	24	TBA	Instructor posts Take-home Exam 3 on iCollege (covers lectures 1-25) at 7:00 PM

April 13			Students in Groups 1 & 2 upload lecture presentation (PowerPoint and Word files) on iCollege before 5:30 PM
April 14	25	Paper presentation (Groups 1&2)	Student uploads Written critique #1 on iCollege before 5:30 PM
April 18			Students in Groups 3 & 4 upload lecture presentation (PowerPoint and Word files) on iCollege before 5:30 PM
April 19	26	Paper presentation (Groups 3&4)	Student uploads Written critique #2 on iCollege before 5:30 PM
April 20			Students in Groups 5 & 6 upload lecture presentation (PowerPoint and Word files) on iCollege before 5:30 PM
April 21	27	Paper presentation (Groups 5&6)	Student uploads Written critique #3 on iCollege before 5:30 PM
April 25			Students in Groups 7 & 8 upload lecture presentation (PowerPoint and Word files) on iCollege before 5:30 PM
April 26	28	Paper presentation (Groups 7&8)	Student uploads Written critique #4 on iCollege before 5:30 PM Student uploads completed Take-home Exam 3 on iCollege before 5:30 PM