Biochemistry & Molecular Biology (BMB) 829
Methods of Macromolecular Analysis and Synthesis
Fall Semester 2021
Course Syllabus, Policies, and Schedule

Credit Hours: 2
Course meeting days and time: TR 9:10-10:00
Course location: 111 Biochemistry Building

Instructors

Charles G. Hoogstraten; Course Coordinator
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Course Description and Objectives

The course seeks to introduce students to modern molecular and structural/analytical techniques, including chromatin immunoprecipitation, two-hybrid systems for protein-protein interaction detection and analysis, mass spectrometry and its omics applications, flow cytometry, *in vivo* imaging, confocal microscopy, NMR, isothermal titration calorimetry, and surface plasmon resonance. It provides methodological information that goes beyond the textbook basics on molecular biology, optical imaging and protein structure and interactions. Students should develop basic understanding of the capabilities and limitations of these tools that will provide a foundation for use of these techniques in research.

Required Textbook & Course Materials:
No required textbooks; required reading material will be provided by instructors on D2L.

Format:
This course will be taught in-person for both lectures and exams, with any exceptions announced by the instructor both in class and on D2L. Because of irregularities in course attendance that may arise from quarantines and other effects of the ongoing COVID pandemic, lectures will be recorded (audio and video feeds) and posted to D2L whenever practicable. These are not a general replacement for class attendance, but students are encouraged to make use of them in cases of known or suspected COVID exposure or the observation of symptoms in order to avoid possible viral spread.

Required Technologies:
This course will make extensive use of the D2L platform at Michigan State (d2l.msu.edu) to communicate course materials of various sorts. An internet connection and device capable of downloading documents, displaying Microsoft Word and PowerPoint and Adobe PDF documents and displaying video are required.

Recommended Texts & Other Materials:
Additional recommended reading and viewing materials will be provided on D2L.

COVID-19 Policy:
Michigan State University is at present requiring all personnel to wear masks when indoors and, except in very limited exemption circumstances, to be fully vaccinated before attending any MSU classes, meetings, or functions. Details may be found at https://msu.edu/together-we-will/directives.html. For the safety of students, instructors, and others in the building, BMB 829 fully supports and expects compliance with these and all other University policies relating to infectious disease safety. Students declining to wear masking or to practice appropriate viral safety will be asked to leave the classroom.

The BMB 829 instructors are fully cognizant of the difficulties the pandemic has posed for many students. Our goal is to see all of our students succeed despite the ongoing challenges of the pandemic. Should you find yourself in scheduling, academic, or mental or emotional health difficulties, you are urged to contact the current course instructor and Prof. Hoogstraten as soon as possible so that appropriate accommodations may be made. In addition, MSU has made

extensive resources available through the Keep Learning section of the University website, including academics (https://remote.msu.edu/learning/additional-resources.html) and for students facing challenges related to mental health (https://remote.msu.edu/learning/mental-health.html). Students are encouraged to make full use of any or all of these resources as the need arises.

Learning Continuity Statement:
Should students be unable to attend class for an extended period of time, they should communicate this to the Course Coordinator (hoogstr3@msu.edu) as soon possible once the situation becomes evident. Students should work with course instructors to develop a schedule for regular communication and reasonable timelines for completing assignments including exams.

Course Continuity Statement:
Should an instructor be required to be absent for an extended period of time, scheduling of different course modules may be adjusted accordingly. Students may communicate with either the Course Coordinator or any of the other course instructors regarding grading and assessment modifications.

Prerequisites:
Recommended background equivalent to BMB 462.

Late Work Policy:
Full credit for late submissions will only be considered if arranged with the instructor in advance of the due date. Otherwise, point penalties may be assigned or late work may not be accepted at the discretion of the individual instructor. Communication with the instructor about situations leading to late work as soon as possible is *strongly* advised.

Student Expectations:
All participants in this class are held to the standard set by MSU's Policy on Integrity of Scholarship and Grades. The policy can be read in full at the MSU Ombudsperson's website.

On March 22, 2016, The Associated Students of Michigan State University (ASMSU) adopted the following Spartan Code of Honor:
"As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that honor is worth more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do."

Disability Access:
Students must inform the instructor and course coordinator at the beginning of the semester, or as soon as reasonably possible after a situation arises during the semester, of any accommodations needed. Information related to disability access is available on the Resource Center for Persons with Disabilities (RCPD) website. Students: to make an appointment with a specialist, call: (517) 353-9642 Or TTY: (517) 355-1293 or visit the RCPD website.

Course Outline and Schedule

Assessments:
Each module will have separate due dates for problem set(s), to be announced at the beginning of each module. A midterm exam is scheduled for the regular class session on October 21, covering lecture material through October 12, i.e., material presented by Profs. Kuo, O'Reilly, and Bernard. A final exam, scheduled for 10:00 a.m. to 12:00 noon on Tuesday December 14, will cover lecture material from October 14 until the end of the semester, i.e., material presented by Profs. Frame, Hoogstraten, and Quinn. The final will not be cumulative

Course Outline:
The planned schedule of lecture presentations is presented in the table below, with class meeting number, dates, instructors, and lecture topics.

#	Date	Instructor	Topic
1	9/2	Kuo	Molecular cloning at different scales
2	9/7	Kuo	Introduction to genome editing
3	9/9	Kuo	Protein-DNA interaction, ChIP
4	9/14	Kuo	Protein-DNA interaction, ChIP at the genome scale
5	9/16	Kuo	Protein-protein interactions, Y2H
6	9/21	Kuo	Protein-protein interactions, TAP
7	9/23	O'Reilly	An Introduction to pre-clinical optical imaging, and the IVIS Spectrum
8	9/28	O'Reilly	Bioluminescence Imaging – concepts and applications in in vivo preclinical imaging
9	9/30	O'Reilly	Fluorescence Imaging – concepts and applications in in vivo preclinical imaging
10	10/5	Bernard	Flow Cytometry: Instrumentation and Applications
11	10/7	Bernard	Flow Cytometry: Instrumentation Operation Overview
12	10/12	Bernard	Flow Cytometry: From Experimental Design to Data Analysis
13	10/14	Frame	Confocal Microscopy, Optical Filters, Fluorescent Labeling, Fusion Proteins
14	10/19	Frame	Live Cell Imaging, Colocalization/FRET, Laser Capture Microscopy
	10/21		**Midterm Exam covering lectures through 10/12**
15	10/28	Hoogstraten	Principles of NMR: Basics and observables
16	11/2	Hoogstraten	Principles of NMR: Biomolecular Experimentation

17	11/4	Hoogstraten	Applications of NMR: Structure
18	11/9	Hoogstraten	Applications of NMR: Dynamics and Catalysis
19	11/11	Hoogstraten	Biophysical Studies of Binding: Principles
20	11/16	Hoogstraten	Biophysical Studies of Binding: ITC and SPR
21	11/18	Quinn	Mass Spectrometry: Defining Analytical Goals
22	11/23	Quinn	MS: Strategies for Metabolite Annotation
	11/25		**Thanksgiving Day -- No Class**
23	11/30	Quinn	GC/MS and LC/MS
24	12/2	Quinn	Untargeted Profiling of Metabolites
25	12/7	Quinn	MS/MS, Molecular Networking and GNPS
26	12/9	Quinn	GNPS data analysis activity
	12/14		**Final exam (10:00 – 12:00, regular classroom)**

Grading Policy:
The course grade will be apportioned as follows:

Problem set overall average	40%
Midterm exam	30%
Final exam	30%

At least one problem set will be assigned by each instructor. Format and deadlines will be announced in class and posted on D2L by each instructor. The overall problem set average will be determined in a weighted fashion based on the number of lectures for each instructor. The weight given to each exam section will be commensurate with the number of lecture hours for each module covered by the exam. Students can expect the distribution of material on each exam to be very roughly proportional to the number of lectures given by each instructor. Letter grades will be assigned at the end of the semester and will be curved based on the final distribution of student scores.
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