PLB/BMB 856: Plant Molecular and Omic Biology
Syllabus - Spring 2023

Instructors:

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Brief Description of Course:

The intention of the course is to provide a survey of plant molecular biology, molecular genetics, genomics and cell biology, emphasizing recent research advancement and technology development in these disciplinary areas.

Prerequisite:

College-level genetics and/or biochemistry courses and an understanding of molecular biology and gene expression are ***essential*****.** Please do not enroll in the course if you do not have this background. Please contact Hideki Takahashi (htakaha@msu.edu) if you have any doubts about the suitability of your preparation.

Credits: 3-0

Class Session: 3:00-4:20 PM on every Tuesday/Thursday
Room 247, Plant Biology Building

Course Materials: D2L (https://d2l.msu.edu/d2l/loginh/)
Use your MSU NetID and password (case-sensitive) to log in.

Assignment Folder: Google Drive (https://googleapps.msu.edu/)
Use your MSU NetID and password (case-sensitive) to log in.

***Zoom Meeting:** https://msu.zoom.us/j/91537765409
Meeting ID: 915 3776 5409
Passcode: omics856

*The Zoom option will be used to accommodate students who will need to quarantine after COVID-19 exposure or in case we need to change the course modality to online learning during the semester.

Course Grade:

The course grade is based on two exams (50% of grade total; split between the midterm and the final), writing of a research proposal (30% of grade total), and out-of-class homework assignments (20% of grade total).

Class Format/Daily Preparation:

Sessions of the class typically will consist of lectures by the instructors combined with a discussion of reading materials. For each week, two to four key articles will be posted as pdf files at the D2L web site, by the previous Friday. ***Please read these articles before joining class sessions.*** These articles are designated for thorough understanding and in-depth discussion of lecture topics.

Students should prepare by making sure that they can answer the following key questions:

- What was the goal of the research, including the problem being addressed?
- Which figure(s) or table(s) presents the most critical data in the study? Why?
- What were the strengths and weaknesses of the paper?
- What would *you* do next?

The instructors will provide lecture notes by or soon after lecture time through D2L. These notes will provide copies of some of the figures and tables that may be mentioned from the articles other than the assigned reading materials.

Homework:

Short homework assignments are scheduled 10 times during the semester. Homework will be made available through D2L after lectures on Thursday. The homework assignments will be due Friday, 11:59 PM. Upload your response to your assignment folder in Google Drive.

Exams:

The two exams will have an open-book, take-home format.

- Notes, books, articles, and online information may be consulted, but students are expected to complete their exams independently, without discussion with others until after all exams are turned in.
- The exams will be made available to students through D2L as indicated on the schedule.
- Upload your complete exam response to your assignment folder in Google Drive.

	Available on D2L	Due in Google Drive
Midterm Exam	March 2, 5:00 PM	March 3, 11:59 PM
Final Exam	May 2, 5:00 PM	May 3, 11:59 PM

Research Proposal:

The assignment is to write an original research project proposal on a specific topic in plant molecular biology, molecular genetics and genomics.

- ***The proposal should include the molecular genetics and genomics aspects of the problems you choose to address*** (as opposed to being focused only on the biochemistry, quantitative genetics, molecular breeding or physiology aspects of the problem). It should be related to a topic pertinent to the course. However, it does not have to be on a topic specifically covered in class.

- You should focus on a basic biology problem, though you may extend it with a perspective on translational possibilities. For instance, you could write a proposal in relation to mechanisms of plant disease resistance; molecular genetics of plant development; molecular and physiological responses to the environment (e.g., light, temperature, water, UV); etc.
- The proposal should be original and creative. Students may not use a paper written for another course, nor conceptualized by someone else.
- You are encouraged to start researching your topic as soon as the course begins, including discussions with course instructors before or after class times.
- Your proposal should be written using a 11-12 point standard 'with serif' font (Times New Roman 12 point is a good choice) and single line spacing, numbering all pages.

- The general format of the proposal should be as follows:

  A. Summary with Specific Aims (1 page max.). State the broad, long-term objectives of the proposed line of research and describe concisely and realistically what the specific research described in the proposal is intended to accomplish. Specific aims should be listed as a short list (typically 3 specific aims total).

  B. Background and Significance (2 pages max.). Summarize what is known about the chosen area of research critically evaluating the existing knowledge and specifically identifying the gaps the project is intended to fill. State concisely the importance of the research and relate the specific aims to the broad, long-term objectives of the project. Please cite key references in this and the next section, preferably in a "first author, date" style.

  C. Experimental Design and Methods (4 pages max.). Outline the experimental design and the procedures to be used to accomplish the specific aims of the project. Include discussion on how you will interpret the data. Discuss the potential difficulties and limitation of the proposed procedures and present alternative approaches to achieve the aims where appropriate. On a separate page (not included in the 4 page max count), give a tentative sequence or timetable for the investigation.

  D. References. List the literature cited in the text, including titles and full list of authors.

  E. Graduate and Past Research Projects (1 paragraph). Briefly summarize the research you are conducting for your graduate degree.

- Your research proposal should be submitted in three steps.

Jan 31	One page summary statement about your long-term goal, hypothesis, specific aims, and experimental design to be described in your proposal
Feb 7 or 9	Discussion about your choice of topic and summary statement with the instructors
Apr 18	Submission of the final version of your proposal

- Upload your documents to your assignment folder in Google Drive.

Oral Presentation of Research Proposal:

Class periods (currently planned on April 25th and 27th) are reserved for students to give 10-minute presentations describing their research proposals to the rest of the class. The order of the presentations will be randomly selected and announced by only one day prior to the first session; thus all students should be prepared to speak on April 25th.

- Each student to give a 10-minute presentation describing the research proposal.
- Electronic slides (PowerPoint) should be used to aid the presentations.
- We recommend no more than 10 slides for a 10-minute presentation.

Other Recommended Activities:

- Throughout the semester, several seminar series will be hosting scientists who will present lectures on pertinent topics. Some may be mentioned in class, and posted on the D2L site or provided by email. We encourage you to mention seminars in class so that other students may learn of them.
- If you are a BMB student in the Molecular Plant Sciences (MPS) Program and would like to obtain more information on topics in molecular genetics and genomics that are not covered in PLB 856, you may consider attending lectures in BMB 801 "Molecular Biology". The course is offered in Fall semesters. Please contact the course instructors David Arnosti (arnosti@msu.edu) and Bill Henry (henryrw@msu.edu) for details or advice.

Course Assessment:

Michigan State University and the instructors take seriously the opinion of students in the evaluation of the effectiveness of instruction, and MSU has implemented the SIRS (Student Instructional Rating System) process to gather student feedback. This course utilizes the "online SIRS" system. You will receive an e-mail sometime during the last two weeks of class asking you to fill out the SIRS online form at your convenience. Please note the final grade for this course will not be accessible on STUINFO during the week following the submission of grades for this course unless the SIRS online form has been filled out. You will have the option on the online SIRS form to decline to participate in the evaluation of the course – we hope, however, that you will be willing to give us your frank and constructive feedback so that we may instruct students better in the future.

COVID-Related Accommodations:

- The course will be administered by following MSU COVID directives (https://msu.edu/together-we-will/directives.html). To slow the spread of COVID-19, Michigan State University is directing everyone to take personal responsibility to protect their own health and safety, as well as the health and safety of MSU faculty, staff, students, visitors and loved ones.
- ***Do not come to class if you test positive for COVID or experience COVID symptoms.*** Class will change to an in-person/online hybrid format (Zoom option) to accommodate students who need to stay at home and quarantine.
- The course instruction may change to online learning (Zoom option) should there be a surge in COVID-19 cases in the community. We will follow the university directives and public health guidance in case we need to change the course modality during the semester. Relevant information will be posted on D2L or through email communications to students.

PLB 856 Plant Molecular and Omic Biology

Lecture	Date	Instructor	Topics	Exam & Homework	Research Proposal Writing
1	1/10/23	Takahashi	Course Organization / Model Organism / Natural Diversity		
2	1/12/23	Takahashi	Plant Transformation	Homework 1	
3	1/17/23	Takahashi	Reverse Genetics / Genome Editing / TILLING		
4	1/19/23	Takahashi	Forward Genetics	Homework 2	
5	1/24/23	Takahashi	Transcriptional Regulation		
6	1/26/23	Takahashi	Transcriptomics	Homework 3	
7	1/31/23	Hsu	Mechanisms of Translation / Translatome Analysis		One page summary
8	2/2/23	Hsu	Translational Regulation and Application	Homework 4	
	2/7/23	Takahashi, Lebeis	Proposal Discussion		
	2/9/23	Takahashi, Lebeis			
9	2/14/23	Takahashi	Gene Expression		
10	2/16/23	Takahashi	Gene Regulatory Network	Homework 5	
11	2/21/23	Takahashi	Integration with Metabolomics		
12	2/23/23	Takahashi	siRNA	Homework 6	
13	2/28/23	Takahashi	VIGS / miRNA		
14	3/2/23	Takahashi	Post-transcriptional Regulation	Midterm Exam; Due 3/3/2023	
	3/7/23		Spring Break		
	3/9/23				
15	3/14/23	Takahashi	Hormone Signaling		
16	3/16/23	Takahashi	Chemical Genomics	Homework 7	
17	3/21/23	Takahashi	Hormone Transport		
18	3/23/23	Takahashi	Small Peptides	Homework 8	
19	3/28/23	Takahashi	Ionomics		
20	3/30/23	Takahashi	Evolution of Metabolism		
21	4/4/23	Lebeis	Plant-Microbe Interaction / Microbiome		
22	4/6/23	Lebeis		Homework 9	
23	4/11/23	Lebeis			
24	4/13/23	Lundquist	Proteomics / Post-translational Modification		
25	4/18/23	Lundquist			Full proposal
26	4/20/23	Lundquist		Homework 10	
	4/25/23	All	Student Presentation		
	4/27/23	All			
	5/2/23			Final Exam; Due 5/3/2023	