PLB/BMB 856: Plant Molecular and Omic Biology
Syllabus - Spring 2026

Instructors:

Hideki Takahashi (course coordinator)	htakaha@msu.edu	Lecture 1-14
Douglas Whitten	whitten3@msu.edu	Lecture 15
April Kaneshiro	kaneshi4@msu.edu	Lecture 16
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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:

Advanced undergraduate or equivalent college-level courses in molecular genetics, molecular biology and/or biochemistry. Please contact the course coordinator (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/)
SS26-PLB-BMB-856-001 - Plant Molecular and Omic Biology
Use your MSU NetID and password (case-sensitive) to log in.

Uploading Assignment: **OneDrive** folder **SS26-PLB-BMB-856 Your Name**
Use your MSU NetID and password (case-sensitive) to log in.

Course Grade:

The course grade is based on homework assignments (30% of grade total), exam (30% of grade total), and writing of a research proposal (40% 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 unit of the course, 2 to 3 key articles will be posted as pdf files at the D2L 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 (slides) 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 6 times during the semester.

- Homework assignments will be made available through D2L.
- Upload your response to the course OneDrive folder by due dates indicated in the course D2L calendar.

Exam:

The exam scheduled on **March 24th** 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 exam will be made available through D2L on March 23rd.
- Upload your complete exam response to the course OneDrive folder.

Research Project 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. Project Summary (1 page max.): State the broad, long-term objectives of the proposed line of research and the hypothesis. 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 (4 pages max.): Outline the experimental design and 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.

  D. Timetable (0.5 page max.): Give a tentative sequence or timetable for the investigation.

  E. References: Give a complete list of literature cited in the text, including titles and full list of authors.

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

- Upload all documents to the course OneDrive folder.

- Project summary: Course coordinator will read and give comments on your project summary.

- Final proposal: Course coordinator (Takahashi) and a randomly assigned instructor (Farre, Lebeis or Skirycz) will read and comment on your proposal. These comments will include advice and suggestions about proposal writing, in general.

- Oral Presentation of Research Proposal:
  - Class periods (April 16th, 21st and 23rd) are reserved for students to give 15-minute presentations describing their research proposals to the rest of the class.
  - Each student to give a 15-minute presentation (including 3 minutes for Q&A) about their research proposal.
  - Electronic slides (PowerPoint) should be used to aid the presentations.
  - We recommend no more than 10 slides.

- Timeline:
    1) **February 5th** – One-page project summary (*first draft*)
    2) **February 10th** and **12th** – Individual discussion with the course coordinator

        Each student will be given the opportunity (15 minutes) to discuss their ideas for the project proposal. Written feedback will be given on your one-page project summary.
    3) **February 26th** – One-page project summary (*second draft*)
    4) **April 15th** – Full proposal
    5) **April 16th, 21st and 23rd** – Oral presentation

Artificial Intelligence (AI):

Using artificial intelligence (AI) is permitted in specific contexts. Students may use AI as a tool to explore information and prepare for the course-related assignments, such as the homework, exams and research project proposals. However, the text to be submitted for these course-related assignments must be written by yourself. Developing critical thinking and writing skills are essential for your academic success. AI tools can be helpful, but they are not always accurate. Students should critically evaluate the AI-generated information, acknowledging the benefit and limitations.

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.

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 Student Perceptions of Learning Survey (SPLS) to gather student feedback. You will receive an e-mail sometime during the last few weeks of class asking you to fill out the SPLS online form at your convenience. You will have the option to decline to participate in the course evaluation—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.

Course Schedule:

Lecture	Date	Instructor	Topics	Assignment Due	Points
1	January 13, 2026	Takahashi	**Unit 1. Forward & Reverse Genetics**		
2	January 15, 2026	Takahashi	Model Organism / Natural Diversity		
3	January 20, 2026	Takahashi	Plant Transformation / Genome Editing		
4	January 22, 2026	Takahashi	Genetic Screening		
				Unit 1 Homework: January 23	50
5	January 27, 2026	Takahashi	**Unit 2. Transcriptional Regulation**		
6	January 29, 2026	Takahashi	Transcriptomics		
7	February 3, 2026	Takahashi	Gene Expression		
8	February 5, 2026	Takahashi	Gene Regulatory Network	Project Summary (first draft): February 5	50
				Unit 2 Homework: February 6	50
	February 10, 2026		**Proposal Discussion** (individual discussion about your research project proposal)		
	February 12, 2026				
9	February 17, 2026	Takahashi	**Unit 3. Post-transcriptional Regulation**		
10	February 19, 2026	Takahashi	siRNA / VIGS		
11	February 24, 2026	Takahashi	miRNA		
12	February 26, 2026	Takahashi	Translation	Project Summary (second draft): February 26	50
				Unit 3 Homework: February 27	50
	March 3, 2026		**Spring Break**		
	March 5, 2026				
13	March 10, 2026	Takahashi	**Unit 4. Proteomics & Metabolomics**		
14	March 12, 2026	Takahashi	Evolution of Metabolism		
15	March 17, 2026	Whitten	Proteomic analysis		
16	March 19, 2026	Kaneshiro	Proteomics In-Action / PTM		
				Unit 4 Homework: March 20	50
	March 24, 2026		**Exam** (take-home exam)		300
17	March 26, 2026	Lebeis	**Unit 5. Plant-Microbe Interaction**		
18	March 31, 2026	Lebeis	Plant Immune Response		
19	April 2, 2026	Lebeis	Microbiome Analysis		
				Unit 5 Homework: April 3	50
20	April 7, 2026	Howe	**Unit 6. Small Molecule Signaling**		
21	April 9, 2026	Howe	Plant Hormones		
22	April 14, 2026	Howe	Hormone Signaling		
				Full proposal (final draft): April 15	250
	April 16, 2026		**Student presentation** (each student will give a 15-minute presentation about their research project proposal)		
	April 21, 2026				50
	April 23, 2026				
				Unit 6 Homework: April 24	50
				Total:	1000