# **PLB/BMB 866 Molecular Plant Physiology Fall 2021**

## **Class Meetings**

Tuesday and Thursdays, 2:40 PM to 4:00 PM in room 247 Plant Biology Laboratories and by Zoom.

*This will be a hybrid course*. Some lectures will be available either in person or by Zoom, while some may be available only by Zoom. Students must be available for the times designated above for either new lecture material or prerecorded lecture material. Please inform the lecturer if you have to be away from both the lecture room and Zoom during the scheduled class period for any reason.

## **Teaching Team**

Professor Thomas D. Sharkey

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## **Course Description**

PLB 866 is designed for first year graduate students in the molecular plant sciences program but is open to anyone wanting a comprehensive treatment of molecular plant physiology. This is a core course in the Molecular Plant Sciences program. The main topics will be molecular (including biochemical) aspects of plant physiology. Topics include cell biology, photosynthesis, cell wall metabolism, lipid metabolism, and signaling and sensing. A quantitative understanding of plant processes will be emphasized through a series of homework exercises.

## **Course Goals**

This course is designed to provide the foundational understanding of a number of plant physiological processes that are important for starting graduate studies. The course will be run in a way that will help students prepare for their comprehensive oral exam. Writing skills are emphasized in PLB 856 and students in the MPS program are required to take a bioinformatics course, which will require working with big data sets. To complement these skills, PLB 866 will emphasize quantitative understanding exercises but not writing exercises nor big data skills. As a result of taking this course students should be familiar with a wide range of plant physiological processes and be able to analyze data, form hypotheses, and discuss molecular plant physiological issues at a graduate level. The course should also be useful for understanding seminars that you will attend as part of the MPS or departmental seminar series. A previous course in plant physiology would be helpful but is not assumed for this course.

## **Student Responsibility**

Study at MSU places a premium on self-motivation, the instructors will provide information, exercises, and oversee discussions and debate designed to help you learn concepts and skills related to scientific reasoning. You will be responsible for making the most of these resources and seeking to understand both the knowledge base and the scientific practices in biology.

## **Instructor Responsibility**

Instructors will work to provide students with up-to-date, relevant information on issues in molecular plant physiology. Instructors will respond to issues around compliance with the Americans with Disabilities Act. Please contact Professor Sharkey if you need accommodation.

## **Required Course Materials**

### Desire2Learn (D2L) and Electronic Communications

Course materials will be posted on D2L (<https://d2l.msu.edu/>). We will also use the D2L mail system to send course announcements so you should be sure that this system is connected to your e-mail account, or you should check the D2L mail system regularly.

### Textbook, other reading materials

There are two excellent texts that cover portions of the material in this class. Both are available online through the MSU library. They are

*Biochemistry and Molecular Biology of Plants*, by Bob B. Buchanan; Wilhelm Gruissem; Russell L. Jones (2nd edition, 2015).

https://ebookcentral-proquest-com.proxy2.cl.msu.edu/lib/michstate-ebooks/detail.action?docID=4035886

and

*Plant Biochemistry*, by Hans-Walter Heldt and Birgit Piechulla. https://www-sciencedirect-com.proxy2.cl.msu.edu/book/9780123849861/plant-biochemistry

In addition, recent reviews and primary literature will be assigned for most class meetings. These are available from the MSU Library web site

## **Coursework**

There are two types of graded coursework in this course.

### **Exams**

* There will be three exams in this course.
* Exams will be mostly short answer questions and some questions requiring longer answers or drawing.
* Exams will be open book – take home exams due at the end of the day listed on the schedule.
* Exams will be worth 80% of your grade.

### **Quantitative exercises**

* Twelve quantitative exercises will be worth 20% of your grade. These will be mostly physical chemistry problem sets designed to be useful in plant physiological research.
* Many of the problem sets will require use of Excel. You have access to Excel as a member of the university. Some students use R or Python. This is acceptable.
* Problem sets may be discussed in class on the days they are listed in the syllabus

## **Attendance policy**

* Attendance is expected at all class meetings. In some cases attendance will be virtual. Please inform the instructor if you will be unable to attend a class meeting. At least some lectures will be entirely on-line. Please let Professor Sharkey know if you have limited internet access. See this website on internet access options <https://remote.msu.edu/learning/internet.html>

## Group work

Group study can significantly enhance your learning experience. You are encouraged to study for exams in groups but the exams themselves will be only your own work. You are encouraged to discuss the quantitative exercises but each student must write out answers or create spreadsheets with answers on their own.

## **Grades**

Your grade will be determined by your performance on the written exams and the assigned homework.

This grading scale shows the percentage you must receive to guarantee a particular grade. The grades in the course will be adjusted if necessary based on the final distribution of scores. This adjustment may raise your grade from the scale shown here, but it will not lower your grade.

| Grade | Percentage Earned |
| --- | --- |
| 4.0 | > 90% |
| 3.5 | > 85% |
| 3.0 | > 80% |
| 2.5 | > 75% |
| 2.0 | > 70% |
| 1.5 | > 65% |
| 1.0 | > 60% |
| 0.0 | <60% |

## Policy on Classroom Etiquette

## Excerpts from [Academic Freedom for Students at Michigan State University](http://splife.studentlife.msu.edu/academic-freedom-for-students-at-michigan-state-university)

## Article 2: Academic Rights and Responsibilities

## III. A. *The student is responsible for learning the content of a course of study according to standards of performance established by the faculty and for adhering to standards of professional behavior established by the faculty.*

## III.B.4.  *The student’s behavior in the classroom shall be conducive to the teaching and learning process for all concerned.*

## III.B.10. *The student and the faculty share the responsibility for maintaining professional relationships based on mutual trust and civility.*

## Faculty have the right to remove students from the classroom for disruptive conduct.

## **Academic Integrity**

Academic dishonesty of any kind will result in a zero, or other penalty grade, for the assignment or the course, and will be reported to the Dean of your college.

MSU states the following (in part) about academic honesty:

* *“Academic honesty is central to the educational process and acts of academic dishonesty are serious offenses within the University community. Suspension from the University could be the consequence for acts of academic dishonesty.*
* *Students should be familiar with General Student Regulation 1.00 on Protection of Scholarship and Grades, and with the all-University policy on Integrity of Scholarship and Grades. In addition, it is important that students clearly understand the specific expectations of their individual instructors with regard to this important matter. The process for adjudicating cases of academic dishonesty is outlined in Section 2.4 of Academic Freedom for Students at Michigan State University.”*

[MSU Student Handbook](http://splife.studentlife.msu.edu/regulations/types-of-rules-and-regulations-2)

Integrity is also essential to the conduct of science. Scientific misconduct will feature in some of the discussions.

## Schedule of class meetings (as of August 29, 2021)

|  | Topic | Instructor |  |
| --- | --- | --- | --- |
| 9/2/21 | Introduction/cell biology | Sharkey |
| 9/7/21 | Red and blue light sensing | Sharkey |
| 9/9/21 | Light absorption | Sharkey |
| 9/14/21 | Photosynthetic electron transport | Sharkey |
| 9/16/21 | Calvin Benson cycle | Sharkey |
| 9/21/21 | Rubisco | Sharkey |
| 9/23/21 | Photorespiration | Sharkey |
| 9/28/21 | C4 CAM | Sharkey |
| 9/30/21 | Polysaccharides | Sharkey |
| 10/5/21 | Exam | Sharkey |
| 10/7/21 | Discussion of quant. exercises | Sharkey |
| 10/12/21 | The clock/circadian rhythms | Sharkey |
| 10/14/21 | Cellular secretory pathway | Kim |
| 10/19/21 | Cell walls | Kim |
| 10/21/21 | Cell walls | Kim |
| 10/26/21 | Break |  |
| 10/28/21 | Water relations/salinity | Sharkey |
| 11/2/21 | Long distance transport, phloem | Sharkey |
| 11/4/21 | Tropisms circumnutation | Sharkey |
| 11/9/21 | Determinants of plant growth | Sharkey |
| 11/11/21 | Exam | Sharkey |
| 11/16/21 | Sugar sensing | Sharkey |
| 11/18/21 | Protein trafficking | Sharkey |
| 11/23/21 | Reactive oxygen | Sharkey |
| 11/25/21 | Thanksgiving |  |
| 11/30/21 | Lipids | Benning |
| 12/2/21 | Lipids | Benning |
| 12/7/21 | Lipids | Benning |
| 12/9/21 | Heat shock responses | Sharkey |
| 12/15/21 | Final | 10:AM-12 PM |
|  |  |  |  |
|  |  |  |  |

## Covid 19 specific information

MSU Community Compact regarding COVID-19: [Required for in-person or hybrid courses]

The novel coronavirus, which causes the disease COVID-19, has been declared a worldwide pandemic. The COVID-19 virus is extremely contagious and is believed to spread mainly from person-to-person contact. The COVID-19 pandemic represents an unprecedented public health crisis that has impacted every facet of life, including the classroom environment. As a result, significant changes in how we conduct in-person classes must be made. This section of the syllabus discusses the policies and procedures we will use in class.

This class abides by all principles, guidelines, and requirements detailed in the [MSU Community Compact](https://msu.edu/together-we-will/msu-community-compact/?utm_source=reopening-email&utm_medium=email&utm_campaign=faculty-staff). Specifically, all participants in the class will adhere to the following:

**Face coverings.** **Face coverings must be worn by everyone** (including all faculty, staff, students, vendors, and visitors) indoors and outdoors while on property owned or governed by MSU and while participating in MSU-related or MSU-sponsored activities. Thus, unless you are unable to tolerate a face covering for medical reasons you must wear a face covering inside and outside of class. **This face covering must cover your mouth and nose**.

**Physical distancing.** The classroom is reasonably large, we will spread out in the class room.

**Personal Hygiene.** All students must maintain proper hygiene and health practices, including:

* Washing hands frequently with soap and water or, if soap is unavailable, using hand sanitizer with at least 60% alcohol
* Routinely cleaning and sanitizing living spaces and/or workspace
* Using the bend of the elbow or shoulder to shield a cough or sneeze
* Refraining from shaking hands

**Adherence to Signage and Instructions.** Students will (a) look for instructional signs posted by MSU or public health authorities, (b) observe instructions from MSU or public health authorities that are emailed to my “msu.edu” account, and (c) follow those instructions.

**Self-Monitoring.** Students will self-monitor for flu-like symptoms (for example, cough, shortness of breath, difficulty breathing, fever, sore throat or loss of taste or smell). If a student experiences any flu-like symptoms, they will stay home and contact a health care provider to determine what steps should be taken.

**Exposure to COVID-19.** If a student is exposed to someone who is ill or has tested positive for the COVID-19 virus, they will stay home, contact a health care provider and follow all public health recommendations.

**Compliance and reporting.** Those who come to MSU facilities must commit to the personal responsibility necessary for us to remain as safe as possible, including following the specific guidelines outlined in this syllabus and provided by MSU more broadly (see below). There may be times when action will be necessary to reinforce expectations. **If you do not wear appropriate face coverings (see MSU’s guidelines), do not wear your face covering appropriately (i.e., over your mouth and nose), or do not adhere to physical distancing guidelines (i.e., six feet apart), you will be asked to correct the situation or leave the facility.** In addition, MSU will utilize the processes already in place to respond to any issues of noncompliance with standards established for the health and safety of our community. For classroom disruptions or issues, the responses and processes that have been used previously remain the first line of action. If necessary, the student conduct system will be the avenue used to adjudicate student disciplinary situations.