PLB 866 Molecular Plant Physiology Spring 2019

Class Meetings

Tuesday and Thursdays, 2:40 PM to 4:00 PM 1030 Molecular Plant Sciences Building

Teaching Team

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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 MPS program and it is assumed that the student will have taken PLB 856. Topics in that course will not be repeated in this course. The main topics will be molecular (including biochemical) aspects of plant physiology including cell biology, photosynthesis, cell wall metabolism, lipid metabolism and other topics. 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. Therefore, 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.

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.

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

The textbook we will use is Plant Biochemistry, by Hans-Walter Heldt and Birgit Piechulla. This book is available electronically from the MSU Library (http://catalog.lib.msu.edu/record=b8396959~S39a). There are several other excellent books available, especially *Biochemistry and Molecular Biology of Plants*, by Bob B. Buchanan; Wilhelm Gruissem; Russell L. Jones (2nd edition, 2015).

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 worth 66% of your grade.

Quantitative exercises

- Twelve quantitative exercises will be worth 33% of your grade. These will be mostly physical chemistry problem sets designed to be useful in plant physiological research.

Attendance policy

Attendance is expected at all class meetings. Please inform the instructor if you will be unable to attend a class meeting.

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.

Schedule of class meetings

See D2L

Grades

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

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%

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.

Policy on Classroom Etiquette

Excerpts from 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

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

	Topic	Instructor	Homework (tent.)
1/8/19	Introduction/cell biology of plants	Sharkey	
1/10/19	Endomembrane system/Plastids	Sharkey	Nernst Equation - electrochemistry
1/15/19	Photosynthetic electron transport	Sharkey	
1/17/19	Photosynthetic electron transport	Sharkey	Molecular spectroscopy
1/22/19	Respiration	Sharkey	
1/24/19	Photosynthetic carbon metabolism	Sharkey	Thermodynamics
1/29/19	Photosynthetic carbon metabolism	Sharkey	
1/31/19	Photorespiration	Sharkey	Enzyme kinetics
2/5/19	Gas exchange	Sharkey	
2/7/19	C4 CAM	Sharkey	Gas Laws
2/12/18	Exam	Sharkey	
2/14/18	Polysaccharides	Sharkey	
2/19/18	Cell walls	Wilkerson	
2/21/18	Cell walls	Wilkerson	Kinetics and radioactive decay
2/26/18	Cell walls	Wilkerson	
2/28/18	Water relations/salinity	Sharkey	Water relations Lockhart equation
Break			
3/12/18	Long distance transport, phloem	Sharkey	
3/14/18	Tropisms circumnutation	Sharkey	
3/19/18	Circadian rhythms	Sharkey	
3/21/18	Chloroplast protein import pathways	Schnell	Energy balance
3/26/18	Exam	Sharkey	
3/28/18	Lipids	Benning	
4/2/18	Lipids	Benning	
4/4/18	Lipids	Benning	0
4/9/18	Lipids	Benning	
4/11/18	Sugar sensing	Sharkey	Henderson-Hasselbalch equation
4/16/18	Determinants of plant growth	Sharkey	
4/18/18	Reactive oxygen	Sharkey	Growth - exponential - logistic - Gompertz
4/23/18	Heat shock responses	Sharkey	
4/25/18	Red and blue light sensing	Sharkey	Arrhenius - Q10 temperature equations
5/2/18	Final 3:00 PM		