

BOT 4503 Plant Physiology

Spring 2005
Class Time: M, W, F 9:30-10:20 am
Location: Biology Rm 209
Office Hours: M, W 10:30-12:30 or by appt.

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BIO 426
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1. Course Catalog Description: A study of mechanisms used by plants to cope with the environment.

Specific Course Objectives: Students will gain an understanding of processes specific to the physiology of plants, including cell biological, developmental and biochemical underpinnings. Topics include chloroplast biogenesis and photosynthesis, respiration, hormone signaling, water and nutrient uptake and transport, phloem transport, growth and development, plant stress response and defense mechanisms.

Prerequisites: PCB 3023 or consent of the Instructor

2. Course Materials

Required Text: Taiz, L. and Zeiger E. (2002) Plant Physiology, 3rd Edition. Sinauer Associates, Inc., Sunderland, MA.

Lectures and other materials: Will be available from the class WebCT page

Additional Background Readings:

Buchanan, B. B., Gruissem, W., and Jones, R. L. (2000) Biochemistry & Molecular Biology of Plants. American Society of Plant Physiologists, Rockville, MD.

Salisbury, F. B. and Ross, C. W. (1992) Plant Physiology, 4th Ed. Wadsworth Publishing Co., Belmont, CA.

Specific chapters as assigned from the free online publication "The Arabidopsis Book" which can be downloaded at <http://www.aspb.org/publications/arabidopsis/>

Plant Physiology Online Study Guide: <http://www.plantphys.net/>

Other readings or helpful web links will be posted on the class WebCT site.

3. Exams: Your exams will consist primarily of multiple choice, true/false, matching, and short essay questions. Scantrons will be provided.

If you fail to attend one of the exams for any reason, you must provide documented evidence that circumstances beyond your control prevented you from taking the exam in order to take a make-up exam. All makeup exams will be administered by prearrangement with the Instructor.

All exams (except the final exam) will occur in class (begin at 9:30 am and end at 10:20 am).

4. Critical Review: You will choose (from 3 papers I will provide) a paper from the primary literature to read and evaluate. You will prepare a written critique of the paper, including a brief synopsis of the paper, and a critical evaluation of the methods used by the authors as well as their conclusions. Your critique should be 2-3 typed pages (12 pt font), not including any additional figures you might choose to include.

5. Class Presentation: You will select a specific, narrowly-defined topic of your choice related to plant physiology and research it. In the second half of the semester, you will present a mini-lecture (15 minutes) on that topic to the class, including answering questions that come up. Material presented by your classmates will be fair game for exams, so you should ask questions and take notes during mini-lectures. You will be evaluated on your mini-lectures based on the following general criteria; topic, clarity, organization, informational content, the quality of your visual (and otherwise) aids, and most importantly, inclusion of some discussion of the scientific process used to discover the information you present. Examples of appropriate topics might be strategies for phytoremediation of mercury in soils, the physiology of salt tolerance/management in a specific plant species growing in saltwater environments, mechanisms of protein import into chloroplasts, etc. Obviously, it will be essential to choose a narrow topic so that you can discuss it in appropriate depth in the allotted timeframe. You must discuss your intended topic with me for approval prior to March 2, 2005.

6. In-class Activities: At various times, you will be asked to participate in class learning activities.

7. Grading:

Midterm exam I	100 pts
Midterm exam II	100 pts
Critical Review	75 pts
Student Mini-lecture	75 pts
In-class activities	50 pts
Final Exam	150 pts

TOTAL 550 pts

Scale:

<u>% of Points Earned</u>	<u>Grade</u>	<u>GPA</u>
90 – 100	A	4.00
80 - 89	B	3.00
65 - 79	C	2.00
55 - 64	D	1.00
0 - 54	F	0.00

A Few Notes:

5 points/day will be deducted for late assignments. Cheating will result in an automatic "F" and disciplinary action. Plagiarism is not permitted and all sources need adequate citations – please ask if you have any questions. It is assumed that all students will act in a mature manner in the classroom, showing consideration for their peers and the instructor. Pagers, beepers, and cell phones must be turned off in the classroom. Please contact me during the first week of class if you need (or might need) any special accommodations due to disability or otherwise. Finally, the information in this syllabus is subject to revision.

8. Important Dates:

January 17,	no class
February 16	Exam I
March 2	Deadline to select and have mini-lecture topic approved
March 14, 16, 18	no class
March 30	Exam II
April 8	Critical Review due in class
April 29	Final Exam (7:00 am)

TOPICS TO BE COVERED

(subject to modification)

1. Overview/review of plant cell biology
Nucleus and cell division, plastids, endoplasmic reticulum, golgi, plasma membrane, cell wall and plasmodesmata
2. Transport
Water potential, water balance in the plant, transpiration and stomatal function
3. Mineral nutrition
Essential nutrients, nutrient uptake, mycorrhizal fungi
4. Solute transport
Transport across various membranes, anatomy of nutrient transport in the root, significance of ion transport, other than nutrition
5. Photosynthesis
Harvesting light, electron transport chain, photophosphorylation, protecting the photosynthetic apparatus, protein targeting to the chloroplast, Calvin cycle, special mechanisms to concentrate CO₂, storage sugars, physiological ecology of photosynthesis
6. Phloem transport
Anatomy, source-sink relationships, phloem loading/unloading mechanisms
7. Respiration and lipid metabolism
Glycolysis, gluconeogenesis, citric acid cycle, mitochondrial electron transport, lipid biosynthesis
8. Assimilation of mineral nutrients
Nitrogen fixation and assimilation, sulfur, phosphate, and oxygen assimilation
9. Secondary metabolites and plant defense mechanisms
Terpenes, phenolic compounds, alkaloids, cyanogenic glucosides, glucosinylates, proteins and amino acids
- *10. Plant signal transduction

- Cell surface receptors, G-protein coupled receptors, lipid signaling, calcium signaling
11. Cell walls
 - Structure, biosynthesis, role in cell expansion, role in signaling
 - *12. Growth and development
 - Embryogenesis, shoot and root meristems, root, leaf and flower development, phase change, induction of flowering and circadian rhythms
 13. Light signaling
 - phytochrome and red light signaling, cryptochrome and blue light signaling
 14. Auxin
 - Function, biosynthesis, metabolism, polar transport, details of tropisms and phyllotaxy, mechanism of auxin signaling
 15. Gibberellins
 - Function, biosynthesis, metabolism, seed germination, cell elongation, cell division
 16. Cytokinins
 - Function, biosynthesis, metabolism, transport, Agrobacterium biology, and mechanism of cytokinin signaling
 17. Ethylene
 - Function, biosynthesis, metabolism, role in plant defense, abscission, senescence, and mechanisms of signaling
 18. Abscisic Acid
 - Function, biosynthesis, metabolism, and role in seed dormancy and stress signaling
 19. Other plant hormones
 - Brassinosteroids, Jasmonic Acid, Etc.
 20. Stress Response
 - Water deficit, heat, cold, salt, oxygen
 21. Pathogen Defense
 - Recognition and response