BSC 420/520: PLANT PHYSIOLOGY-SPRING 2005

Experimental study of plant life processes to include applicable biophysical and biochemical principles, water relations, molecular biology, stress physiology, and growth and development. 3 lec-3 lab (PR: BSC 121; BSC 322 and organic chemistry recommended).

INSTRUCTOR: Dr. Marcia Harrison, office S200A, 696-4867; Harrison@marshall.edu; LAB S107 and 109
TEXT: Plant Physiology, 2002, Taiz and Zeiger, 3rd edition
Cell Biology Text; General Biology Text recommended

COURSE MATERIALS: Additional course materials will be available on WebCT-VISTA and at http://www.marshall.edu/cellcentral/bsc420.htm

OFFICE HOURS:
Office hours: M 4:00 - 5:30 pm; WF 11:00 am-12:00 pm; W 8:30-10:00 am ***OR by appointment***.

COURSE OBJECTIVES:
1. To examine the basic processes involved in plant physiology at the whole plant, biochemical and molecular levels.
2. To read and evaluate current research papers in plant physiology.
3. To evaluate post-genomic emphasis in directing plant physiology research.
4. To design experiments to study plant physiology incorporating whole plant, microscopic, biochemical, molecular, computer/ bioinformatics approaches.
5. To build a laboratory portfolio of experiments and experimental design.

REQUIREMENTS:
Exams – 3 lecture exams (300 points total)
Lab work and portfolio; Independent Projects (100 points)
Weekly quizzes (50 points)
Readings and class participation (50 points)

Exams will consist of a combination of short essays, short answers questions, and problems. A study guide will be provided at lease one week prior to the exam. Students are welcome to work on the study guide and show part to the instructor for review.

Lab work grade will be based on lab work as presented in the final portfolio and the student's independent projects. Checklists will be provided for portfolio contents, and for independent project presentations (poster contribution and PowerPoints).

Weekly quizzes will be conducted on WebCT-VISTA and will be worth 5 points each. A total of 15 quizzes are scheduled. The final grade will be a total of the highest 10 quizzes.

Readings and class participation grade will be based on lecture and lab attendance and overall class contribution according to the following system: -2 points per unexcused lecture absence; -5 points per unexcused absence when student is required to present a figure from a research article; -5 points per unexcused lab absence; -5 points for missing a class commitment. If needed, labs can be made up by arrangement with the instructor.

GRADING:
A: 500-450 points (90% of total points); B: 449-400 points (80% of total points); C: 399-350 points (70% of total points); etc.

EXAMS:
Make-up exams will be given for excused absences reported before the scheduled exam.
Exam 1 - Feb 18
Exam 2 - April 1
Exam 3 - 10:15 May 2 (according to the Spring 2005 exam schedule)

MAJOR WRITING ASSIGNMENTS:

1. Exams will be composed of short answer, essay questions and data analysis.
2. Each lab will require data analysis (written summary, calculations, tables, graphs, etc). The data analysis will be completed by the next week for discussion and grade. A final portfolio will consist of the complete laboratory assignments that will include a short introduction of background material, objectives, protocol used, data, data analysis and results (e.g., graphs, tables). **Portfolio due date: May 4, 2005 by 5:00 pm**
3. Independent Project Report: A formal report for your independent research projects is required.
Independent Project Proposal due date: March 11
Independent Project Presentation: April 22 (Sigma Xi Research Day) and week of April 25

LECTURE, LAB, AND SERVICE SCHEDULE:

Formal lectures will be held on Mondays, Wednesdays and Fridays at 10:00 am in S376. Lectures will consist of a review and discussion of the material concerning the major topic and reading of current research in the area of study. Students will be responsible for reading and presenting parts of research papers as part of their lecture participation grade. Student preparation for the lectures will consist of a weekly WebCT-VISTA quizzes (5 points each). The quizzes will be taken independently before 9:30 a.m. of the Monday lectures (Wednesday lectures for the first two weeks of classes). Coverage of the quizzes will be provided during the Wednesday lecture and posted on WebCT. The quizzes will primarily cover definitions and review basic concepts at the BSC 121 level or cover the introductory portion of text chapters. Friday session will be flexible to accommodate discussion of student projects, course assignments, and exams. Labs will be held on Mondays from 1 to 3:50 pm in S118. The first 8-9 labs will be conducted as a class and focused on applying laboratory techniques to student independent projects.

LECTURE AND LAB SCHEDULE:

Week	Dates	Lecture and Lab Topics
1	1/10-1/14	*Lab 1*. Introduction to plant growth; *Nutrient systems-hydroponics, tissue culture*; Safety Tutorial -soybean growth for nodulation -hydroponics systems-nutrients -basic greenhouse management -prepare tissue culture media and plates *Lecture*: Course syllabus discussion and development, Course overview, plant tissue structures and introduction to plant movements *Quiz 1:* Plant cell structure/plant tissue structure (by 9:30 a.m. January 19)
2	1/19-1/21	**Martin Luther King Jr. Holiday – No Class or lab on Monday 1/17** *Quiz 2:* Review water relations (by 9:30 a.m. Wednesday January 19) *lecture:* Water relations; Water relation problems
3	1/24-1/28	*Quiz 3:* water relations (by 9:30 a.m. Monday January 24th; all subsequent quizzes are to be completed by 9:00 a.m. Prior to the Monday lecture) *Lectures:* Finish water relation problems; Mineral Nutrition *Lab 2*. Plant growth protocols continued - A*rabidopsis* nomenclature and growth protocols -plate tissue culture (soybean cotyledons; African violets)
4	1/31-2/4	*Quiz 4*: research article review-water relations *Lecture:* Research article-water relations and plant movements *Lab 3:* Overview of TAIR (The Arabidopsis Information Resource) -Overview of microarray experiments and database -Select topic for independent research projects -Data mine microarray experiments -Select *Arabidopsis* mutants and DNA vectors (submit for ordering)
5	2/7-2/11	*Quiz 5:* Biochemistry review *Lecture:* Overview of primary and secondary metabolism; photosynthesis *Lab 4:* Experimental design for gene expression studies (gene gun and microarray), prepare plant materials; primer design for gene expression analysis; reagents for plasmid-prep
6	2/14-2/18	*Quiz 6:* Secondary metabolites *Lecture:* Secondary metabolism; Shikimic acid pathway (Web topic 13.2); Mevalonic acid pathway

		Lab 5: Transient gene expression- plasmid prep; GC-Analysis of ethylene for plant hormone and nitrogen fixation research **Exam 1: Friday, Feb. 18**
7	2/21-2/25	*Quiz 7:* Plant biotechnology *Lecture:* Plant biotechnology; Current research in the development of medicinal plant products *Lab 6:* Transient Gene Expression- prepare bullets; prepare reagents for GUS analysis.
8	2/28-3/4	*Quiz 8:* Cell wall review *Lecture:* Cell wall and cellular growth *Lab 7:* Transient Gene Expression - plant transformation using the gene gun (transform plants and callus); prepare timeline for analysis; plate *Arabidopsis* seed for microarray experiment
9	3/7-3/11	*Quiz 9:* Plant growth *Lecture: Plant g*rowth *Projects*: Final approval for independent project proposal *Lab 8:* Gene Expression Analysis – RNA extraction and analysis of RNA quantity and quality for microarray
10	3/14-3/18	*Quiz 10:* Stomata *Lecture:* Plant movements: Organelle movement; stomatal movement; blue light responses *Lab 9:* Gene Expression Analysis – RT-PCR and microarray introduction; begin independent projects
	3/18	**Last Day to Drop an Individual Course**
11	3/28-4/1	*Quiz 11:* Research article on stomatal movement *Lecture:* Research article on stomatal movement; Exam review *Lab 10:* Gene Expression Analysis – Analyze RT-PCR results; Complete microarray; Independent projects **Exam 2: Friday, April 1**
12	4/4-4/8	Quiz 12: Plant hormones and tropisms *Lecture:* Mechanism of the regulation of phototropism and gravitropism; nastic movements and thigmotropism *Lab 11:* Independent projects
13	4/11-4/15	Quiz 13: Research article on gravitropism *Lecture:* Research article on gravitropism *Lab 12:* Independent projects- poster preparation
14	4/18-4/22	*Quiz 14:* Light regulation and phytochrome *Lecture:* Circadian rhythms *Lab:* Final poster preparation; Sigma Xi Research Day, April 22
15	4/25-4/29	*Quiz 15:* Review for research article: circadian rhythms *Lecture:* Research article: circadian rhythms; exam review *Lab*: Presentations of independent work; portfolio contents; lab clean-up
	5/2	**Exam 3: 10:15 May 2**