

**BOTANY 102 - PLANT PHYSIOLOGY**  
**FALL, 2008**

LECTURE TTh 1430-1520, DH 344  
LAB TTh 1530-1820, DH 344

PROFESSOR Dr. David K. Bruck  
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Office Hours - TTh 1030-1150, W 1100-1150

LAB TECHNICIAN Jennifer Cross  
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REQUIRED TEXTS Hopkins WG. 2004. Introduction to Plant Physiology, 3rd edition. John Wiley & Sons, Inc., New York, NY, 559 pp.  
Bruck DK. 2008. Plant Physiology Lab Manual and Lecture Supplements.

OPTIONAL TEXTS Bowsher C, Steer M, and Tobin A. 2008. Plant Biochemistry. Garland Science, New York.

Buchanan BB, Gruissem W, and Jones RL. 2001. Biochemistry and Molecular Biology of Plants. Drake International Services, Oxford.

UNITS 4

PREREQUISITES Bio 1 (Plant Biol), Bio 3 (Cell Biol), Chem 8 and 9 or 112A,B, and 113A (Organic Chem), Bio 115 (General Genetics)

RECOMMENDED COURSES Chem 135 (Biochemistry), Bio 100W (Writing Workshop)

REQUIRED MATERIALS Lab notebook, preferably flat, hardbound

The field of plant physiology is concerned with the functional and mechanistic aspects of plants or, essentially, how the plant works at the molecular level. This course will cover plant molecular biology (plant transformations and biotechnology), water relations (osmosis, water uptake, endodermal structure, xylem transport, mechanisms of stomatal action, transpiration), plant growth regulation (hormones and photomorphogenesis), ion and sucrose (phloem) transport, and those biochemical processes that are unique to plants, including C<sub>3</sub>, C<sub>4</sub>, and CAM photosynthesis, photorespiration, and N<sub>2</sub> fixation. Environmental (stress) physiology, development, differentiation, endogenous rhythms, flowering, and secondary metabolites will be covered only briefly.

It will be assumed that you have a basic knowledge of inorganic and organic chemistry (including general groups of compounds, redox reactions, pH, molarity, molecular structure, chemical equations, and energetics), of general botany (including plant cell structure, tissue and organ morphology, reproductive processes, and higher taxonomic groups), of general biology (including cell division, the respiration pathway, gene structure, transcription and translation, membrane structure, and the scientific method), and of algebra. Most of these topics can be reviewed by reading the appropriate sections of the course text.

The lecture schedule will follow the laboratory schedule only loosely. The lab is intended to illustrate the principles of plant physiology through experimentation. Because of the difficulty of

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designing classroom laboratory exercises that give expected results with reasonable assurance, that fit into the prescribed periods of time, that the department has multiple sets of equipment to carry out, that are relatively inexpensive, and that are manageable at this level, some topics will be overemphasized in lab while others are underemphasized. In these cases, the lecture schedule may deviate from the lab schedule.

During the course, you will learn some lab techniques. You will also develop some skills in hypothesis testing, experimental design, and critical analysis of experimental data. You will undoubtedly experience the all-too-common frustration of an unsuccessful experiment, not to mention the tedium and repetition that accompany some experimental protocols whether successful or not. You will become familiar with some classical work in plant physiology as well as some of the frontier areas of research.

LABORATORY REQUIREMENTS You will be expected to read and understand the laboratory directions, within reason, before the applicable lab period. The introduction to each lab contains general background information as context for the lab. It also contains the purpose of each exercise. A lab exam is scheduled. A full writeup of one or two labs in the form of scientific research reports may be required. I will not announce which labs to write up until they have been completed and discussed. You should, therefore, keep notes on all labs as if each will be chosen.

LABORATORY NOTEBOOK The lab notebook should be a flat, hardbound notebook with lined or graphed pages. The following items should be written in the notebook: (1) notes during my introductory remarks preceding each lab, (2) rough notes during the lab on any deviations from the proscribed procedure, including errors or novel approaches, (3) any data collected in a readable table that a reader could understand, (4) pooled data from class, to be relayed during a subsequent lab period, (5) calculations and graphing assignments, (6) final data display in well constructed tables, including caption, headings, and units, (7) answers to questions that appear at the end of many of the lab procedures in the manual (not required but instead to be used as guides and discussion items to help you organize your thoughts for the lab exam), and (8) at least a paragraph discussing expected results, whether your results or those of the class as a whole (pooled) met these expectations, and why they did not (the latter is not intended to be an error analysis, although it is useful to include *procedural* errors if they were likely to have contributed to the deviation in results; we will discuss these problems as a class). The lab notebooks will be collected following the last structured lab for grading.

LABORATORY PROJECT Each student will be expected to design, plan, write a proposal for, conduct, and orally deliver an individual research project with a partner. Generally, it should be an adaptation of an experiment conducted in one of our classroom labs rather than a completely original experiment. Some variations on class experiments are suggested in the course lab manual. You may peruse the text, popular literature, review articles, or any other sources for ideas. Consult me about the suitability of your idea as it develops. Details for writing the proposal appear in your lecture supplements. Lab periods have been reserved for the individual projects near the end of the semester. The project will be presented orally during the final-exam period.

CHEATING Plagiarism and other forms of cheating are strictly prohibited by University regulations and will perturb me greatly. I encourage students to work together on non-exam types of assignments, but final products should, without exception, be written individually. Wording that is alike will be construed as copied. On exams, including take-home exams, and papers, it is crucial that other students not be consulted at all. Using exams, papers, and lab notebooks from previous semesters will also be regarded as cheating. The university policy on academic honesty

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reads as follows: Your own commitment to learning, as evidenced by your enrollment at San Jose State University, and the University's Academic Integrity Policy require you to be honest in all your academic course work. The faculty is required to report all infractions to the Office of Judicial Affairs.

University policy on academic integrity, with which I concur in its entirety, can be found at [http://sa.sjsu.edu/judicial\\_affairs/faculty\\_and\\_staff/academic\\_integrity/green\\_sheet.html](http://sa.sjsu.edu/judicial_affairs/faculty_and_staff/academic_integrity/green_sheet.html). It states

Academic integrity is essential to the mission of San José State University. As such, students are expected to perform their own work (except when collaboration is expressly permitted by the course instructor) without the use of any outside resources. Students are not permitted to use old tests, quizzes when preparing for exams, nor may they consult with students who have already taken the exam. When practiced, academic integrity ensures that all students are fairly graded. Violations to the Academic Integrity Policy undermine the educational process and will not be tolerated. It also demonstrates a lack of respect for oneself, fellow students and the course instructor and can ruin the university's reputation and the value of the degrees it offers.

We all share the obligation to maintain an environment which practices academic integrity. Violators of the Academic Integrity Policy will be subject to failing this course and being reported to the Office of Student Conduct & Ethical Development for disciplinary action which could result in suspension or expulsion from San Jose State University.

### **CHEATING**

At SJSU, cheating is the act of obtaining or attempting to obtain credit for academic work through the use of any dishonest, deceptive, or fraudulent means. Cheating at SJSU includes but is not limited to the following:

Copying in part or in whole, from another's test or other evaluation instrument; Submitting work previously graded in another course unless this has been approved by the course instructor or by departmental policy. Submitting work simultaneously presented in two courses, unless this has been approved by both course instructors or by departmental policy. Altering or interfering with grading or grading instructions; Sitting for an examination by a surrogate, or as a surrogate; any other act committed by a student in the course of his or her academic work which defrauds or misrepresents, including aiding or abetting in any of the actions defined above.

### **PLAGIARISM**

At SJSU plagiarism is the act of representing the work of another as one's own (without giving appropriate credit) regardless of how that work was obtained, and submitting it to fulfill academic requirements. Plagiarism at SJSU includes but is not limited to:

The act of incorporating the ideas, words, sentences, paragraphs, or parts thereof, or the specific substances of another's work, without giving appropriate credit, and representing the product as one's own work.

GRADING AND EXAMS There will be three noncumulative exams, the last of which will be during the last regular lecture period. They will cover lecture material for the period since the previous exam and will be given during the lecture period. Reading material will be assigned, but unless specifically stipulated, it will not be directly tested unless specifically designated. It should primarily be used as a supplement for support of, clarification of, and additional information on lecture material that you find difficult. Lab material will be covered in a separate exam. The exams will each be weighted by the percentages below to arrive at the overall course score. After overall scores for the course have been determined, those scores will be curved. Note that the failure to turn in any assignment, including the Calculations' Worksheet, will result in the assignment of an "Incomplete" grade for the semester.

The course score will tentatively be based on the following percentages (exam and due dates can be found in the Lab and Assignment Schedule at the end of this greensheet; most of the dates are tentative and depend on the progress of the lectures). Percentages will be adjusted if any assignments are omitted.

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First midterm	15%
Second midterm	15%
Third midterm	15%
Take-home lab exam	10%
Lab writeup	9%
Lab notebook	5%
Calculations' worksheet	3%
Primary research paper summaries	10%
Lab project proposal	6%
Project execution and presentation	12%

Class participation will be factored into the lab grade. Furthermore, should you miss a lecture, it is your responsibility to borrow notes from a classmate. Should you miss an exam *without prior permission*, you will not be permitted to make it up, and you will receive a "0" for that exam. Under some circumstances, arrangements can be made in advance for makeup exams if the reason is very compelling. Illness must be severe and *documented*.

### POLICIES

You are responsible for understanding the policies and procedures about add/drops, academic renewal, withdrawal, etc., found at <http://info.sjsu.edu/static/catalog/policies.html>. The Department and University strongly discourage drops at any time in the semester but especially after the first week. The university policy on drops indicates that university and departmental guidelines require serious and compelling reasons to drop a course. Grades alone do not constitute reason for dropping a course (see university catalogue).

If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please see me. Presidential Directive 97-03 requires that students with disabilities register with DRC to establish a record of their disability.

A lab fee has been charged for this course during registration.

### **Reading List for Lecture Topics in W.G. Hopkins Introduction to Plant Physiology (3<sup>rd</sup> edition)**

#### Photosynthesis

The nature of light and light absorption: 3:47-50, 52-54, 55  
Chloroplast structure: 2:39-41  
Light reactions: 4:63-64, 68-76, 83; 2:41-43  
Calvin cycle: 5:89-90, 98-102  
C<sub>4</sub> pathway: 5:108-113  
Plasmodesmata: 1:21  
Photorespiration: 1:16 (peroxisomes); 5:104-107  
CAM: 5:115-117  
Environmental Effects: 9:189-193  
Starch and sucrose synthesis: 6:123-125

#### Plant Molecular Biology and Biotechnology

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*Arabidopsis*: 4:286

Crown gall disease and *Agrobacterium*: 16:342; 23:519-521

Methodology and Genetic Engineering: 23:517-533

### Plant Hormones

Hormones (general): 152:309-312

Auxin biochemistry: 15:313-319

Auxin transport: 16:349-351

Cell wall structure: 14:291-292

Cell growth: 14:292-293

Auxin mode of action: 16:344-349

Receptors and signal transduction: 14:288-291

Cell division: 16:341-342

Cell enlargement: 16:344

Vascular differentiation: 16:351-352

Seed germination: 16:352-356

Shoot elongation: 16:356-357

Apical dominance: 16:358-359

Leaf abscission: 16:362

Flower and fruit development: 16:362-363, 364

Floral sex: 16:363-364

### Tropisms and Nastic Responses

Gravitropism: 16:359-360, 18:398-399, 400, 401-407

Phototropism: 18:392-394, 395-398

Nastic movements: 18: 408-412

### Nitrogen Fixation

Nitrogen cycle: 8:167-168, (181-184)

Nodule formation: 8:169-171, 173-174

Nitrogen fixation: 8:174-178

### Water Relations

Water potential and osmosis: 10:207-217

Transpiration: 11:219-239

Root pressure: 3:47-49

Stomatal action: 5:89-98

### Phytochrome

Photomorphogenesis: 17:367-368

Phytochrome structure and chemistry: 17:368-374, 374-376

### Phloem Transport

Phloem structure: 6:131-133

Translocation and assimilate partitioning: 6:133-143

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**Laboratory and Assignment Schedule F08**

AUG	2 5	HB101:pBI121  Streak (Micro Service Rm)	2 6	Check-In	2 7	[PLASMID CULT] Overnight Susp Culture  (Micro Service Rm)	2 8	MINI-PREP	2 9	
	SEPT	1	Labor Day	2	AGRO STREAKING ARAB CULTURE	3		4	LINEARIZATION  Calculations	5
SEPT	8		9	AGAROSE GEL St PROTPLT ISOL	1 0		1 1	PROTOPLAST ISOLATION  Summary 1: MB	1 2	
SEPT	1 5	[AGRO CULTURE] (Students)	1 6	ELECTROPORATION	1 7	[Agro Virulence] (Students)	1 8	DISK TRANSFORM	1 9	
SEPT	2 2		2 3	P/S RATE  [Tissue transfer]	2 4		2 5	St GA & GERM  [Disk Transfer]	2 6	[Freeze barley grains] (Bruck)
SEPT	2 9	[AGRO CULTURE] (Students)	3 0	St GUS ASSAY CO <sub>2</sub> UPTAKE	1	[Agro virulence] (ARABIDOPSIS LAB) (Students)	2	Fin GUS ASSAY ARAB TRANSF Fin GERM  Summary 2: PS	3	
OCT	6		7	Fin GA	8		9	St AUXIN  Exam #1	1 0	
OCT	1 3		1 4	PEA HARVEST  Proposal due	1 5		1 6	PROJECTS	1 7	
OCT	2 0		2 1	Fin AUXIN PROJECTS  Proposal revision	2 2		2 3	PROT ASSAY	2 4	
OCT	2 7		2 8	[Gel casting] IEF	2 9		3 0	SDS-PAGE  Lab writeup	3 1	
NOV	3		4	[Gel destain] St STOMATA  Exam #2	5		6	[Gel dry] Fin STOMATA	7	
NOV	1 0		1 1	PROJECTS  Lab Exam	1 2		1 3	PROJECTS	1 4	
NOV	1 7		1 8	PROJECTS	1 9		2 0	Thanksgiving	2 1	
NOV	2 4		2 5	PROJECTS	2 6		2 7	PROJECTS	2 8	
DEC	1		2	PROJECTS  Lab Notebook	3		4	PROJECTS	5	
DEC	8		9	Checkout  Exam #3	1 0		1 1		1 2	
DEC	1 5		1 6		1 7	Presentations 1445-1700	1 8		1 9	