

**Plant Physiology & Laboratory**  
**BIO 446 & 446L**  
**Spring 2003**

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**Lectures:** MWF, 10:00-10:50am, SC 301

**Labs:** WF, 12:00-2:50pm, SC 262

**Office Hours:** M 11-12, Tu 1-2 or by appointment

SC 153

x1407

**Texts**

Hopkins, W.G.. 1999. Introduction to plant physiology. 2nd ed. Wiley, New York.

Pechenik, J.A. 2001. A short guide to writing about biology. 4th ed. Longman, New York.

Reiss, C. 1994. Experiments in plant physiology. Prentice Hall, Upper Saddle River, New Jersey.

**Course Description & Objectives**

Plant physiology is the study of plant cellular, organ and organism function. A physiologist endeavors to understand function in physical and chemical terms. This understanding can then be used to construct accurate models of plant function, and responses to the plant's internal and external environment can then be predicted.

In this course, we will be looking at plant function, usually under controlled conditions. We will examine how plants acquire and allocate the energy, water and nutrients needed to survive; how they control their growth, via hormones and external and internal cues; and how they measure time, in order to coordinate their growth with seasonal changes in the environment. We will briefly touch on plant responses to stress and recent developments in biotechnology. Plant physiologists are making more use of molecular techniques. However, our main focus in laboratory will be on classical techniques.

This is a BlackBoard course. Course materials, including lecture notes, exam keys and running grade averages, will be posted on BlackBoard. The instructor will show you how to access materials

**Grading Policy**

In lecture, there will be three hour exams given during the semester and a comprehensive (cumulative) final exam. The hour exams will focus on the most recently covered sections of material (since the last exam), and exam questions will be derived primarily from topics covered in lecture (unless otherwise indicated). Each exam will be announced at least one week prior to the exam date. Exams will consist of some combination of short answers, matching, multiple choice, and essay questions.

Also, all questions will be derived from lecture material and information in the textbook. Exams will be curved only at the discretion of the instructor.

In laboratory, there will be 11 laboratory reports. Labs for which you are expected to turn in a report are marked with a star. The other labs will need to be completed but do not require a formal report. Much of the data can be entered in the lab text (Reiss). However, you should get a lab book in which to enter other information, such as the answers to discussion questions, as well for your laboratory project. The 1<sup>st</sup> laboratory report will receive full credit simply for being turned in on time. The purpose of this lab is to receive feedback on the proper way to write a lab report. Other labs will be graded on their quality. Guides will be posted for each laboratory write-up. *Note that it is important to turn in labs on time.* Labs turned in one day late will be penalized 1 point (out of 50). The penalty will grow geometrically, however. A lab turned in two days late will lose 2 points, 3 days late will lose 4 points, 4 days late will lose 8 points, etc. I won't count weekends since there is no easy way for you to turn in work on those days. Note that some labs require you to work on plants outside of regular laboratory hours. I will ensure that you get access during those times.

You will also design and carry out a laboratory project near the end of the term. Deadlines for project descriptions and the final report are listed in the schedule. Note that you should meet with me the week before the project description is due to get my approval.

I feel that it is important for students, especially in an upper-level course, to attend department seminars. Thus, I will award **15 extra points** before computing final grades to students who attend **2 department seminars** (half-credit for attendance at one seminar will not be given). In the event that I am not present, a signed note from any faculty member will serve as proof. If you are not able to attend department seminars because of work or class conflicts, see me; we may be able to arrange your presence at seminars at nearby institutions.

There is no possibility for extra credit projects beyond attendance at department seminars. The point values are as follows:

<b>Grading Scale</b>				
Exam 1	100 points	A	90-100%	1350-1500 points
Exam 2	100 points	B	89-89%	1200-1349 points
Exam 3	100 points	C	70-79%	1050-1199 points
Final Exam	200 points	D	60-69%	900-1049 points
Lab Reports (11 x 50)	550 points	F	0-59%	0-899 points
Lab Attendance (26 x 5)	130 points			
Lab Notebook	170 points			
Lab Project	150 points			
(Seminar Attendance	10 points)			
Total Points	1500 points			
	(1510 points)			

### **Missed Examinations**

Missed exams must be taken within one week of the scheduled exam. If you miss an examination for medical reasons, you must give the instructor a written statement to that effect signed by the attending physician. If you missed an examination for a non-medical emergency, you must submit appropriate written documentation of the emergency; however, acceptance of an excuse for a non-medical emergency is at the discretion of the instructor. If an exam is missed due to a situation that could have reasonably been anticipated, you will receive a grade of 0. Make-up exams will be given in any format. You must submit excuses within seven days after missing the exam; later submissions will not be accepted.

### **Academic Dishonesty**

The work you will do in this course is subject to the **Student Honor Code**. The Honor Code is a commitment to the highest degree of ethical integrity in academic conduct, a commitment that, individually and collectively, the students of Northern Kentucky University will not lie, cheat, or plagiarize to gain an academic advantage over fellow students or avoid academic requirements. More specifically, academic misconduct includes cheating (using unauthorized materials, information, or study guides), plagiarism, falsification of records, unauthorized possession of examinations, intimidation, and any other action that may improperly affect the evaluation of your performance. It also includes assisting others in any such acts for attempts to engage in such acts. Violations of the Honor Code will result in actions that may range from grade penalties (including lowering a grade to outright course failure) to disciplinary action from the University's Honor Council (more details about the Honor Code are at <http://www.nku.edu/~deanstudents/HonorCode.htm>). I also encourage you to familiarize yourself with the Code of Student Rights and Responsibilities at <http://www.nku.edu/~deanstudents/Rights-Contents.htm>.

**Supplies:** You will need a lab coat for some of the labs. The Department will supply gloves when needed. Safety glasses are recommended for some labs unless you already wear glasses. Lab coats and safety glasses can be obtained from □□□.

**Withdrawal:** Last day to withdraw with a "W" is March 28, 2003. Late withdrawals after this date will require verification of circumstances beyond your control (i.e., serious illness, employment change, death).

### **Attendance Policy**

I strongly encourage--but do not require--your attendance at all lecture meetings. Although your lecture attendance record is not calculated into your overall course grade, students with several absences usually do not perform well on exams. If you miss a lecture, it is your responsibility to obtain notes from classmates or me. Please avoid habitual tardiness, as this disrupts the class. Most students excel in this class only if they put in at least two hours of study outside class for every hour of lecture.

I *do* require your attendance at all scheduled lab meetings. If you miss a meeting for medical reasons, you must give the instructor a written statement to that effect signed by the attending physician. If you missed a meeting for a non-medical emergency, you must submit appropriate written documentation of the emergency; however, acceptance of an excuse for a non-medical emergency is at the discretion of the

instructor. If a meeting is missed due to a situation that could have reasonably been anticipated, you will receive a grade of 0. You must submit excuses within seven days after missing the exam; later submissions will not be accepted. Please also note that some laboratories will require you to come into lab outside of scheduled hours. If this presents a difficulty, please see me as soon as possible to make alternate arrangements.

### **Cell Phone, Beepers, and Tobacco Products**

Please turn off all cell phones and beepers before entering the classroom or laboratory. Even better, don't bring them! This is not only courteous to your fellow classmates, but it minimizes interruptions to the delivery of subject information and the flow of learning. If your cell phone or beeper goes off, you may be asked to leave. Also, no tobacco products of any kind are allowed in this class (unless we are doing research on them!). Again, this is a courtesy to your classmates and the learning process.

*A note for students with disabilities:* If you have a disability that may prevent you from fully demonstrating your abilities in this class, you are encouraged to contact Disability Services (859-572-5180, <http://www.nku.edu/~disability/>). Also, please contact me as soon as possible so that we can discuss any accommodations that might be necessary to ensure your full participation and to facilitate your educational opportunities.

Remember, it is your responsibility to attend class and laboratory, study and fully understand the material presented in this course! An outline of topics that I expect to cover is given below. **N.B.** This syllabus is subject to change at the discretion of the instructor.

## TENTATIVE LECTURE & LABORATORY SCHEDULE

**Key:** Plain Text = lecture topic  
*Italic* = laboratory; No. refers to Exp. No. in Reiss  
*\*Italic* = laboratory with lab report  
**Bold** = exams  
**BOLD CAPS** = No Class  
Underline = Lab due

Week	Date	Topic	Reading
1	1/13	Introduction & Review of Plant Cells	1, 1-15
	1/15	Cells, Tissues, Organs & Water	1, 15-19, 2, 21-29
		<i>*Exp. 9: Tissue-Water Relations in Potato</i>	
	1/17	Osmosis and Chemical & Water Potential	2, 29-35
		<i>Exp. 10: The Pressure Bomb &amp; Determination of Water Potential</i>	
2	1/20	<b>NO CLASS</b> --Martin Luther King Day	
	1/22	Transpiration	3, 37-44
		<i>*Exp. 11: Transpiration &amp; the Mechanism of Guard Cell Movement</i>	
		<u>Lab Due: Exp. 9</u>	
3	1/24	Ascent of Sap	3, 49-54
		<i>Exp. 24: Bioassay for Gibberellins</i>	
	1/27	Root Uptake of Water	3, 54-59
	1/29	Plant Nutrition	4, 61-76
		<i>*Exp. 12: Mineral Nutrition</i>	
		<u>Lab Due: Exp. 11</u>	
4	1/31	Nutrient Uptake across Membranes	5, 77-89
		<i>Exp. 29: The Greening of Cucumber Cotyledons</i>	
	2/3	Root Uptake of Nutrients	5, 89-97
	2/5	Nitrogen Cycle & Nitrogen Fixation	6, 99-113
		<i>Exp. 13: Nitrate Reductase: The Transformation of Chlamydomonas</i>	
	2/6	Nitrogen Assimilation	6, 113-121
		<i>*Exp. 15: Ion Transport &amp; Electrochemical Potential</i>	
5	2/10	<b>Exam I</b>	
	2/12	Light	7, 125-132k
		<i>*Exp. 3: Separation, Identification &amp; Quantitation of Plant Pigments</i>	
	2/14	Plant Pigments	7, 133-141
		<i>Exp. 25: <math>\square</math>-Amylase: Location &amp; Timing in Wheat Seed Germination</i>	
		<u>Lab Due: Exp. 15</u>	

6	2/17	<b>NO CLASS</b> --President's Day	
	2/19	Leaves & Photosynthesis I	8, 143-154
		<i>Exp. 4: Whodunit – or – the Influence of Light Intensity on Starch Production in Photosynthesis</i>	
		<u>Lab Due: Exp. 3</u>	
7	2/21	Leaves & Photosynthesis II	8, 154-161
		<i>*Whole-Plant Photosynthesis (to be handed out)</i>	
		<u>Lab Due: Exp. 12</u>	
8	2/24	Bioenergetics of Photosynthesis	9, 163-173
	2/26	Light Reactions I	9, 173-180
		<i>*Exp. 5: Photosynthesis: Partial Reactions in Cell-Free Preparations</i>	
	2/28	Light Reactions II	9, 180-187
		<i>Exp. 18: Plant Movements &amp; Differential Growth of Plants</i>	
		<u>Lab Due: Whole-Plant Photosynthesis</u>	
9	3/3	Carbon Metabolism & Dark Reactions	10, 189-198
	3/5	Photorespiration & Alternate Photosynthetic Pathways	10, 198-214
		<i>*Exp. 6: Carbon Fixation</i>	
	3/7	Distribution of Photosynthate	11, 215-221
		<i>Exp. 7: Light Relations in Whole Cell Photosynthesis</i>	
		<u>Lab Due: Exp. 5</u>	
		Spring Break 3/10-3/15	
10	3/17	<b>Exam II</b>	
	3/19	Phloem Function	11, 221-233
		<i>*Exp. 16: Translocation of Labeled Sucrose</i>	
		<u>Lab Due: Exp. 6</u>	
11	3/21	Respiration I	12, 235-241
		<i>Exp. 8: Respiratory Control in Potato Tuber Slices &amp; Mitochondria</i>	
	3/24	Respiration II	12, 241-254
	3/26	Carbon Assimilation and Productivity	13, 255-265
		<i>*Exp. 2: Amylase: Enzyme Assay</i>	
	3/28	Molecules & Metabolism	14, 267-284
		<i>Exp. 1: Determination of the Ascorbic Acid Content of Cabbage</i>	
		<u>Lab Project Description Due</u>	
11	3/31	Patterns of Plant Development I	15, 287-298
	4/2	Patterns of Plant Development II	15, 298-307
		<i>Exp. 17: Plant Tissue Culture</i>	
		<u>Lab Due: Exp. 2</u>	
	4/4	Hormones I	16, 309-325
		<i>*Exp. 20: Apical Dominance</i>	

<b>12</b>	4/7	Hormones II	<b>16</b> , 325-334,
	4/9	Hormones III	<b>17</b> , 350-365
	<i>Exp. 21: Leaf Senescence</i>		
	4/11	Photomorphogenesis I	<b>18</b> , 367-380
	<i>Project</i>		
<b>13</b>	4/14	<b>Exam III</b>	
	4/16	Photomorphogenesis II	<b>18</b> , 380-389
	<i>Exp. 23: Ethylene Production &amp; Flower Senescence</i>		
	4/18	Plant Movements I	<b>19</b> , 391-408
	<i>Project</i>		
<b>14</b>	4/21	Plant Movements II	<b>19</b> , 408-414
	4/23	Photoperiodism	<b>20</b> , 415-434
	<i>Exp. 27: Seed Germination: Light &amp; Hormones</i>		
	<u>Lab Due: Exp. 20</u>		
	4/25	Temperature & Moisture	<b>21</b> , 435-447
	<i>Project</i>		
<b>15</b>	4/28	Stress Physiology I	<b>22</b> , 451-459
	4/30	Stress Physiology II	<b>22</b> , 459-475
	<i>Exp. 22: Hormones &amp; Leaf Abscission</i>		
	5/2	Plant Physiology & Biotechnology	<b>23</b> , 447-487
	<i>Project</i>		
<b>16</b>	5/5	Conclusion	
		<u>Lab Due: Exp. 16</u>	
	5/7	<b>Final Exam</b> , 10:10am-12:10 pm	
	5/9	<u>Lab Project &amp; Lab Notebooks Due, 4:00 pm</u>	