

**Syllabus – Biology 4xxW, Structure and Function in Vascular Plants – Spring 20xx**

*Morphology, anatomy, and physiology of vascular plants, stressing the interrelationships between development, growth, water relations, photosynthesis, transport, and metabolism. This course satisfies capstone project degree requirements in the Biological Sciences. 4 credits (3 + 3). Prerequisites: BIOL F115X/F116X; MATH 107X or higher; STAT 200X; ENGL F111X, and ENGL F211X or ENGL F213X; senior standing or permission of instructor.*

Lectures: MWF 10:30-11:30 am, IRV 208

Lab: M 2:15-5:15 pm, IRV 207

Instructor: Dr. Syndonia Bret-Harte – [msbretharte@alaska.edu](mailto:msbretharte@alaska.edu)

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Teaching Assistant: TBD

**Required Text:** *Plant Physiology, 5<sup>th</sup> Edition* (2010), by L Taiz and E. Zeiger, Sinauer Associates, publisher. The textbook publisher maintains on-line learning resources at <http://www.plantphys.net/>. There is a copy of the textbook on 2-hour reserve in the BioSciences Library in the Arctic Health Research Building. Some course materials, including this syllabus and lecture outlines, will be posted online on Blackboard.

**Additional Useful Texts:**

*Plant Physiological Ecology, 2<sup>nd</sup> edition*, by H Lambers, FS Chapin III, and TL Pons, Springer, publisher

*Physicochemical and Environmental Plant Physiology, 4<sup>th</sup> edition*, by PS Nobel, Elsevier Academic Press, publisher

*Physiological Plant Ecology, 3<sup>rd</sup> edition*, by W Larcher, Springer, publisher

These books are available in the library.

**Course goals and student learning outcomes:** The overall goal of this course is to provide an understanding of how plants function as whole organisms, and the relationships between their structure, function, and the environments in which they live. At the end of the course, I hope that you will understand how plants are intimately connected to their environments and how they function in an integrated way. I hope that you will understand the quantitative principles that underlie much of how plants function, achieve mastery of the concepts presented in the course and improve your ability to formulate hypotheses, conduct experiments, and write scientific reports.

**Instructional Methods:** This course is based on lectures, laboratory exercises, and discussion sections. Lectures cover the major topics, emphasizing and discussing the important points. Discussion sections help you figure out how to approach the problem sets, and give you a chance to clarify anything that you don't understand from lecture. The problem sets help you understand how to apply the physical and quantitative principles that underlie how plants

function. Laboratory exercises help you learn how to measure and identify plant structure and function in a hands-on way. In the laboratory you will also develop and carry out your own research project in plant physiology, and present and write-up your findings. Writing up the laboratory reports and your independent research project helps you improve your ability to write scientific reports. Your personal participation in lectures, discussion sections, and laboratory exercises is both important and required, and will help you learn the material of the course.

### Grading and class policies:

1. Points will be awarded for performance on lecture and laboratory exercises.
2. Grades will be based on percentage of total possible points according to the following scale. UAF has instituted a +/- scale for the grades, as noted below.

A	90-100% (A- = 90-92%, A+ = 97-100%)
B	80-89% (B- = 80-82%, B+ = 87-89%)
C	70-79% (C- = 70-72%, C+ = 77-79%)
D	60-69% (D- = 60-62%, D+ = 67-69%)
F	0-60%

### 3. Lecture and laboratory exercises:

Points	Activity	Date due
200	Two mid-term exams, one hour each	Feb 23, Apr 6
200	Final exam, two hours	May 9
200	Eight problem sets	As specified in calendar
125	2 short lab reports, lab notebook, lab quizzes & miscellaneous assignments	As specified in calendar & class
25	Ungraded diagnostic writing assignment	Jan 24
25	Proposal for independent lab project	Feb 25
50	Draft of Introduction & Methods	Apr 8
50	Draft of Results & Discussion	Apr 22
25	Oral presentation of independent lab project	Apr 25
100	Final Independent Lab Project Report	May 4

A significant part of each exam will involve written essays, and more than 50% of the total grade is based on written materials. Exam scores may be graded on a curve, in which case the scale above will be adjusted. Due dates and the course schedule may change. If so, an announcement will be made in class.

4. Attendance and punctuality at lecture and lab are expected. If you are consistently late to class, points will be deducted from your score. All electronic devices, except computers used for taking notes and presentations, should be turned off and put away before class starts. You are responsible for all materials, information, handouts, announcements and assignments made orally, electronically or in writing.

5. If you are going to miss an exam, it is essential that you contact Dr. Bret-Harte as soon as possible to discuss the reasons. Unexcused absences from exams will be recorded as a zero.

- 6.** If you are going to miss lab, you must contact the Teaching Assistant as soon as possible to make arrangements for making up the exercises you will miss. You are responsible for mastering the material and completing assignments from a missed lab. Unexcused absences from lab will be recorded as a zero.
- 7.** Late assignments and problem sets will lose 10% for each day that they are late, unless an arrangement is made with Dr. Bret-Harte in advance.
- 8.** Academic Integrity – the UAF Student Code of Conduct is presented on page 49-50 of the 2010-2011 Course Catalog. No collaboration among students is allowed on exams or quizzes, and although students may work together in collecting, analyzing, and interpreting data from laboratory exercises, no collaboration is permitted in writing of lab reports, lab assignments, or problem sets. Copying or paraphrasing another student's writing is a violation of the Code of Conduct. If in doubt about whether you should cite or acknowledge someone, do so. If you are unsure of how to cite someone's writings or ideas, ask the instructor or teaching assistant for help. Reference librarians are also a good source of information for help with citations. Violations of the Code of Conduct may result in an F for the course and/or referral to the university disciplinary committee.
- 9.** You are encouraged to seek whatever assistance you may need from the instructor and teaching assistant to successfully complete course requirements. Please come to office hours, send e-mails, and leave phone messages. You have a better chance of improving your grade earlier, rather than later. We are happy to review and comment on draft papers and to offer suggestions for preparing presentations. You can also take your drafts to the Writing Center (call 5314 for an appointment) for help with organization, presentation and clarity.
- 10.** The Office of Disability Services implements the Americans with Disabilities Act (ADA) and ensures that UAF students have equal access to the campus and course materials. I will work with the Office of Disability Services (208 Whittaker; 474-5655) to provide reasonable accommodation to students with disabilities. Please talk to me at the beginning of the semester if you need help or special accommodations of any kind.

**Course Schedule (subject to change)**

<b>Date</b>	<b>Topic</b>	<b>Reading</b>
<b>January</b>		
21	F Introduction: overview of plant structure and overall plant growth	ch. 1, App. 2
24	M Overall growth and photosynthetic energy capture Lab 1: Plant morphology <i>ungraded diagnostic writing assignment due</i>	ch. 7, pp. 164-87; App. 1
26	W Photosynthetic energy capture	ch. 7, pp. 164-96
28	F Discussion: <i>overall growth problem set</i>	
31	M Photosynthetic energy capture II Lab 2: Plant growth analysis	
<b>February</b>		
2	W Physiology of photosynthesis I <i>Overall growth problem set due</i>	ch. 8, pp. 200-25
4	F Discussion: <i>photosynthesis problem set</i>	
7	M Physiology of photosynthesis II Lab 3: Discussion of independent projects, Photosynthesis I	ch. 9, pp. 243-54, 263-65
9	W Physiology of photosynthesis III <i>Photosynthesis problem set due</i>	ch. 9, pp. 257-62
11	F Photosynthetic gas exchange <i>Report due for lab 2: growth analysis</i>	ch. 4, pp. 96-102
14	M Water cost of photosynthesis Lab 4: Photosynthetic gas exchange & pigment extraction	
16	W Leaf energy balance and temperature	ch. 9, pp. 254-56
18	F Discussion: <i>leaf function problem set</i> <i>Lab notebooks due</i>	
21	M Stomatal control and responses Lab 5: Transpiration and control of stomatal function	ch. 18, pp. 524-31
23	W <i>First mid-term exam</i>	
25	F Water potential, cell osmotic relations <i>Independent Project Proposal due; leaf function problem set due</i>	ch. 3, pp. 67-83
28	M Water transport I Lab 6: Water potential; Plant Anatomy I	ch. 4
<b>March</b>		
2	W Water transport II	ch. 4
4	F Discussion: <i>water potential problem set</i>	
7	M Water transport III Lab 7: Plant anatomy II	ch. 4
9	W Water uptake by roots <i>Water potential problem set due</i>	ch. 4, pp. 87-90
11	F Discussion: <i>water transport problem set</i>	
14-18	<i>Spring break</i>	
21	M Photosynthate translocation Lab 8: Plant anatomy III	ch. 10

23	W	Photosynthate translocation II <i>Water transport problem set due</i>	ch. 10
25	F	Discussion: <i>Translocation problem set</i>	
28	M	Mineral nutrition Lab 9: mineral deficiency experiment set-up; individual projects	ch. 5
30	W	Mineral Nutrition II <i>Translocation problem set due</i>	ch. 5
<b>April</b>			
1	F	Toxic minerals, Ion uptake by cells <i>Lab notebooks due</i>	ch. 5, ch. 6
4	M	Ion transport I Lab 10: score mineral deficiency experiment; individual projects	ch. 6, App. 1
6	W	<i>Mid-term exam II</i>	
8	F	Discussion: <i>ion transport problem set</i> <i>Draft of Independent Project Introduction and Methods due</i>	
11	M	Ion transport II Lab 11: harvest mineral deficiency experiment; individual projects	ch. 6
13	W	Plant respiration <i>Ion transport problem set due</i>	ch. 11, pp. 305-31
15	F	Discussion: <i>growth and respiration problem set</i>	
18	M	Cell walls and growth of plant cells Lab 12: Data analysis for individual projects <i>Report due for labs 9&amp;10: mineral deficiency experiment</i>	ch. 15
20	W	Controls over cellular growth rate <i>Growth and respiration problem set due</i>	ch. 15
22	F	Plant hormone classes and actions <i>Draft of Independent Project Results and Discussion due</i>	ch. 19-24*
25	M	Plant hormones II Lab 13: <i>Oral presentations on independent projects</i>	ch. 19-24*
27	W	Phytochrome and light responses	chs. 17, 18
29	F	<i>UAF Springfest; no class</i>	
<b>May</b>			
2	M	Cold and freeze tolerance Lab 14: Field trip	ch. 26
4	W	Cold and freeze tolerance II <i>Final Independent Project Report due</i>	ch. 26
6	F	Review <i>Lab notebooks due</i>	
9	M	<i>Final exam, 10:15-12:15</i>	

*Additional readings and supplementary handouts will be assigned in class.*

*\*There is a lot of material in these chapters, and we won't cover everything. Read these chapters selectively, to help you understand anything that is not clear from the lectures.*