Biology of Plants
Biology 315, Fall 2015
Union College

Dr. Steven Rice
121 Wold
phone: x-6243; email: rices@union.edu
Lecture TuTh 10:55-12:40 N222, Lab M 1:50-4:40 S201
Office Hours: M 9:30-10:30, Th 9:30-10:30 or by appointment

Course Synopsis and Learning Outcomes: Plants are one of the major life forms on earth and are easily distinguished by their biochemistry, photoautotrophic nutrition, anatomy, modular growth form, and/or by their life history characterized by an alternation of generations. As such, the higher plants or embryophytes are a cohesive evolutionary group. However, the embryophyte clade is also diverse and contains over 350,000 species. These serve as the primary producers in most terrestrial, wetland, and in many aquatic environments. Within these habitats, plants have adapted to a wide range of physical and biological conditions and are functionally as well as taxonomically diverse. In this course, students will learn about the major characteristics and innovations of the embryophytes and to evaluate the functional and adaptive significance of variants in form, physiology, and life history characteristics that exist among diverse plant groups. The study of plant biology goes beyond the basics of content and also includes understanding the methods and approaches used by plant biologists. Throughout the lecture and laboratory portion of the course, students will explore the scientific process by critical reading of the primary literature, by evaluating models and experiments, by developing and testing hypotheses, by analyzing and interpreting experimental results, and by communicating experimental results orally and in writing.

Structure of Course: In addition to lecture, class meetings will be devoted to discussions and other exercises where models, experiments, and results are critically evaluated. It is essential that you do the required reading—**you are responsible for learning from the text and other readings, even if the material is not reviewed in class**. In addition to reinforcing the lecture content, the laboratories will provide practice with the design, implementation, analysis, and writing of experiments. These are designed to last the full time, plan on it.

Course Requirements: All work must be completed and handed in to receive a grade for the course. You may make up a test only in the case of a documented emergency. Note that the final exam will be given only on the scheduled date. Make your plans accordingly. Attendance in class is expected. Labs are not to be missed and will be made up with an acceptable, documented excuse brought to my attention in a timely manner.

Grading: The breakdown of the grades is as follows:

- Lab Practical Exams (10% and 20%)……..……...…30%
- Mid-Term Exam…….……15%
- Final Exam…….…... 20%
- Other Assignments/Participation……...……..….5%
- Labs
  - Plant Structure Poster……..……10%
  - Biomechanics Assign……..2.5%
  - Bryophyte Assign.....…….2.5%
  - Photosynthesis Project……...……...15%

Letter grades will be assigned based on a 10 point scale with +/-.

Required Texts: 1. BIO 315 Plant Biology, online text from Nature Education. Details for online access will be provided; 2. Rushforth, S.R., R.R. Robbins, J.L. Crawley and K.M. Van De Graaff 2012. A Photographic Atlas for the Botany Laboratory, 6th ed. Morton Publishing Company, Englewood, CO.

Academic Honesty: Matriculation at the College is taken to signify implicit agreement with the Academic Honor Code, available at honorcode.union.edu. It is each student's responsibility to ensure that submitted work is his or her own and does not involve any form of academic misconduct. Please as Prof. Rice for clarification regarding, but not limited to, collaboration, citations, and plagiarism. Ignorance is not an excuse for breaching academic integrity. In this course, students are encouraged to work with their lab partners in the gathering and analysis of data, but are required to construct graphs and figures and to write all portions of assignments on their own. The Plant Structure Poster is an exception as students will receive a group grade for the project.

BIO 315 Biology of Plants
Topic Outline Spring 2014

Week	Date	Unit	Topic	Reading/Assign. (titles are chapters from Online Text)
1	9/10	Plant Growth Form and Structure	Plant Diversity, Growth Form and Structure Overview	Plants and Humans
	9/14		*Lab*: Diversity in structure and function—field trip	Evolution of Land Plants
	9/15		Primary growth and structure: roots, stems, leaves	Plant Anatomy, Plant Growth and Development (Primary Growth), Funk and Vitousek 2007
2	9/17		*Primary Structure: roots, stems, leaves	Plant Structure and Function
	9/21		*Lab:* Primary Structure Poster Projects	
	9/22		*Plant primary structure discussion/poster projects	Olsen et al. 2013
3	9/24		Secondary growth	Plant Growth and Development (Secondary Growth), Swetnam 1993
	9/28		*Lab:* Biomechanics of Vine and Tree Stems.	
	9/29		*Secondary growth, twigs and bark	**Poster Projects Due**
4	10/1	Plant Diversity	Plant Life Cycles and Bryophytes	Nonvascular Plants
	10/5		*Lab:* Plant life cycles & bryophytes/review for Practical Exam	**Biomechanics Lab Due**
	10/6		***Lab Practical Exam I**	
5	10/8		*Seedless vascular plants	Seedless Vascular Plants, Watkins et al. 2010
	10/12		*Lab:* Water dynamics of bryophytes (Field Trip—leave at common hour)	Loisel et al. 2009
	10/13		Seed Plants	Seed Plants
6	10/15		**Mid-Term Exam**/Tissue Grinding	
	10/19		*Lab:* Seed Plants/ Gymnosperms	Gymnosperms
	10/20		Angiosperms	Angiosperms, Kiepiel & Johnson 2014

7	10/22		*Angiosperms	Flowering Plant Life Cycle, Flowering Plant Reproduction
	10/26		*Lab:* Fruit/Seed Plant Review	
	10/27	Photosynthesis	Photosynthesis Introduction	Photosynthesis Overview
8	10/29		**Lab Practical II**	
	11/2		*Lab:* Photosynthesis I. Gas exchange	Lambers et al. 2003 p. 10-40
	11/3		Light response and control of photosynthesis	Plants and Light; **Bryophyte Water Dynamics Assignment Due**
9	11/5		*Photosynthesis projects	
	11/9		*Lab:* Photosynthesis II, projects	
	11/10	Plants and Agriculture	Photosynthetic Variants	C3, C4 and CAM Photosynthesis
10	11/12		Photosynthesis Project Presentations	
	11/16		*No Lab*	**Photosynthesis Lab Due**
	11/17		Food security, agriculture and biotechnology	Büntgen et al. 2011
11		FINAL		

*indicates lab exercise during lecture time, please meet in the laboratory and bring the Rushforth et al. 2012 book.
Text refers to chapters in the BIO 315 Plant Biology online textbook.

References:

Büntgen, U., W. Tegel, K. Nicolussi et al. 2011. 2500 years of European Climate Variability and Human Susceptibility. Science 331: 578-582.

Funk, J.L. and P.M. Vitousek 2007. Resource-use efficiency and plant invasion in low-resource systems. Nature 446:1079-1081.

Kiepiel, I. and S.D. Johnson 2014. Shift from bird to butterfly pollination in *Clivia* (Amaryllidaceae). American Journal of Botany 101: 190-200.

Lambers, H., S. Chapin III, T. Pons 2003. Physiological Ecology. Springer, NY.

Loisel, J., M. Garneau and J.-F. Hélie 2009. Modern Sphagnum $\delta^{13}C$ signatures follow a surface moisture gradient in two boreal peat bogs, James Bay lowlands, Québec. Journal of Quaternary Science 24: 209-214.

Olsen, J.T., K.L. Caudle, L.C. Johnson, S.G. Baer and B.R. Maricle 2013. Environmental and genetic variation in leaf anatomy among populations of Andropogon gerardii (Poaceae) along a precipitation gradient. American Journal of Botany 100: 1957-1968.

Rushforth, S.R., R.R. Robbins, J.L. Crawley and K.M. Van De Graaff 2012. A Photographic Atlas for the Botany Laboratory, 6th ed. Morton Publishing Company, Englewood, CO.

Swetnam, T.W. 1993. Fire history and climate change in giant sequoia groves. Science 262: 885-889.

Watkins, J.E., N.M. Holbrook and M.A. Zwieniecki 2010. Hydraulic properties of fern sporophytes: consequences for ecological and evolutionary diversification. American Journal of Botany 97: 2007-2019.