

COURSE SYLLABUS

TEXTS:

Evert, Ray F. and Susan E. Eichhorn. 2013. Biology of Plants. Eighth Edition. W. H. Freeman & Co. ISBN: 1-4641-1928-7

Evert, Ray F., Susan E. Eichhorn, and Joy B. Perry. 2013. Laboratory Topics in Botany. Seventh Edition. W.H. Freeman & Co. ISBN: 0-7167-6205-6

Plotkin, Mark J. 1993. Tales of a Shaman's Apprentice. Penguin Books. ISBN: 0 1401.2991

OPTIONAL:

Leopold, Aldo. 1949. A Sand County Almanac. Balantine Books. This book is optional. You can purchase it in the bookstore for about \$12.00; however, there are several copies on reserve in Reeves Library. We will cover the last chapter toward the end of the semester.

COURSE OBJECTIVES:

Biology 119 is an introductory course in plant science designed to introduce you to plants, their physiological functions, their roles in natural ecosystems, and how humans use them. We will examine the importance of plants in our every day lives. Not only do plants provide us with food and fiber, but they also afford us also a broad array of important medicines, pharmaceuticals and pain killing drugs. Certain plants produce potent anticancer drugs, and it is likely that drugs from other plants will be useful in treating AIDS. Ironically, the ecosystems where these plants are found are at risk and many of them may not survive the next two or three decades. We will discuss the rapid loss of biodiversity and its potential effects on our lives.

Another goal of the course is to examine the historical and cultural significance of plants, particularly the pivotal role of plant domestication in the rise of civilization.

We will see how plants have been used as experimental organisms to solve important biological problems. We will explore the relationships between structure and function in higher plants, especially photosynthesis, and we will see how the photosynthetic mechanism responds to environmental changes. We will also examine how plants control their growth and development and how the control mechanisms respond to seasonal changes and pressure from herbivores. We may discuss some of the new advances in plant biotechnology to see how genetic manipulation of important plant species is accomplished. Finally, we will examine representative examples of major

plant divisions to see how they reproduce. Based on differences in reproductive patterns we will discuss some of the major trends in plant evolution.

#### ATTENDANCE:

Plan to attend all regular classes, laboratories, and exams. Missing an exam means that the exam will be given a score of zero and averaged with other test grades for the semester. In the case where an exam is missed for a valid reason, the exam will not count against the final average and the remaining test scores will be averaged.

#### GRADING:

Grades are based on lecture exams, laboratory quizzes, a laboratory practical exam, and a final exam.

	<u>Point Value</u>	<u>Percentage of Final Grade</u>
Three (3) hour exams (100 points each)	300	33.3%
Three (3) laboratory quizzes (60 points each)	180	20.0%
One (1) laboratory practical exam	150	16.7%
Final exam (comprehensive)	<u>270</u>	<u>30.0%</u>
	900	100.0%

Letter grades are assigned using 10-point intervals:

90-100% = A, 80-89% = B, 70-79% = C, 60-69% = D, < 60% = F

#### ACADEMIC HONESTY:

The instructor adheres to the policy statement on academic integrity outlined in the current Student Handbook.

Cheating on an exam or a laboratory quiz will result in a grade of zero for the exam or quiz.

**Do not bring cell phones to class on days when exams are scheduled, or to the laboratory on days when a lab quiz is to be given. The instructor is singularly unforgiving about this.**

## EXTRA CREDIT:

For those who wish to do so there are extra credit films that may be viewed in Reeves Library. Each is worth 10 points. If you elect to do this, you must advise the instructor in advance then go to Reeves Library to view the film. Some of these are available as CDs that you can check out and view on your personal computer. Others are on VHS video cassette tapes. To receive credit you will need to turn in a one page, hard copy written abstract (**not an email**) to the instructor summarizing the central ideas in the film. Your summary should be turned in within one week of viewing the film. All video summaries must be turned in to the instructor on or before **Friday 5 December**. Video summaries are not accepted during final exam week.

You may select up to **two** from the following titles (excluding any which we may have used in class or the laboratory):

Aldo Leopold's Wilderness  
 AMATE: The Great Fig Tree  
 Ecology of the Forest  
 Faces of the Rain Forest  
 Manu: Peru's Hidden Rain Forest  
 Natural Connections  
 Pollination  
 Pollination: The Insect Connection  
 Queen of Trees<sup>1</sup>  
 Race to Save the Planet 5: Remnants of Eden  
 Sexual Encounters of the Floral Kind  
 Spirits of the Rainforest

### Recent acquisitions:

Rain Forest - Natl. Geographic  
 Lost Cities of the Amazon - National Geographic  
 Secrets of the Dead: Lost in the Amazon

Students who wish to request accommodations in this class for a disability must contact Ms. Elaine Mara, assistant director of academic support services for academic and disability support, at the lower level of Monocacy Hall, or by calling [610-861-1401](tel:610-861-1401). Accommodations cannot be provided until authorization is received from the Academic Support Center.

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<sup>1</sup> This may not be in Reeves library. If you want to view it, see the instructor for a copy.

## LECTURE SCHEDULE

Mon.	25 Aug.	No Class	
Wed.	27 Aug.	Orientation; "What is a seed?"	
Fri.	29 Sept.	Seed structure, germination, and seed ecology	
Mon.	1 Sept.	Seedling development and its control	(Labor Day)
Wed.	3 Sept.	Flowers and floral anatomy	
Fri.	5 Sept.	How do flowering plants reproduce?	
Mon.	8 Sept.	How flowering plants reproduce	
Wed.	10 Sept.	Pollination biology, the essence of mutualism	
Fri.	12 Sept.	Plant ecology	
Mon.	15 Sept.	Plant ecology	
Wed.	17 Sept.	Plant ecology	
Fri.	19 Sept.	Tropical forests exemplify the principles of ecosystem structure	
Mon.	22 Sept.	Tropical forests	
Wed.	24 Sept.	<b>FIRST HOUR EXAM</b>	
Fri.	26 Sept.	Molecular composition of plant cells	
Mon.	29 Sept.	How do plants defend themselves against herbivores?	
Wed.	1 Oct.	Enzymes and factors affecting their action	
Fri.	3 Oct.	The structure of plant cells	(MID TERM)
Mon.	6 Oct.	The structure of plant cells	
Wed.	8 Oct.	How do plant cells divide? Mitosis and the concept of totipotency. Totipotent cells can be used to clone useful plants.	
Fri.	10 Oct.	Meiosis is all about sex. Why is sexual reproduction important in the evolution of species? Can some plants survive without sex?	
Sat.	11 Oct. -	Tue. 14 Oct.	<b>FALL RECESS</b>
Wed.	15 Oct.	Cells, differentiation, and plant tissues	
Fri.	17 Oct.	Plant structure: Stems and leaves	
Mon.	20 Oct.	Plant structure: Leaves and roots	
Wed.	22 Oct.	Photosynthesis: "Harvesting the Sun"	
Fri.	24 Oct.	The light reactions of photosynthesis	
Mon.	27 Oct.	<b>SECOND HOUR EXAM</b>	
Wed.	29 Oct.	C <sub>3</sub> , C <sub>4</sub> , and CAM plants	
Fri.	31 Oct.	Alternation of generations: the fern life cycle (fern allies if time allows)	
Mon.	3 Nov.	Moss life cycle as an example of bryophytes (liverworts if time permits)	

- Wed. 5 Nov. Liverworts  
Fri. 7 Nov. The pine, a gymnosperm
- Mon. 10 Nov. Plant growth and development  
Wed. 12 Nov. Growth and development: hormones and tropisms  
Fri. 14 Nov. Growth and development: How do plants see light? Phytochromes
- Mon. 17 Nov. Growth and development: photoperiodism and flowering  
Wed. 19 Nov. **THIRD HOUR EXAM**  
Fri. 21 Nov. How are plants important to us? (Or, what might life be like without them?)
- Mon. 24 Nov. Useful plants and plant products  
Wed. 26 Nov. - Sun. 30 Nov. **THANKSGIVING VACATION**
- Mon. 1 Dec. Useful plants and plant products  
Wed. 3 Dec. Biodiversity: How many species are present on earth, and how fast are they disappearing? Why should we worry about species extinction?  
Fri. 5 Dec. Biodiversity (Last day of classes)
- Tue. 9 Dec. **FINAL EXAM** 8:30 am

## LABORATORY SCHEDULE

Many of the laboratory exercises come from the lab manual by Evert and Eichhorn. Others are based on handouts from the instructor. **Lab exercises are closely related to lecture topics, so plan to bring your lecture notes and text book to the lab.** You will have occasion to use both frequently. Laboratory assignments should be read BEFORE coming to the lab. Three lab quizzes, each about 15 minutes, will be given during the semester. A practical exam emphasizing structure and function is scheduled for the last lab meeting.

<u>Date</u>	<u>Subject Material</u>	<u>Assignments</u>
26, 28 Aug.	Start <i>Brassica rapa</i> seedlings & fern gametophyte cultures	
2, 4 Sept.	The light microscope Plant cells	Topic 1-1 Topic 4-1
9, 11 Sept.	<b>FIRST LAB QUIZ</b> Seeds, germination, and seedling development  The structure of flowers	Handout Topic 3-1 Topic 20-2 to 20-6 Topic 18-7 to 18-10
16, 18 Sept.	Field Trip	
23, 25 Sept.	Plant water relations: determination of water potential of potato tuber tissue. Relevance of water potential to stomate regulation, sugar transport, and water movement in plants	Handout
30 Sept. 2 Oct.	Field Trip <sup>2</sup>  MID TERM	
7, 9 Oct.	Enzyme lab: extraction and assay of catalase from spinach leaves	Handout
Sat. 11 Oct. - Tue. 14 Oct.	<b>FALL RECESS</b>	
16 Oct.	Is catalase found throughout the plant? Is the activity of the enzyme affected by light?	Handout

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<sup>2</sup> If the weather cooperates, this field trip will probably be moved to **Saturday** 4 October. If so, we will not have lab on Tuesday and Thursday 30 Sept. and Thurs. 2 Oct.

21, 23 Oct.	<b>SECOND LAB QUIZ</b> Mitosis: root meristems Meiosis	Topic 5-1 Topic 9-1
28, 30 Oct.	Three major tissue systems of plants and the cells which comprise them Stems of dicots and monocots	Topic 3-3, 3-4 Topic 21-1 Topic 23-1
4, 6 Nov.	Leaves: dicots, monocots, C <sub>3</sub> and C <sub>4</sub> , abscission Secondary growth of stems Roots: root systems, primary growth, origin of secondary roots, dicot & monocot roots	Topic 24-1 Topic 25-1 Topic 22-1
11, 13 Nov.	<b>THIRD LAB QUIZ</b> The fern life cycle: an example of alternation of generations with dominant sporophytes Mosses have dominant gametophyte generations	Topic 16-4 to 16-9 Topic 14-5 to 14-7
18, 20 Nov.	<i>Marchantia</i> , a liverwort Pine life cycle: an example of the gymnosperms	Topic 14-1 to 14-4 Topic 17-1 to 17-7
25 Nov.	Is catalase found throughout the plant? Is the activity of the enzyme affected by light?	Handout

Wed. 26 Nov. - Sun. 2 Dec. **THANKSGIVING RECESS**

2, 4 Dec. **PRACTICAL EXAM**

**SUMMARY OF SEMESTER DEADLINES**

Tue. Thurs.	9, 10 September	First lab quiz
Wednesday	24 September	First hour exam
Tue. Thurs.	21, 23 October	Second lab quiz
Monday	27 October	Second hour exam
Tue. Thurs.	11, 13 November	Third lab quiz
Wednesday	19 November	Third hour exam
Tue. Thurs.	2,4 December	Laboratory practical exam
Tuesday	9 December	Final exam (8:30 am)

**TIME LINE FOR READINGS IN *TALES OF A SHAMAN'S APPRENTICE***  
(Plotkin, 1993)

Topics in Plotkin's book will be discussed at several points in lecture on 19 and 26 September, so you should plan to read the book according to the following time line. We will also use it between 21 November and 5 December in discussions on ethnobotany and biodiversity. In any event, be certain to complete the book prior to **Friday 17 October** since it will be included on the **second exam**.

<u>Assignment</u>	<u>Completion Date</u>	
Foreword Chapters 1 & 2	Monday	8 September
Chapters 3 & 4	Monday	22 September
Chapters 5,6 & 7	Monday	6 October
Chapters 8 & 9	Friday	17 October

**LIBRARY REFERENCE MATERIALS ON RESERVE**

When you read the assignments in these books, prepare a short, one or two paragraph summary of each and **incorporate it into your lecture notes**. These reading assignments will be included on exams.

Judson, Olivia, 2002. Dr. Tatiana's Sex Advice to All Creation: The Definitive Guide to the Evolutionary Biology of Sex. Metropolitan Books. Henry Holt and Co.  
Chapter 4: *Swords or Pistols* (read pp. 60-65 on fig wasps)

Leopold, Aldo. 1948. A Sand County Almanac. Ballantine Books. Read the last chapter, *The Land Ethic* (pp. 237-279).

Western, David and Mary Pearl. 1989. Conservation for the Twenty-first Century. Oxford University Press. Two chapters will be assigned. See the list of reading assignments.



## SEMESTER READING ASSIGNMENTS

(Topics arranged in the order we will cover them. From Evert and Eichhorn. 2013. 8th Edition)

Reading assignments are selected to supplement lecture topics and should be read **BEFORE** coming to class on the day that the topics are to be discussed. Most assignments are from the textbook. A few are from reference books on reserve in the library. For topics marked with an asterisk (\*) there will be additional reading assignments in the form of handouts in class.

<u>Lecture Topics</u>	<u>Assignments</u> <sup>3</sup>
Orientation	EC, Ch. 1, pp. 1-15
Seeds, germination, and the development of the plant body	EC, Ch 22, pp. 530-537
Flowers, floral anatomy, and reproduction in flowering plants	EC, Ch. 19, pp. 457-476 EC, Ch. 20, pp. 477-500 EC, Ch, 22, pp. 526-530
Pollination biology	EC, Ch. 20, pp. 487-491 Judson, O. Ch. 4. <i>Swords or Pistols</i> (pp. 60-65)
Plant ecology <sup>4</sup> Biomes and global ecology	EC, Ch. 31, Ecology (on the Web) EC, Ch. 32, Global ecology (Web)
Molecular components of plant cells*	EC, Ch. 2, pp 18-37
How do plants defend themselves against herbivores?	EC, Ch. 2. Secondary Metabolites pp. 30-35 EC, Ch. 20. Biochemical Evolution pp. 497-498 Handouts: Anti-herbivore Defenses in Tropical Plants <i>The night moves of pregnant Moths</i>
Enzymes and factors which affect their action* (especially pp 99-106)	EC, Ch. 5, pp. 94-106

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<sup>3</sup> EC = Evert and Curtis.

<sup>4</sup> The two chapters on ecology are not in the text. You can download them without charge from the publisher's Web site at [www.whfreeman.com/raven8e](http://www.whfreeman.com/raven8e). Save them as pdf files on your hard drive. You will need Adobe Acrobat v. 3 or higher. The files are fairly large (4.1 and 6.3 MB), so they will take a few minutes to download.

Structure of plant cells*	EC, Ch. 3, pp. 38-62 EC, Ch. 4, pp. 75-91
Mitosis*	EC, Ch. 3, pp. 62-74
Totipotency and its importance in plant biotechnology (In particular note the essay on totipotency. Top of p. 202)	EC, Ch. 10, pp. 198-205
Meiosis*	EC, Ch. 8, pp. 152-159
(Note the basis for cytoplasmic inheritance, p. 168)	
Asexual reproduction	EC, Ch. 8, pp. 169-173
Cells, differentiation, and plant tissues Note in particular the structures of tracheary elements of the <b>xylem</b> , and <b>sieve cells</b> , <b>companion cells</b> , <b>P-protein</b> and the <b>forisome</b> in the <b>phloem</b> .	EC, Ch. 23, pp. 538-557
Stems*	EC, Ch 25, pp. 579-589
Leaves (including stem & leaf modifications)*	pp. 590-613
Secondary growth in stems	EC, Ch. 26, pp. 614-635
Roots*	EC, Ch. 24, pp. 558-578
Photosynthesis*	EC, Ch. 7, pp. 122-149.
This is an <b>especially important</b> chapter, and it is integral to the mission of the course. Look over the <b>study questions</b> carefully (pp. 148-149).	
Systematics and the diversity of living things	EC, Ch.12, pp. 234-250
Alternation of generations*	EC, Ch. 12, pp. 250-255 (Including Life Cycles & Diploidy) EC, Ch. 17, pp. 397-398 (Fig. 17-8)
Lower vascular plants (ferns and fern allies)* Focus on the <b>fern life cycle</b> as a prototype for this group. Omit the life cycle of <i>Selaginella</i> on pp. 410-411.	EC, Ch. 17. pp. 391-429 (pp. 409-429 is the most important) See the <b>fern life cycle</b> , pp. 422-423)
Bryophytes*	EC, Ch. 16. pp. 366-390
In this chapter concentrate on the life cycle of <b>mosses</b> (pp. 378-387) and the <b>liverwort</b> <i>Marchantia</i> (pp. 373-377)	In particular, the life cycle of mosses (pp. 386-387) and <i>Marchantia</i> (pp. 376-377)

## Gymnosperms\*

Here the most important part of the chapter is pp. 437-448. **Pines** will be our only example of gymnosperms (see life cycle on pp. 442-443).

EC, Ch. 18. pp. 430-456

## Plant growth and development

## Hormones\*

How plants respond to their environment (especially phototropism, photoperiodism, and phytochrome)

EC, Ch. 27. pp. 638-659  
(Including study questions, p. 659)  
EC, Ch. 28. pp. 660-682

## Why are plants important to us?

## Handouts:

Useful Plants and Plant Products  
Drugs of Plant Origin  
EC, Ch. 21, pp. 501-523 (Read the short essay Origin of Maize, p. 510)

## Biodiversity and conservation

Leopold, last chapter of the book,  
*The Land Ethic*, pp. 237-279.  
Western and Pearl:  
(1) *Overview*  
(2) *Overview of Recent Extinctions*  
(Jared Diamond), pp. 37-41  
(3) *A Major Extinction Spasm: Predictable and Inevitable?*  
(Norman Myers), pp. 42-49