

COURSE SYLLABUS

TEXTS:

Raven, Peter H., Ray F. Evert, and Susan E. Eichhorn. 2005. Biology of Plants.  
Seventh Edition. W. H. Freeman & Co. ISBN: 0-7167-1007-2

Evert, Ray F., Susan E. Eichhorn, and Joy B. Perry. 2005. 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 may purchase it in the bookstore for about \$12.00, or copies will be on reserve in Reeves Library.

COURSE OBJECTIVES:

Biology 119 is an introductory course in plant science designed to introduce you to plants as living organisms, 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 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 which contain these plants are at risk and many of them may not survive the next two decades. Early in the course 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 exciting new advances in plant biotechnology to see how genetic manipulation of important plant species is accomplished.

Finally, we will examine a few representative examples of major plant divisions and 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%

#### ACADEMIC HONESTY:

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

## EXTRA CREDIT:

For those who wish to do so there are extra credit videos which may be viewed in the Reeves Library. Each is worth 10 points. If you elect to do this, you must advise the instructor in advance and then go to Reeves Library to view the film. To receive credit you will need to turn in a one page abstract 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 **Monday 7 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 laboratory):

A Walk Through the ACEER Useful Plants Trail (in the Peruvian Amazon)

Aldo Leopold's Wilderness

AMATE: The Great Fig Tree

Ecology of the Forest

Faces of the Rain Forest

Intimate Strangers: Symbiosis

Manu: Peru's Hidden Rainforest

Natural Connections

Pollination

Pollination: The Insect Connection

Queen of Trees

Race to Save the Planet 5: Remnants of Eden

Seeds of Tomorrow

Sexual Encounters of the Floral Kind

Spirit of the Rainforest

## LECTURE SCHEDULE

Mon.	31 Aug.	Orientation; "What is a seed?"
Wed.	2 Sept.	Seed structure, germination, and seed ecology
Fri.	4 Sept.	Seedling development and its control
Mon.	7 Sept.	No class
Wed.	9 Sept.	Flowers and floral anatomy
Fri.	11 Sept.	How do flowering plants reproduce?
Mon.	14 Sept.	How do flowering plants reproduce?
Wed.	16 Sept.	Pollination biology, the essence of mutualism
Fri.	18 Sept.	Why are plants important to us? (Or, what might life be like without them?)
Mon.	21 Sept.	Useful plants and plant products
Wed.	23 Sept.	Principles of plant ecology
Fri.	25 Sept.	<b>FIRST HOUR EXAM</b>
Mon.	28 Sept.	Plant ecology
Wed.	30 Sept.	Plant ecology
Fri.	2 Oct.	Biodiversity: How many species are present on earth, and how fast are they disappearing? Why should we worry about species extinction?
Mon.	5 Oct.	Molecular composition of plant cells
Wed.	7 Oct.	Molecular composition of cells. Enzymes and factors affecting their action
Fri.	9 Oct.	The structure of plant cells (MID TERM)
Sat.	10 Oct. - Tue.	13 Oct. <b>FALL RECESS</b>
Wed.	14 Oct.	The structure of plant cells
Fri.	16 Oct.	How do plant cells divide? Mitosis and the concept of totipotency. Totipotent cells can be used to clone useful plants
Mon.	19 Oct.	Meiosis and sexual reproduction
Wed.	21 Oct.	Cells, differentiation, and plant tissues
Fri.	23 Oct.	Stems and leaves
Mon.	26 Oct.	<b>SECOND HOUR EXAM</b>
Wed.	28 Oct.	Leaves and roots
Fri.	30 Oct.	Photosynthesis: "Harvesting the Sun"
Mon.	2 Nov.	The light reactions of photosynthesis
Wed.	4 Nov.	C <sub>3</sub> , C <sub>4</sub> , and CAM plants
Fri.	6 Nov.	Ecological adaptations of photosynthesis

Mon. 9 Nov. Alternation of generations: the fern life cycle (fern allies if time allows)  
Wed. 11 Nov. Moss life cycle as an example of bryophytes (liverworts if time permits)  
Fri. 13 Nov. Liverworts

Mon. 16 Nov. The pine, a gymnosperm  
Wed. 18 Nov. Growth and development: hormones and tropisms  
Fri. 20 Nov. Growth and development: How do plants see light? Phytochromes

Mon. 23 Nov. **THIRD HOUR EXAM**

Wed. 25 Nov. - Sun. 29 Nov. **THANKSGIVING VACATION**

Mon. 30 Nov. Growth and development: photoperiodism and flowering  
Wed. 2 Dec. How do plants defend themselves against herbivores?  
Fri. 4 Dec. Plant domestication, the development of agriculture, and the rise of  
civilization

Mon. 7 Dec. History's Haves and Have-Nots: Geographic differences in the onset of food  
production. Apples or Indians? Why did peoples of some regions fail to  
domesticate plants?

Wed. 9 Dec. Plant biotechnology (Last day of classes)

Fri. 11 Dec - Fri. 18 Dec. Final Exam Period

## 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 laboratory.

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>
3 Sept.	Start <i>Brassica rapa</i> seedlings & fern gametophyte cultures	
10 Sept.	The light microscope Plant cells	Topic 1-1 Topic 3-1
17 Sept.	<b>FIRST LAB QUIZ</b> Seeds, germination, and seedling development  The structure of flowers	Handout Topic 2-1 Topic 18-7 to 18-9
24 Sept.	Field Trip	
1 Oct.	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
8 Oct.	Field Trip	
Sat 10 Oct. - Tue. 13 Oct.	<b>SPRING RECESS</b>	
15 Oct.	<b>SECOND LAB QUIZ</b> Enzyme lab: extraction and assay of catalase from spinach leaves	Handout
22 Oct.	Mitosis: root meristems Meiosis	Topic 4-1 Topic 8-1

29 Oct.	Three major tissue systems of plants and the cells which comprise them Stems of dicots and monocots	Topic 2-3, 2-4 Topic 23-1
5 Nov.	Leaves: dicots, monocots, C <sub>3</sub> and C <sub>4</sub> , abscission Roots: root systems, primary growth, origin of secondary roots, dicot & monocot roots	Topic 24-1 Topic 22-1
12 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 16-1 Topic 14-5 to 14-7
19 Nov.	<i>Marchantia</i> , a liverwort Pine life cycle: an example of the gymnosperms	Topic 14-1 to 14-4 Topic 17-1 to 17-6
Wed. 25 Nov. - Sun. 29 Nov.	<b>EASTER RECESS</b>	
3 Dec.	<b>PRACTICAL EXAM</b>	

**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 between 16 and 21 September, so you should plan to read the book according to the following time line. In any event, be certain to complete the book prior to 25 September since it will be included on the first exam.

<u>Assignment</u>	<u>Completion Date</u>
Foreword Chapters 1 & 2	Wednesday    2 September
Chapters 3 & 4	Monday        7 September
Chapters 5,6 & 7	Friday         14 September
Chapters 8 & 9	Friday         21 September

**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.

Coe, Michael D. 1964. *The chinampas of Mexico*. Scientific American. 211 (1): 90-98. July

Diamond, Jared. 1977. Guns, Germs, and Steel. The Fate of Human Societies. W. W. Norton & Company. Read chapters 4-8 in Part Two (The Rise and Spread of Food Production).

Grube, Nikolai (Ed). 2001. MAYA. Divine Kings of the Rain Forest. Konemann Verlagsgesellschaft. Read *Maya Agriculture* (pp. 70-79) and *Tortillas and Tamales* (pp. 80-83).

Harris, Marvin. 1977. Cannibals and Kings. Random House. Read Chapter 3: *The Origins of Agriculture*. (p. 29).

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. Several chapters will be assigned. See the following list of reading assignments.

### SEMESTER READING ASSIGNMENTS

(For Raven et al. 2005. Seventh 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 the items marked with an asterisk (\*) additional reading assignments will be supplied in the form of handouts.

<u>Lecture Topics</u>	<u>Assignments<sup>1</sup></u>
Orientation	REC, Ch. 1, pp. 1-13
Seeds, germination, and the development of the plant body	REC, Ch 22, pp. 502-509
Flowers, floral anatomy, and reproduction in flowering plants	REC, Ch. 19, pp. 434-451 REC, Ch. 20, pp. 465-474 REC, Ch, 22, pp. 497-502
Pollination biology	REC, Ch. 20, pp. 452-464 Judson, O. Ch. 4. <i>Swords or Pistols</i> (pp. 60-65)
Why are plants important to us? (useful plants and plant products)	Handouts REC, Ch. 21, pp. 475-495
Plant ecology <sup>2</sup> Biomes and global ecology	REC, Ch. 31, Ecology (on the Web) REC, Ch. 32, Global ecology (Web)
Biodiversity and conservation	Leopold, last chapter of the book, <i>The Land Ethic</i> , pp. 237-279. Western and Pearl: (1) <i>Overview</i> , pp. (2) <i>Overview of Recent Extinctions</i> (Jared Diamond), pp. 37-41 (3) <i>A Major Extinction Spasm: Predictable and Inevitable?</i> (Norman Myers), pp. 42-49 (4) <i>Cultural Approach to Conser-</i>

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1 REC = Raven, Evert, and Curtis.

2 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/raven](http://www.whfreeman.com/raven). 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.

Molecular components of plant cells*	REC, Ch. 2, pp 15-28
Enzymes and factors which affect their action*	REC, Ch. 5, pp. 89-101
Structure of plant cells*	REC, Ch. 3, pp. 35-58 REC, Ch. 4, pp. 71-87
Mitosis*	REC, Ch. 3, pp. 58-70
Totipotency and its importance in plant biotechnology	REC, Ch. 10, pp. 188-194
Meiosis*	REC, Ch. 8, pp. 141-162 (especially pp. 141-150)
Cells, differentiation, and plant tissues	REC, Ch. 23, pp. 510-527
Stems and leaves*	REC, Ch 25, pp. 547-579
Secondary growth in stems	REC, Ch. 26, pp. 580-600
Roots*	REC, Ch. 24, pp. 528-546
Photosynthesis*	REC, Ch. 7, pp. 115-153. This is an <b>especially important</b> chapter, and it integral to the mission of the course.
Systematics and the major groups of living things	REC, Ch.12, pp.219-237
Alternation of generations*	REC, Ch. 17, pp. 376-377 (Fig. 17-8)
Lower vascular plants (ferns and fern allies)* Focus on the <b>fern life cycle</b> as a prototype note for this group.	REC, Ch. 17. pp. 368-407 (pp. 389-398 most important, <b>fern life cycle, pp. 396-397)</b>
Bryophytes* In this chapter concentrate on the life cycle of <b>mosses</b> (pp. 362-363) and the <b>liverwort</b> <i>Marchantia</i> (pp. 354-355)	REC, Ch. 16. pp. 345-367
Gymnosperms* Here the most important part of the chapter	REC, Ch. 18. pp. 408-433

is pp. 414-427. **Pines** will be our one example on the gymnosperms (see pp. 418-419).

Plant growth and development

Hormones\*

REC, Ch. 27. pp. 603-621

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

REC, Ch. 28. pp. 622-644

Plant domestication and development of agriculture

Coe, M: The Chinampas of Mexico

Harris, M. Ch. 3: *Origin of Agriculture*

Grube, N. pp. 70-79 on *Maya Agriculture* and pp. 80-83 on *Tortillas and Tamales*

Diamond, J. Chapters 4-8. Study questions for this assignment will be distributed in class.