

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. Plan on reading the last chapter, *The Land Ethic*, for our discussion on biodiversity.

COURSE OBJECTIVES:

Biology 119 is an introductory course in plant science designed to introduce you to plants as living organisms. One of the principal goals is to 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. Recent research has shown that certain plants produce potent anticancer drugs, and it is likely that drugs from tropical 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.

A second goal will be for us to 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 environmental changes. Some time will be devoted to how plants respond to stress, in particular to how they defend themselves against herbivores. We may discuss some of the exciting new advances in plant biotechnology to see how genetic manipulation of important plant species is accomplished.

Another goal will be to 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.

Finally, we will look at the historical and cultural significance of plants, particularly the pivotal role of plant domestication in the rise of civilization.

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. Exams and quizzes are arranged so that in a given week only one item is scheduled.

	<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 need to advise the instructor in advance and then go to Reeves Library to locate the video cassette or DVD. 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 received by the instructor on or before **Friday 30 April** at 4:00 pm. Video summaries are not accepted during final exam week.

You may select no more than two from the following titles (excluding any that we might have used in class or laboratory:

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.	18 Jan.	Orientation; "What is a seed?"	
Wed.	20 Jan.	Seed structure, germination, and seed ecology	
Fri.	22 Jan.	Seedling development and its control	
Mon.	25 Jan.	Flowers and floral anatomy	
Wed.	27 Jan.	How do flowering plants reproduce?	
Fri.	29 Jan.	How do flowering plants reproduce?	
Mon.	1 Feb.	Pollination biology, the essence of mutualism	
Wed.	3 Feb.	Why are plants important to us? (Or, what might life be like without them?)	
Fri.	5 Feb.	Useful plants and plant products	
Mon.	8 Feb.	Molecular composition of plant cells	
Wed.	10 Feb.	Molecular composition of plant cells	
Fri.	12 Feb.	FIRST HOUR EXAM	
Mon.	15 Feb.	Enzymes, catalysts of life. Factors which affect their action	
Wed.	17 Feb.	The structure of plant cells	
Fri.	19 Feb.	The structure of plant cells	
Mon.	22 Feb.	How do plant cells divide? Mitosis and the concept of totipotency. Totipotent cells can be used to clone useful plants.	
Wed.	24 Feb.	Meiosis and sexual reproduction	
Fri.	26 Feb.	Cells, differentiation, and plant tissues	(MID TERM)
Mon.	1 Mar.	Stems and leaves	
Wed.	3 Mar.	Leaves and roots	
Fri.	5 Mar.	Plant growth and development: hormones and tropisms	
Sat. 6 Mar. - Sun. 14 Mar.		SPRING RECESS	
Mon.	15 Mar.	Growth and development: How do plants see light? Phytochromes	
Wed.	17 Mar.	Growth and development: photoperiodism and flowering	
Fri.	19 Mar.	How do plants defend themselves against herbivores?	
Mon.	22 Mar.	SECOND HOUR EXAM	
Wed.	24 Mar.	Principles of plant ecology	

Fri.	26 Mar.	Plant ecology	
Mon.	29 Mar.	Plant ecology	
Wed.	31 Mar.	Plant ecology	
Fri.	2 Apr -	Mon. 5 Apr.	EASTER RECESS
Wed.	7 Apr.	Alternation of generations: the fern life cycle (fern allies if time allows)	
Fri.	9 Apr.	Moss life cycle as an example of bryophytes (liverworts if time permits)	
Mon.	12 Apr.	Liverworts	
Wed.	14 Apr.	The pine, a gymnosperm	
Fri.	16 Apr.	Photosynthesis: "Harvesting the Sun"	
Mon.	19 Apr.	The light reactions of photosynthesis	
Wed.	21 Apr.	C ₃ , C ₄ , and CAM plants	
Fri.	23 Apr.	THIRD HOUR EXAM	
Mon.	26 Apr.	Ecological adaptations of photosynthesis	
Wed.	28 Apr.	Biodiversity: How many species are present on earth, and how fast are they disappearing? Why should we worry about species extinction?	
Fri.	30 Apr	Plant domestication, the development of agriculture, and the rise of civilization	(Last day of classes)
Mon.	3 May -	Sat. 8 May	Final Exam Period
Tue.	4 May 1:30 pm	Final exam date for the course	

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.

Four 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>
21 Jan.	Start <i>Brassica rapa</i> seedlings & fern gametophyte cultures	
28 Jan.	The light microscope Plant cells	Topic 1-1 Topic 3-1
4 Feb.	FIRST LAB QUIZ Seeds, germination, and seedling development The structure of flowers	Handout Topic 2-1 Topic 18-7 to 18-9
11 Feb.	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
18 Feb.	Cloning plants with tissue culture	Handout
25 Feb.	Enzyme lab: extraction and assay of catalase from spinach leaves	Handout
4 Mar.	SECOND LAB QUIZ Examine tissue culture experiments (2 weeks) Is catalase found throughout the plant?	Handout

Is the activity of the enzyme affected by light?

Sat 6 Mar. - Sun. 14 Mar. **SPRING RECESS**

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|---------|---|----------------------------------|
| 18 Mar. | Examine tissue culture experiments (4 weeks)
Mitosis: root meristems
Meiosis | Topic 4-1
Topic 8-1 |
| 25 Mar. | Examine tissue culture experiments (5 weeks)
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 |
| 1 Apr. | Field trip (We'll leave mid morning and return to campus about 5:00 pm.) | |

Fri. 2 Apr. - Mon. 5 Apr. **EASTER RECESS**

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| 8 Apr. | THIRD LAB QUIZ
Examine tissue culture experiments (7 weeks)
Leaves: dicots, monocots, C ₃ and C ₄ , abscission
Roots: root systems, primary growth, origin of
secondary roots, dicot & monocot roots | Topic 24-1
Topic 22-1 |
| 15 Apr. | 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 |
| 22 Apr. | <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 |
| 29 Apr. | PRACTICAL EXAM | |

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 4 and 6 February, 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 13 February as it will be included on the first exam.

<u>Assignment</u>	<u>Completion Date</u>	
Foreword Chapters 1 & 2	Friday	22 January
Chapters 3 & 4	Monday	25 January
Chapters 5,6 & 7	Friday	29 January
Chapters 8 & 9	Friday	5 February

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>Assignments¹</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) Molecular components of plant cells*	Handouts REC, Ch. 21, pp. 475-495 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

¹ REC = Raven, Evert, and Curtis.

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
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 ecology ²	REC, Ch. 31, Ecology (on the Web)
Biomes and global ecology	REC, Ch. 32, Global ecology (Web)
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)*	REC, Ch. 17. pp. 368-407
Focus on the fern life cycle as a prototype note for this group.	(pp. 389-398 most important, fern life cycle, pp. 396-397)
Bryophytes*	REC, Ch. 16. pp. 345-367
In this chapter concentrate on the life cycle of mosses (pp. 362-363) and the liverwort <i>Marchantia</i> (pp. 354-355)	
Gymnosperms*	REC, Ch. 18. pp. 408-433
Here the most important part of the chapter is pp. 414-427. Pines will be our <u>one</u> example on the gymnosperms (see pp. 418-419).	

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. 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.

Photosynthesis*

REC, Ch. 7, pp. 115-153. This is an **especially important** chapter, and it integral to the mission of the course.

Biodiversity and conservation

Leopold, last chapter of the book,
The Land Ethic, pp. 237-279.
 Western and Pearl:
 (1) *Overview*, pp.
 (2) *Overview of Recent Extinctions*
 (Jared Diamond), pp. 37-41
 (3) *A Major Extinction Spasm:
 Predictable and Inevitable?*
 (Norman Myers), pp. 42-49
 (4) *Cultural Approach to Conser-
 vation Biology* (Brian Horton)
 pp. 241-246

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.