

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 \$6.00, 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. 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.

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.

A third 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 see how plants respond to changes in their environment. We will also discuss some of the exciting new advances in plant biotechnology to see how genetic manipulation of important species is accomplished.

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

study their reproduction. Based on differences in reproductive patterns we will discuss the major trends in plant evolution.

ATTENDANCE:

Plant 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%
Four (4) laboratory quizzes (50 points each)	200	22.2%
One (1) laboratory practical exam	150	16.7%
Final exam (comprehensive)	250	<u>27.8%</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 check out the video cassette. 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, 8 December**. Video summaries are not accepted during final exam week. You may select up to three from the following titles:

A Walk Through the ACEER Useful Plants Trail (in the Peruvian Amazon)
 AMATE: The Great Fig Tree
 Amazon, Land of the Flooded Forest
 Ecology of the Forest
 Faces of the Rain Forest
 Intimate Strangers: Symbiosis
 Manu: Peru's Hidden Rainforest
 Natural Connections
 Pollination
 Pollination: The Insect Connection
 The Queen of Trees
 Race to Save the Planet 5: Remnants of Eden
 Secret Life of Plants:¹
 Branching Out
 Putting Down Roots
 The Birds and the Bees
 Plant Politics
 Living Together
 It's A Jungle Out There
 Sexual Encounters of the Floral Kind
 Spirit of the Rainforest

¹ These films are from a PBS television series. Each is about 50 minutes in duration. All have dramatic time lapse photography showing plant activities (e.g. growth, flowering) at accelerated speeds.

LECTURE SCHEDULE

Mon.	28 Aug.	Orientation; “What is a seed?”
Wed.	30 Aug.	Seed structure, germination, and seed dormancy
Fri.	1 Sept.	Seedling development. Flowers and floral anatomy
Mon.	4 Sept.	No classes (Labor Day)
Wed.	6 Sept.	How do flowering plants reproduce?
Fri.	8 Sept.	How do flowering plants reproduce?
Mon.	11 Sept.	Pollination biology: the essence of mutualism
Wed.	13 Sept.	Principles of plant ecology
Fri.	15 Sept.	Plant ecology
Mon.	18 Sept.	Why are plants important to us? (Or, what might life be like without them?)
Wed.	20 Sept.	Useful plants and plant products
Fri.	22 Sept.	Plant domestication, the development of agriculture, and the rise of civilization
Mon.	25 Sept.	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.	27 Sept.	FIRST HOUR EXAM
Fri.	29 Sept.	Biodiversity: How many species are present on earth, and how fast are they disappearing? Why should we worry about species extinction?
Mon.	2 Oct.	Conservation biology. Which species are important?
Wed.	4 Oct.	Molecular composition of plant cells
Fri.	6 Oct.	Enzymes, catalysts of life. Factors which affect their action (Mid Term)
Sat. 7 Oct. - Tue. 10 Oct. FALL RECESS		
Wed.	11 Oct.	The structure of plant cells
Fri.	13 Oct.	Cell structure
Mon.	16 Oct.	How do plant cells divide? Mitosis and the concept of totipotency. Totipotent cells can be used to clone useful plants.
Wed.	18 Oct.	Meiosis and sexual reproduction
Fri.	20 Oct.	Cells, differentiation, and plant tissues
Mon.	23 Oct.	The structure of plants: stems and leaves
Wed.	25 Oct.	Leaves and roots
Fri.	27 Oct.	SECOND HOUR EXAM

- Mon. 30 Oct.. Plant growth and development: hormones and tropisms
 Wed. 1 Nov. Growth and development: How do plants perceive light? The discovery of phytochrome.
 Fri. 3 Nov. Growth and development: photoperiodism and flowering
- Mon. 6 Nov. Alternation of generations and the fern life cycle
 Wed. 8 Nov. Fern allies and lower vascular plants
 Fri. 10 Nov. Moss life cycle as an example of bryophytes (liverworts if time permits)
- Mon. 13 Nov. The pine - a gymnosperm
 Wed. 15 Nov. Photosynthesis: "Harvesting the Sun"
 Fri. 17 Nov. Photosynthesis
- Mon. 20 Nov. Photosynthesis
- Wed. 22 Nov. - Sun 26 Nov. **THANKSGIVING VACATION**
- Mon. 27 Nov. Respiration: How plants consume sugar
 Wed. 29 Nov. Plant biotechnology: recent advances
 Fri. 1 Dec. **THIRD HOUR EXAM**
- Mon. 4 Dec. Plant biotechnology
 Wed. 6 Dec. How plants respond to stress
 Fri. 8 Dec. How plants respond to stress
- Mon. 11 Dec. How plants respond to stress
- Wed. 13 Dec. - Tue. 19 Dec. **FINAL EXAMS**

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>
29 Aug.	Start fern gametophytes and Fast Plants (<i>Brassica rapa</i>)	
5 Sept.	The light microscope Plant cells	Topic 1-1 Topic 4-1
12 Sept.	Field trip	
19 Sept.	FIRST LAB QUIZ Seeds, germination, and seedling development The structure of flowers	Handout, Topic 3-1 Topic 18-3 to 18-10
26 Sept.	Cloning plants with tissue culture	Handout
3 Oct.	Enzyme lab: extraction and assay of catalase from bean leaves	Handout
Sat. 7 Oct. - Tue. 10 Oct.	FALL RECESS	
17 Oct.	Field trip	
24 Oct.	SECOND LAB QUIZ Examine tissue culture experiments (4 weeks) The nature of light Photosynthesis in excised <i>Phaseolus</i> leaf discs	Handout Topic 8-7 to 8-9
31 Oct.	Examine tissue culture experiments (5 weeks) Mitosis: root meristems Meiosis	Topic 5-1 Topic 9-1
7 Nov.	THIRD LAB QUIZ Three major tissue systems of plants and the cells which comprise them Stems of dicots and monocots	Topic 3-3, 3-4 Topic 23-1

14 Nov.	Leaves: dicots, monocots, C ₃ and C ₄ , abscission Roots: root systems, primary growth, origin of secondary roots, dicots & monocot roots	Topic 24-1 Topic 22-1
21 Nov.	FOURTH LAB QUIZ 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 15-5 to 15-7
Wed. 22 Nov. - Sun. 26 Nov.	THANKSGIVING RECESS	
28 Nov.	<i>Marchantia</i> , a liverwort Pine life cycle, a representative gymnosperm	Topic 15-1 to 15-4 Topic 17-1 to 17-6
5 Dec.	PRACTICAL EXAM	

LIBRARY REFERENCE MATERIALS ON RESERVE

The books listed below are on reserve in Reeves Library. You can locate them under the course number (Bio 119), or the instructor's name. Ask for them at the check out desk. When you read the assignments, prepare a short, one or two paragraph summary of each and **incorporate it into your lecture notes**. These reading assignments are as important as the readings in your texts, and they will be included on exams.

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

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 & 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.

35 mm SLIDE MODULES

Several modules of 35 mm slides and accompanying audio cassette tapes are available to supplement lecture topics. These are self instructional units and can be used in Reeves Library in rooms equipped with a viewing screens. The slides in each module advance automatically, and they are narrated with sound tracks on the cassette tapes. They are good for topic reviews.

Chemistry of carbohydrates and lipids
Proteins
Enzymes
Membranes

Plant tissue culture, basic concepts
Photosynthesis
Respiration
Plant life cycles: alternation of generations in plants

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 18 September and 22 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 as it will be included on the first exam.

<u>Assignment</u>	<u>Completion Date</u>	
Foreword Chapters 1 & 2	Monday	4 September
Chapters 3 & 4	Friday	8 September
Chapters 5,6 & 7	Monday	11 September
Chapters 8 & 9	Monday	18 September

TIME LINE FOR READINGS IN *GUNS, GERMS, AND STEEL*
(Diamond, 1999)

For class discussion on the rise of agriculture we will use five chapters in Jared Diamond's book *Guns, Germs, and Steel*. Plan to read Part 2: The Rise and Spread of Food Production (chapters 4–8). There are copies of the book on reserve for the course in the library, so you need not buy it. The subject matter from these chapters will be covered on the first exam.

<u>Assignment</u>	<u>Completion Date</u>	
Chapters 4, & 5	Friday	15 September
Chapter 6 & 7	Wednesday	20 September
Chapter 8	Friday	22 September

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>Assignments²</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
Plant ecology ³	REC, Ch. 31, Ecology
Biomes and global ecology	REC, Ch. 32, Global ecology
Why are plants important to us? (useful plants and plant products)	Handouts REC, Ch. 21, pp. 475-495
Plant domestication and development of agriculture	Coe, M: The Chinampas of Mexico Harris, M. Ch. 3: <i>Origin of Agriculture</i> Grube, N. pp. 70-79 on <i>Maya Agriculture</i> and pp. 80-83 on <i>Tortillas and Tamales</i> Diamond, J. Chapters 4-8. Study questions for this assignment will be distributed in class.

2 REC = Raven, Evert, and Curtis.

3 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), and they will take a few minutes to download.

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- vation Biology</i> (Brian Horton) pp. 241-246
Molecular components of plant cells*	REC, Ch. 2, pp 15-34 Slide module: <u>Chemistry of Carbo- hydrates and Lipids</u> Slide module: <u>Proteins</u>
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 Slide module: <u>Membranes</u>
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) Slide module: <u>Plant Cells and Tissues</u> (This slide module is particularly good.)
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
Systematics and major groups of living things	REC, Ch.12, pp.219-237
Alternation of generations*	REC, Ch. 17 pp. 376-377 (Fig. 17-8) Slide module: <u>Plant Life Cycles: <u>Alternation of Generations in Plants</u></u>
Lower vascular plants (ferns and fern allies)* Focus on the fern life cycle as the prototype for this group.	REC, Ch. 17. pp. 368-407 (pp. 389-398 most important, note fern life cycle on pp. 396-397)
Bryophytes* In this chapter concentrate on the life cycle of mosses (pp. 362-363) and the liverwort <i>Marchantia</i> (pp. 354-355)	REC, Ch. 16. pp. 345-367
Gymnosperms* Here the most important part of the chapter is pp. 414-427. Pines will be our one example on the gymnosperms (see pp. 418-419).	REC, Ch. 18. pp. 408-433
Photosynthesis*	REC, Ch. 7, pp. 115-153. This is an especially important chapter, and it integral to the course.
Respiratory metabolism In this chapter do not become bogged down with structural formulas for the respiratory intermediates. That is, do not set about memorizing all of them. Focus instead on the overall pathway and on functions inherent in the pathway. You will revisit respiration in more detail in later courses.	REC, Ch. 6, pp. 102-114
Plant biotechnology	REC, Ch. 10. pp. 180-197 Slide module: <u>Plant Tissue Culture</u>