Biology 119 Bevington
Introductory Botany Spring, 2008

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. 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

see how they reproduce themselves. 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. Examinations serve two roles: they are learning experiences and measurements of achievement.

	Point Value	Percentage of Final Grade
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	27.8%
	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 sign a sheet in the Library and 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 **Friday 25 April**. Video summaries are not accepted during final exam week.

You may select up to <u>two</u> 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
Race to Save the Planet 5: Remnants of Eden
Seeds of Tomorrow
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 This is from a PBS television series. Each video is about 50 minutes in duration. All have dramatic time lapse photography which accelerates plant movements making them easier to understand.

LECTURE SCHEDULE

Mon.	14 Jan.	Orientation; "What is a seed?"
Wed.	16 Jan.	Seed structure, germination, and seedling development
Fri.	18 Jan.	Flowers and floral anatomy
Mon.	21 Jan.	No class (MLK Day) How do flowering plants reproduce?
Wed.	23 Jan.	How do flowering plants reproduce?
Fri.	25 Jan.	Pollination biology, the essence of mutualism
Mon.	28 Jan.	Why are plants important to us? (Or, what might life be like without them?)
Wed.	30 Jan.	Useful plants and plant products
Fri.	1 Feb.	Plant domestication, the development of agriculture, and the rise of civilization
Mon.	4 Feb.	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.	6 Feb.	Molecular composition of plant cells
Fri.	8 Feb.	**FIRST HOUR EXAM**
Mon.	11 Feb.	Molecular composition of plant cells
Wed.	13 Feb.	Enzymes, catalysts of life. Factors which affect their action
Fri.	15 Feb.	The structure of plant cells
Mon.	18 Feb.	The structure of plant cells
Wed.	20 Feb.	How do plant cells divide? Mitosis and the concept of totipotency. Totipotent cells can be used to clone useful plants.
Fri.	22 Feb.	Meiosis and sexual reproduction (MID TERM)
Mon.	25 Feb.	Cells, differentiation, and plant tissues
Wed.	27 Feb.	Stems and leaves
Fri.	29 Feb.	Leaves and roots

Sat. 1 Mar. - Sun. 9 Mar. **SPRING RECESS**

Mon.	10 Mar.	Photosynthesis: "Harvesting the Sun"
Wed.	12 Mar.	Photosynthesis
Fri.	14 Mar.	Respiration: How plants consume sugar
Mon.	17 Mar.	Plant growth and development: hormones and tropisms
Wed.	19 Mar.	**SECOND HOUR EXAM**

Fri.	21 Apr - Mon. 24 Apr.	**EASTER RECESS**
Wed.	26 Mar.	Growth and development: How do plants see light? Phytochrome
Fri.	28 Mar.	Growth and development: photoperiodism and flowering
Mon.	2 Apr.	How do plants respond to stress?
Wed.	4 Apr.	Alternation of generations: the fern life cycle (fern allies if time allows)
Fri.	3 Apr.	Moss life cycle as an example of bryophytes (liverworts if time permits)
Mon.	7 Apr.	The pine, a gymnosperm
Wed.	9 Apr.	Plant biotechnology: recent advances
Fri.	11 Apr.	Plant biotechnology
Mon.	14 Apr.	Principles of plant ecology
Wed.	16 Apr.	Plant ecology
Fri.	18 Apr.	**THIRD HOUR EXAM**
Mon.	21 Apr.	Plant ecology
Wed.	23 Apr.	Biodiversity: How many species are present on earth, and how fast are they disappearing? Why should we worry about species extinction?
Fri.	25 Apr.	Conservation biology. Which species are important?
Mon.	28 Apr. - Sat. 3 May	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.

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.

Date	Subject Material	Assignments
17 Jan.	Start *Brassica rapa* seedlings & fern gametophyte cultures	
24 Jan.	The light microscope	Topic 1-1
	Plant cells	Topic 3-1
31 Jan.	**FIRST LAB QUIZ**	
	Seeds, germination, and seedling development	Handout Topic 2-1
	The structure of flowers	Topic 18-7 to 18-9
7 Feb.	Cloning plants with tissue culture	Handout
14 Feb.	Enzyme lab: extraction and assay of catalase from bean leaves	Handout
21 Feb.	**SECOND LAB QUIZ**	
	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
28 Feb.	Examine tissue culture experiments (3 weeks)	
	The nature of light	Handout
	Photosynthesis in excised leaf discs of *Phaseolus*	Topic 7-7 to 7-10
Sat 1 Mar. - Sun. 9 Mar.	**SPRING RECESS**	
13 Mar.	Field Trip: Longwood Gardens	

20 Mar.	Mitosis: root meristems	Topic 4-1
	Meiosis	Topic 8-1
Fri. 21 Apr. - Mon. 24 Apr.	**EASTER RECESS**	
27 Mar.	Examine tissue culture experiments (6 weeks)	
	Three major tissue systems of plants and the cells which comprise them	Topic 2-3, 2-4
	Stems of dicots and monocots	Topic 23-1
3 Apr.	**THIRD LAB QUIZ**	
	Leaves: dicots, monocots, C_3 and C_4, abscission	Topic 24-1
	Roots: root systems, primary growth, origin of secondary roots, dicot & monocot roots	Topic 22-1
10 Apr.	**FOURTH LAB QUIZ**	
	The fern life cycle: an example of alternation of generations with dominant sporophytes	Topic 16-1
	Mosses have dominant gametophyte generations	Topic 14-5 to 14-7
17 Apr.	*Marchantia*, a liverwort	Topic 14-1 to 14-4
	Pine life cycle: an example of the gymnosperms	Topic 17-1 to 17-6
24 Apr.	**PRACTICAL EXAM**	

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 issue

Diamond, Jared. 1997. Guns, Germs, and Steel. The Fates 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 Verlags-gesellschaft. Read *Maya Agriculture* (pp. 70-79) and *Tortillas and Tamales* (pp. 80-83)

Harris, Marvin. 1977. Cannibals and Kings. Random House. 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.

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 special rooms equipped with a viewing screen. The slides in the modules advance automatically, and they are narrated with sound tracks on the cassette tapes.

Chemistry of carbohydrates and lipids
Proteins
Enzymes
Membranes
Plant tissue culture, the 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 30 January and 3 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.

Assignment	Completion Date
Foreword Chapters 1 & 2	Friday 18 January
Chapters 3 & 4	Monday 21 January
Chapters 5,6 & 7	Wednesday 30 January
Chapters 8 & 9	Friday 8 February

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.

Lecture Topics	Assignments[2]
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

2 REC = Raven, Evert, and Curtis.

Pollination biology	REC, Ch. 20, pp. 452-464
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: *Origin of Agriculture* Grube, N. pp. 70-79 on *Maya Agriculture* and pp. 80-83 on *Tortillas and Tamales* Diamond, J. Chapters 4-8. A time line for these readings is on the previous page. Study questions for this assignment will be distributed in class.
Molecular components of plant cells*	REC, Ch. 2, pp 15-28 Slide module: Chemistry of Carbohydrates and Lipids Slide module: Proteins
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: Membranes
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: Plant Cell and Tissues (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
Photosynthesis*	REC, Ch. 7, pp. 115-153. This is an **especially important** chapter, and it integral to the mission of 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 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 the 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: Plant Life Cycles: Alternation of Generations in Plants
Lower vascular plants (ferns and fern allies)* Focus on the **fern life cycle** as a prototype note for this group.	REC, Ch. 17. pp. 368-407 (pp. 389-398 most important, **fern life cycle, pp. 396-397**)
Bryophytes* In this chapter concentrate on the life cycle of **mosses** (pp. 362-363) and the **liverwort** *Marchantia* (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

Plant biotechnology	REC, Ch. 10. pp. 180-197 Slide module: Plant Tissue Culture
Plant ecology[3]	REC, Ch. 31, Ecology (on the Web)
Biomes and global ecology	REC, Ch. 32, Global ecology (Web)
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 Conservation Biology* (Brian Horton) pp. 241-246

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.