

ENVIRONMENTAL PHYSIOLOGY & ECOLOGY

Syllabus
Spring Semester, 2008

BIO 3610

Dr. John E. Silvius
ENS 272 Ph. 7948

COURSE DESCRIPTION:

A study of physiological mechanisms and adaptations by which plants and animals regulate life processes in response to light, temperature, moisture, and chemicals in their environment. The spring phase considers how organism-environment relationships account for distribution and activity of species within the wider context of biotic communities and bioregions of eastern North America.

GENERAL AIMS:

1. Studying physiological concepts with emphasis on winter environmental challenges to organisms
2. Integrative approach that reaches outside the boundaries of taxonomy, physiology, morphology, ecology
3. Exploring how environmental physiology accounts for distribution in communities and bioregions.
4. Promote intellectual stimulation, mutual edification, and fellowship in multiple learning settings
5. Assist you in defining vocational goals and acquiring knowledge necessary to achieve these goals

LEARNING OBJECTIVES:

KNOWLEDGE ("Your Head"):

1. Define the concepts of *organism* and *environment*, and discuss the interrelationships between them with regard the processes of energy and gas exchange, water relationships, nutrition, and reproduction.
2. Discuss morphological, physiological, and behavioral adaptations that enable plants and animals to acquire energy, water, and nutrition in the midst of seasonally or diurnally varying environments.
3. Explain how environmental physiology supports our understanding of distribution and activity of species within the wider context of biotic communities and bioregions of North America.

SKILLS ("Your Head and Hands") Observing, Manipulating, Analyzing, Cooperating, etc.):

4. Collaborate with peers to learn the skills of observation, analytical reasoning, experimentation; and, data collection, evaluation and oral or written reporting.
5. Show proficiency in using laboratory techniques for physiological studies, and in providing proper care of plants and animals in the laboratory. Shows proficiency in field observation, techniques, and analysis.

ATTITUDES / VALUES ("Your Head, Hands, and Heart" -- Responsibility, Reverence, Humility, etc.)

6. Participate as a member of a "community of learners", who acknowledge Christ as Creator (Col. 1:16), Intelligent Designer (Gen. 1: 31; Rom. 1:20; Job 12:7-10), Lord of creation (Col. 1: 16-17; 2:3), and of their lives (Romans 12: 1), and who manifest His lordship through their faithful attendance and participation, completion of assignments, care of plants and animals, and cooperation in the laboratory.
7. Recognize the responsibility that comes with the God-given privilege of scientific discovery (Gen. 1: 26-28; Ps. 19: 1-6; Prov. 25:2), and evaluate carefully the agricultural and medical technology that is resulting from environmental physiology--e.g. human health and aging, cryopreservation, weather modification, and biotechnology.

II. IMPLEMENTATION:

SCHEDULE: Lectures: MWF 11–11:50 pm ENS 282

Laboratory: Tue 2:00 – 4:50 pm ENS 106

Some content will be addressed during the "Winter Weekend in the North Woods" in place of certain otherwise-scheduled lectures and labs in the subsequent weeks. The "Schedule" (p. 3) must remain tentative due to unpredictable weather and other unforeseen circumstances.

TEXTS: P.J. Marchand. 1996. *Life in the Cold*, 3rd ed. Univ. Press of New England, Hanover, NH.

Smith, R.L., T.M. Smith. 2001. *Ecology & Field Biology*, 6th ed. Benj. Cummings. San Fran.

Barnes, B.V. & W.H. Wagner, Jr. 1981/2004. *Michigan Trees*. U. of Michigan Press, Ann Arbor, MI.

INDIVIDUAL STEWARDSHIP:

1. **Commitment** to God, to professor, and to the "community of learners" will be emphasized.

CHALLENGE: See Phil. 2:3-4 and Col. 3:23-24. A FRUIT of this commitment is a willingness to share in valuing the course objectives and accepting a personal responsibility to achieve them.

2. **Responsibility** as an active participant in four settings:

- a. **Out-of-Class** reading and study will be assigned as an essential preparation for and reinforcement of the other learning settings.

CHALLENGE: Personally commit yourself to regular completion of reading/study assignments. Begin each time in prayer for an alert, inquiring mind. Make "Study Notes" and keep them topically synchronized with lecture/lab content and Study Outlines.

- b. **Laboratory** will aid your comprehension of lecture material, enhance hands-on and scientific reasoning skills, and foster personal interaction. See page 4 for details on laboratory.

- c. **Lecture-Discussions** will facilitate your learning by the following activities:

- > INTEGRATING out-of-class and laboratory learning experiences
- > REINFORCING learning by oral discussion, interaction, and clarification
- > MOTIVATING and INSPIRING your best effort toward this part of your education

CHALLENGE: Come to lecture faithfully, on time, having read assignments in preparation to contribute and receive. Make good lecture notes; add to them ("fill gaps") as soon as possible after class.

- d. **Office Hours** are provided for your additional assistance as scheduled on my door, ENS 272.

CHALLENGE: Please come by if I can help academically, or personally.

GRADE CALCULATION:

Weighting:

Exam I ----- 150

Exam II ----- 150

Exam III ----- 150

Exam IV ----- 150

Laboratory* ----- 200 —>

Attendance/Quizzes ----- 100

Personal Inquiry Project (PIP) ---- 100

Total -----1000

Letter Grades:

A 900 - 100 [Plus (+) and (-) grades are awarded.

B 800 - 899 for the upper or lower 20 points of each

C 700 - 799 grade interval respectively.]

*Laboratory Points Originate from the Following:

Lab Attendance, Active Contribution ---- 50

Lab Reports (choices total 150 pts.) ----- 150

BIO 3610 Environmental Physiology & Ecology – Tentative Schedule ¹ – Spring, 2008

PART I: FOUNDATIONAL CONCEPTS			
DATE	TOPIC	#	READING-STUDY ASSIGN.
Jan. 8 Tu Lab	Introduction	01	50-minute Meeting, ENS 282
Jan. 9 W	What Is Environmental Physiology?	02	Assigned Articles; Definitions of Experts
Jan 11 F	Environmental Factors	03	Marchand <i>Preface</i> ; Smith, Chapter 2
Jan 14 M	Organism & Environment: Experiment Design		Lab Procedure for Lab #1
Jan. 15 Lab 1	Organism & Environment: Energy Exchange		Lab Proced; Small Mammal Design [50-pt. Rep]
Jan. 16 W	Temperature Relationships	04	Marchand, Ch 4, p 93-98; Smith, Ch.3, p 48-50
Jan. 18 F	Temperature Relationships (continued)		Readings for #04 (continued)
Jan. 21 M	Animal Metabolism and Measurement	06	Assigned Reading, “Animal Energetics” (Eckert)
Jan 22 Lab 2	Small Mammal Respiration		Lab Procedure [50-point Report; Lab 1 Rep. Due]
J 23,25 W,F	Physical Thermoregulation in Animals	07	Marchand, Chapter 4, pp 98–106
Jan 28 M	Physiological Thermoregulation in Animals	08	Marchand, Ch. 4, p 106–117; Smith Ch 8, p.102
Jan 29 Lab 3	“North Woods Trip” Orientation		Trip Itinerary; Supplies; [Lab 2 Rep. Draft Due]
Jan 30 W	Snow Properties & Subnivian Environment	09	Marchand, Chapter 2
Feb. 1 F	Exam I	10	[Lab 2 Report Due]
Feb. 4 M	Return and Discuss Exam I; Trip Preparation		Trip Resource Packet and Thu. Assignment
Feb 5 Lab 4	No Scheduled Laboratory		Open Time for Other Tasks
PART II: WINTER in the “NORTH WOODS” and Cell Physiology of Cold Temperature			
Feb 6 W	No Lecture (Prepare for Feb. 7 Discussion)		Open Time; Plan for Departure on Feb. 7
Feb 7 Lab 5	Departure: Animal/Plant Adapt. to Winter	11	Marchand, Chapter 1, pages 2-10
Feb 8 F	Winter Physiology-Ecology in North Woods	12	Resource Packet
Feb 9 Sat	Field Studies and Fireside Discussions	13 14	Marchand, p 104-25; Ch. 5, 7; Smith 127-137
Feb 10 Sun	Return to Cedarville		
Feb 11 M	No Lecture – Reading for Feb. 12 Lab →		Read Procedure Provided for Lab #6
Feb 12 Lab 6	Ice-Nucleating Protein and Supercooling		Lab Proced, [50 pt Rep.]; Begin Trip Debriefing
Feb 13 W	Debriefing from Trip (Continued from Lab 6)	15	Bring Field Data and Discussion Notes
Feb 15 F	Cell Physiology of Cold Temperature Survival	16	Marchand, Ch. 3, pages 41-56
F 18,20 M,W	Cold-Blooded Animal Acclimation to Cold	17	Marchand, Ch. 4, pages 125-141: “Frozen Frog”
Feb 19 Lab 7	Thermogenesis in a Spring Wildflower		Lab Procedure – Field Study
Feb 22 F	Concluding Discussion - and Introduce PIP’s		Articles Provided; choices due 2-27; Report Due
Feb 25 M	Review Session		
Feb 26 Lab 8	Exam II (1 st Hr.); Begin Experimental Design and Assembly of IRGA System for Lab 9:		
PART III: Environmental Physiology of Plants; Personal Inquiry Projects (PIP)			
Feb 27 W	Leaf Anatomy & Physiology; Discuss Exam II		PIP Article Choices Due
Feb 29 F	Measuring Photosynthesis and Transpiration		Reading Provided; Completion of IRGA Setup
Mar 3 - 7	<i>Spring Break</i>		No Classes
Mar 10 M	Measuring Photosynthesis and Transpiration	19	Plans for Data Gathering; Computations
Mar 11 Lab 9	Photosynthesis and Transpiration by IRGA		Laboratory Procedure [50-point Report]
Mar 12,14	Theory and Computations of NAR and E	20	Laboratory Data; Smith, Ch. 7, p 99-102
Mar 17 M	Leaf Morphology and Gas/Energy Exchange	21	From Laboratory Procedure
Mr 18 Lb 10	Consultation on PIP Articles		Discuss Your PIP Outline and Presentation
Mar 19 W	Environmental Challenges to Plants	22	Marchand., Ch 3, p 56–67; Smith Ch 7, 102-104
Mar 21-24	<i>Easter Break</i>		
Mar 25 Lab	Final Consultation on PIP Articles		Discuss Your PIP Outline and Presentation

Mar 26 W	Oral Present. of PIP – #1		Student Presentations in Lab and Lecture Periods – #1
Mar 28 F	Oral Present. of PIP – #2		Student Presentations in Lab and Lecture Periods – #2
Mar 31 M	Oral Present. of PIP – #3		Photosynthesis & Transpiration Report Due#3
Apr 1 Lab 11	Oral Present. of PIP's – #4-5 Exam III Review		
Apr 2 W	Exam III		
PART IV: ECOLOGICAL RELATIONSHIPS			
April 4 F	Environmental Physiology: Defining “Niche”	24	Reading(s) on knowing “niche” of captive animal
Apr 7, 9 M,W	Global Climate and Ecoregions	25	Smith and Smith, Ch. 27; and Websites Suggested
Apr 8 Lab 11	Biogeography, Spatial Data, and GIS		Lab Procedure, Software Provided [25-point Rep]
April 11 F	Biogeography and Applications to Research	26	Smith and Smith, Ch. 27; and Websites Suggested
April 14 M	Biogeography and Human Ecology	27	Video “Hot Zones” and Resources Provided
Apr 15 Lab 12	Forest Community I. Structure and Succession		Lab Procedure Provided - Field Study
April 16 W	Forest Community Structure		Smith, Ch 20, p 384-87; Ch 23 (parts)
April 18 F	Ohio Geology & Ecology		Smith, Ch. 21, p. 417-423; Trip Resources Provided
Apr 21,23 M,W	No Lecture		Open Time for Other Tasks
Apr 22 Lab 13	Hocking Hills Trip 2008 (Day-Trip)		Details Provided
April 25 F	Trip Debriefing – Forest Ecology	28	Trip Notes; Smith, Ch 13, p 234-35; Ch 21, p 403-411
April 28 M	Concluding Topics and Review		
April 30 W	Exam IV		

¹ Subject to change due to unforeseen factors; see Home Page-linked “Schedule” when changes are necessary.

III. SPECIFIC DETAILS:

LABORATORY

The purpose of the laboratory is to aid your comprehension of lecture material, enhance hands-on and scientific reasoning skills, and foster personal interaction through the following experiences:

1. Studies of plant and animal physiology under laboratory conditions using contemporary methods.
2. Field studies of plants, animals, and the habitats or biotic communities to which they are adapted.

EVALUATION of laboratory performance is based upon the expectations outlined in "Learning Objectives" #4 and #5 on page 1. In keeping with these objectives, Laboratory Reports (your choice totaling 150 points) will be assigned, with due date on or after the following Monday after the lab in question. Because it has been demonstrated that student revisions of graded reports improve writing skills, you may be permitted to rewrite a graded report with the offer of an increase in your score pending improvements. However, your original report must have evidenced (a) completeness in your display and analysis of the data, (b) accurate and coherent discussion of the results, and (c) a dedicated attempt to relate the results to current understanding of theory.

STEWARDSHIP – PARTICIPATION AND QUIZZES

Stewardship is a *qualitative* dimension of your participation as a member of the class (a "community of learners") as determined by an attitude that is demonstrated in both out-of-class preparation and in-class presence and participation. See the CHALLENGES on page 2. This stewardship will require a regular, Spirit-motivated, internal commitment to learning. However, an external motivation in the form of “oral reporting assignments” and quizzes (group and individual) will be given for *quantitative* evaluation and feedback.

PERSONAL INQUIRY PROJECT (PIP)

Recognizing that individual interests and learning styles vary, and recognizing the need we each have to be familiar with some of the "primary literature," you will be given opportunity to select one journal article which reports original research methods and presents results and discussion of data. Upon approval of an article, you will be asked to become thoroughly familiar with the methods, data, and conclusions; and locate two other related primary sources, which I will approve. Then, on an appointed day, lead a 30-40-minute discussion of your main article with reference to the related articles. Fellow students will receive copies of your main article and be prepared to ask questions or share insights as well. As you read assigned material early in the course, be thinking of a topic which you would like to study in more detail in the spirit of this "PIP" assignment. The Marchand text has many interesting questions and reference citations.

SPECIAL PROVISIONS:

TECHNOLOGY: Use of calculators may be permitted during exams for computations, but must not contain related information which should instead be provided from memory. Wireless or remote electronic access technology may be used during class sessions (not during exams) as long as the usage enhances your interaction with the subject of the class meeting and does not distract the attention of others. Violation of this policy will constitute reason for denial of the privilege of using the technology in class in the future. Switch your cell phone to off or vibrate mode.

ACADEMIC ASSISTANCE: It is my goal to assist you in every way possible to achieve your academic goals. If you have special needs for which I should make an allowance, please let me know. You should also inform the [Academic Enrichment Center](#) directed by Mrs. Kim Algrim (Ext. 3845) to partner with us. If you believe you may need support in managing the impact of a disability, please contact Marilyn Meyer, Coordinator of Disability Services, by phone at 3843 or email at meyerm@cedarville.edu. Office, CAL 164. Examples of disability categories are AD/HD, Vision, Health Impairment, Psychological, Orthopedic. We rely on Disability Services to verify the need for accommodation and to assist in developing appropriate accommodation strategies. See www.cedarville.edu/DisabilityServices. If you have further questions or if I can assist you in any other way, please let me know.

ACADEMIC DISHONESTY POLICY is enforced in accordance with the spirit and procedures outlined in Appendix A of the [Student Handbook](#).

IV. SELECTED BIBLIOGRAPHY

Animal Energetics and Temperature Relations, in: Eckert, R., *et al.* 1988. *Animal Physiology: Mechanisms and Adaptations*. W.H. Freeman and Co. New York, NY.

Chabot, B.F. and H. A. Mooney. eds. 1985. *Physiological ecology of North American plant communities* New York : Chapman and Hall.

Halfpenny, J.C. and R.D. Ozanne. 1989. *Winter : an ecological handbook*. Johnson Books, Boulder, CO.

Heinrich, Bernd. 2003. *Winter World: The Ingenuity of Animal Survival*. Harper-Collins, Ecco, New York.

Lee, R.E. Jr. 1989. Insect Cold-hardiness: To Freeze or Not to Freeze. *Bioscience* 39(5): 308-313.

Louw, G.N. and M.K. Seely. 1982. *Ecology of Desert Organisms*. Longman. New York, NY.

Molles, M.C. Jr. 2002. *Ecology: Concepts and Applications*, 2nd ed. McGraw-Hill, Boston, MA

Willmer, Pat, *et al.* 2000. *Environmental Physiology of Animals*. Blackwell Science, Oxford.