BOT 480/580
PHOTOSYNTHESIS AND PHOTOBIOLOGY
CREDITS: 3
TERM: Spring
INSTRUCTOR: Michael Behrenfeld
CONTACT INFORMATION: email behrenfm@science.oregonstate.edu

Lecture: .T.Th., 14:00 - 15:20

REQUIRED TEXT:
No textbook required. Reading will be based on primary literature

COURSE DESCRIPTION: The course will explore the diverse use of light in biological systems, with particular emphasis on photosynthesis. Lectures will discuss the nature of light, light in the natural environment, light absorption in biological systems, use of light energy for photosynthesis, communication, defense, motility, and vision, as well as deleterious effects of light and its use for global monitoring satellite systems.

COURSE PREREQUISITES: One course in plant biology or physiology or the equivalent or by permission of instructor

COURSE CONTENT:

Lecture Topics

- Lecture 1: Introduction – Light and Life
- Lecture 2: Nature of Light
- Lecture 3: Light in the Natural Environment (1)
- Lecture 4: Light in the Natural Environment (2)
- Lecture 5: Pigments and Light Absorption
- Lecture 6: Energy Transfer
- Lecture 7: Vision
- Lecture 8: Photosynthesis – The Reaction Centers
- Lecture 9: Photosynthesis – The Electron Transport Reactions
- Lecture 10: Photosynthesis – Chloroplasts
- Lecture 11: Photosynthesis – Carbon Fixation and Metabolism
- Lecture 12: Photosynthesis – Alternative Pathways and ATP-Reductant Balances
- Lecture 13: Photosynthesis – Challenges in Aquatic & Terrestrial Systems
- Lecture 14: Evolutionary Milestones in Photobiological Systems
- Lecture 15: Responses to a Variable Light Environment
- Lecture 16: Photoinhibition, Photodamage, & Phototoxicity
- Lecture 17: Phototaxis & Photomorphogenesis
- Lecture 18: Biological Clocks & Photoperiodism
- Lecture 19: Bioluminescence & Phosphorescence
- Lecture 20: Prokaryotes and Biospheric Productivity
- Lecture 21: Remote Sensing Applications

LEARNING RESOURCES:

BOT580 has no textbook requirement. Reading will be based on primary literature and selected material from:

> *Photobiology: The science of life and light*. L.O. Bjorn [ed.] Springer Publishing, © 2008.
>
> *Photobiology of higher plants*. M. S. McDonald, Wiley Publishing, © 2003.
>
> *Biochemistry and molecular biology of plants.* B.B. Buchanan, W. Gruissem, R.L. Jones [eds.] American Society of Plant Physiologists, Rockville, MD. © 2000.
>
> *Chlorophyll a fluorescence: A signature of photosynthesis*. G.C. Papageorgiou, Govnidjee [eds.] Advances in Photosynthesis and Respiration, Vol. 19. Springer Publishing, © 2004
>
> *Light and photosynthesis in aquatic ecoystems*. J.T.O. Kirk. Cambridge Univ. Press © 1994

Additional materials will be made available through Blackboard.

STUDENT LEARNING OUTCOMES:

(1) Undergraduate students will learn to identify and interpret light uses in biological systems. Graduate students will also learn to quantify light absorption and primary production and apply these skills to natural photosynthetic systems
(2) Undergraduate students will learn to trace linear- and alternative photosynthetic pathways from initial steps of light absorption and energy transfer, through electron transport, ATP formation, and carbon fixation, and finally through cell metabolism. Graduate students will also learn to quantify the partitioning of absorbed light energy to different pathways and calculate pathway quantum yields
(3) All students will learn to appreciate and understand measures of photobiological process in natural systems and methodologies used for these measures
(4) All students will learn to identify and discuss light damage and protection in biological systems
(5) All students will learn to explain and distinguish light regulation in biological clock and metabolic processes
(6) All students will learn to appreciate and contrast biological uses of light for vision, communication, reproduction and defense
(7) Undergraduate students will learn to describe light energy and solar flux in ecosystems. Graduate students will learn to quantify light energy and solar fluxes and interconvert units of light energy used under experimental conditions.

COMMUNICATION

Lectures will be conducted with an open format so that students will be able it interact and have discussions on the material being covered. Additionally peer-reviewed articles and sections of chapters may be distributed via black board.

LECTURES AND READING ASSIGNMENTS

Lectures will be performed using power point presentations and students will have access to lecture material via black board. Reading assignments will be listed on the syllabus and it will be expected that any assignments are completed prior to lecture.

EVALUATION OF STUDENT PERFORMANCE:

The Course grade for **BOT 480** will be based on bi-weekly quizzes worth ten points each. At the end of each lecture, a quiz will be given on material covered during the previous lecture and assigned as reading material. Each student will be allowed to omit his/her two lowest scores (including missed quizzes) at the end of the term. The Course grade will thus be assessed from results of 19 quizzes.

Extra Credit: Students that attend more than 19 lectures and complete more than 19 quizzes will be allowed to add their additional 1 or 2 quiz scores to their total accumulated points from the 19 scores used to evaluate grade. For example, if student achieves 162 points out of a possible 190 points in their top 19 quiz scores (i.e., 85%), but also completes two other quizzes with scores of 4 and 6 points, then their grade would be (162 + 4 + 6) / 190 = 91%.

The Course grade for **BOT 580** will be based on bi-weekly quizzes (80% of grade) and a written topical report based on independent reading of the scientific literature (20%). Quizzes will be given at the end of each lecture on material covered during the previous lecture and assigned as reading material. Each student will be allowed to omit his/her two lowest scores (including missed quizzes) at the end of the term. The overall grade for quizzes will thus be assessed from results of 19 quizzes. The written topical report will be based on independent reading after proposed research topics have been approved by the instructor (end of week 2). Report will be due one week before the end of the class.

Extra Credit: Students that attend more than 19 lectures and complete more than 19 quizzes will be allowed to add their additional 1 or 2 quiz scores to their total accumulated points from the 19 scores used to calculate their overall grade for quizzes. For example, if student achieves 162 points out of a possible 190 points in their top 19 quiz scores (i.e., 85%), but also completes two other quizzes with scores of 4 and 6 points, then their overall quiz score would be (162 + 4 + 6) / 190 = 91%.

FINAL GRADES

Final grades will be based on the cumulative weighted percentages at the end of the term and assigned as follows: A, 94-100%; A-, 90-93%; B+, 87-89%; B, 84-86%; B-, 80-83%; C+, 77-79%; C, 74-76%, C-, 70-73%; D+, 67-69%; D, 64-66%; D-, 60-63%; F, <60%.

STATEMENT REGARDING STUDENTS WITH DISABILITIES:

Accommodations are collaborative efforts between students, faculty and Services for Students with Disabilities (SSD). Students with accommodations approved through SSD are responsible for contacting Dr. Behrenfeld prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through SSD should contact SSD immediately at 737-4098.

EXPECTATIONS FOR STUDENT CONDUCT

Student conduct is governed by the university's policies, as explained in the Office of Student Conduct: information and regulations.

ACADEMIC DISHONESTY POLICY

Students are expected to conduct themselves in a professional manner. Academic dishonesty such as plagiarism and cheating will not be tolerated. Therefore, students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:

* cheating- use or attempted use of unauthorized materials, information or study aids,
* fabrication- falsification or invention of any information,
* assisting- helping another commit an act of academic dishonesty,
* tampering- altering or interfering with evaluation instruments and documents, or
* plagiarism- representing the words or ideas of another person as one's own.

For more information about academic integrity and the University's policies and procedures in this area, please refer to the Student Conduct web site at: http://www.orst.edu/admin/stucon/achon.htm and the section on Academic Regulations in the OSU Schedule of Classes.

OSU STUDENT EVALUATION OF TEACHING

Course evaluation results are extremely important and are used to help me improve this course and the learning experience of future students. Results from the university generated questions are tabulated anonymously and go directly to instructors and department heads. Student comments on the open-ended questions are compiled and confidentially forwarded to each instructor, per OSU procedures. The results on the form are anonymous and are not tabulated until after grades are posted.