

**MS 131/231: MARINE BOTANY/BIOLOGY OF SEAWEEDS
FALL 2007**

LECTURE: M 0900-1700, Biological Classroom

WEBSITE: <http://phycology.mlml.calstate.edu/biolseaweeds.html>

INSTRUCTOR:

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In Class: M, R

TEACHING ASSISTANT:

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WHAT THIS COURSE IS ABOUT

The course focuses on the biological study of photosynthetic organisms that live in the sea. These include (1) planktonic and benthic prokaryotic and eukaryotic microalgae, (2) benthic macroalgae (seaweeds), and (3) terrestrial plants that have reinvaded the sea. As marine microalgae are extensively treated in MS 135 and the biology of terrestrial plants requires an entire series of courses, this *graduate phycology course* focuses almost entirely on seaweeds. During the semester we will touch on 3 themes that can be summed up by the following questions: *1) What evolutionary processes have led to the diversification of the 3 major seaweed groups (red, green, and brown macroalgae)? 2) What life history, physiological, and ecological characters are shared and/or unique among these groups? 3) How are seaweeds distributed in time and space along the California coast?* In studying California seaweeds through this course, you will learn how to: (1) identify California seaweed taxa; (2) understand the key processes leading to seaweed taxonomic diversity; (3) explain general seaweed biogeographic and diversity patterns; (4) diagram seaweed life histories; (5) study seaweed biology using microscopic techniques; (6) prepare seaweed herbarium specimens; and (7) culture seaweeds. Although this is a graduate course, advanced undergraduates may enroll with the instructor's consent.

TEXTBOOK:

I have yet to find a single phycological textbook that encompasses all subject matter to be studied in this course. As such, the only required texts are Abbott and Hollenberg (1976), *Marine Algae of California* and Gabrielson et al. (2004), *Keys to the Seaweeds and Seagrasses of Oregon and California, North of Point Conception*; all students must purchase these books. I strongly recommend Druehl (2000) *Pacific Seaweeds* as a companion to Abbott and Hollenberg (1976). I have also assigned Hoek et al. (1995) *Algae: An Introduction to Phycology*, which will be in the reserve reading section of the MLML library. The rest of the reading material for the course can be downloaded as PDF files using WEBCT from a link on the course website (Adobe Acrobat Reader needed).

Required papers:

Lecture 1 (8/28): **Palmer, J. D. 2003.** The symbiotic birth and spread of plastids: how many times and whodunit? *Journal of Phycology* 39:4-11

- Lecture 2 (9/11) **Littler, M. M., and D. S. Littler. 1980.** The evolution of thallus form and survival strategies in benthic marine macroalgae: field and laboratory tests of a functional form model. *American Naturalist* 116:25-44; **Mann, K.H. 1973.** Seaweeds: their productivity and strategy for growth. *Science* 182:975-981.
- Lecture 3 (9/18): **Searles, R. B. 1980.** The strategy of the red algal life history. *American Naturalist* 115:113-120; **Freshwater, D. W., S. Fredericq, B. S. Butler, M. H. Hommersand, and M. W. Chase. 1994.** A gene phylogeny of the red algae (Rhodophyta) based on plastid rbcL. *Proceedings of the National Academy of Sciences of the United States of America* 91:7281-7285
- Lecture 4 (9/25): **Steneck, R. S., and R. T. Paine. 1986.** Ecological and taxonomic studies of shallow-water encrusting Corallinaceae (Rhodophyta) of the boreal northeastern Pacific. *Phycologia* 25:221-240.
- Lecture 5 (10/23): **Zupan, J. R., and J. A. West. 1988.** Geographic variation in the life history of *Mastocarpus papillatus* (Rhodophyta). *Journal of Phycology* 24:223-229.
- Lecture 6 (10/30): **Clifton, K. E., and L. M. Clifton. 1999.** The phenology of sexual reproduction by green algae (Bryopsidales) on Caribbean coral reefs. *Journal of Phycology* 35:24-34
- Lecture 7 (11/2): **Stewart, J. G. 1989.** Maintenance of a balanced, shifting boundary between the seagrass *Phyllospadix* and algal turf. *Aquatic Botany* 33:223-241.
- Lecture 8 (11/6): **Boland, W. 1995.** The chemistry of gamete attraction: chemical structures, biosynthesis, and (a)biotic degradation of algal pheromones. *Proceedings of the National Academy of Sciences of the United States of America* 92:37-43.
- Lecture 9 (11/13): **Druehl, L. D. 1970.** The patterns of Laminariales distribution in the northeast Pacific. *Phycologia* 9:237-247; **Moe, R. L., and P. C. Silva. 1977.** Antarctic marine flora: uniquely devoid of kelps. *Science* 196:1206-1208.
- Lecture 10 (11/20): **Baker, S. M. 1909.** On the causes of the zoning of brown seaweeds on the seashore. *New Phytologist* 8:196-202; **Serrao, E. A., G. Pearson, L. Kautsky, and S. H. Brawley. 1996.** Successful external fertilization in turbulent environments. *Proceedings of the National Academy of Sciences of the United States of America* 93:5286-5290.
- Lecture 11 (11/27): **Spalding, H., M. S. Foster, and J. N. Heine. 2003.** Composition, distribution, and abundance of deep-water (>30 m) macroalgae in central California. *Journal of Phycology* 39:273-284. **Clark, R. P., M. E. Edwards, M. S. Foster. 2004.** Effects of shade from multiple kelp canopies on an understory algal assemblage. *Marine Ecology Progress Series* 267:107-119.

Additional resources (books):

Bold and Wynne. *Introduction to the Algae*

Cole and Sheath. *Biology of the Red Algae*

Dawson and Foster. *Seashore Plants of California*

Dodge. *The Fine Structure of Algal Cells*

Fritsch. *Structure and Reproduction of the Algae*
Graham and Wilcox. *Algae*
Lee. *Phycology*
Lobban and Harrison. *Seaweed Ecology and Physiology*
Lüning. *Seaweeds: Their Environment, Biogeography, and Ecophysiology*
Rosowski and Parker. *Select Readings in Phycology II*.
Taiz and Zeigler. *Plant Physiology*

Additional resources (journals):

Aquatic Botany
Botanica Marina
European Journal of Phycology
Journal of Applied Phycology
Journal of Phycology
New Phytologist
Phycologia
Proceedings of the International Seaweed Symposium
Progress in Phycological Research
Protist

EXAMS & GRADING:

Midterm:	15%
2 Lab practicals:	15% each
Final exam:	15%
Research project:	15%
Biography:	5%
Herbarium specimens:	20%

Research paper: Students will choose a research topic of phycological interest. Topics can be: cytological; taxonomic; physiological; ecological; evolutionary; aquacultural; paleontological. In all cases the research projects must include the collection of novel biological data. Please confer with us before you choose your topic. Each student will (1) describe their proposed project during a 10 minute oral presentation near the beginning of the course and turn in a proposal (3 pages max), and (2) describe their results in a 15 minute oral presentation near the end of the course (12/10). Final research papers (minimum of 5 double-spaced pages of text, formatted for *Journal of Phycology*) will be due on 12/12.

Phycological biography: Each student will present a 15-minute biography of a researcher whom has made significant career contributions to the field of phycology (during the So Cal fieldtrip 11/26). The biography should include pertinent information on the researcher's background, training, students, etc., as well as a synopsis of their important research contributions. In the end, the student should comment specifically on how the researcher impacted the field of phycology.

Herbarium specimens: Students will learn to prepare herbarium specimens of California seaweeds. Herbariums remain the primary way in which phycologists are able to study morphological and taxonomic questions in seaweeds, as well as identify new species. Specimens will be graded for quality

(cleanliness, correctness, completeness). Correct spelling is required. We will not accept specimens unworthy of ascension into the MLML herbarium. For full credit, a student's herbarium collection must include the following (parentheses indicate # of specimens per taxonomic group):

Rhodophyta: Bangiales (1), Nemaliales (2), Corallinales (2), Gigartinales (3), Rhodymeniales (1), Ceramiales (3), from any orders (2)

Phaeophyceae: Ectocarpales/Dictyotales (1), Chordariales (2), Dictyosiphonales (1), Scytosiphonales (1), Desmarestiales (1), Laminariales (3), Fucales (2)

Chlorophyta: Ulvales/Ulotrichales (2), Cladophorales (2), Codiales (1)

If specimens cannot be found in a given taxonomic group, substitutions can be made a rate of 3:1. Specimens that can be demonstrated to be new to the MLML Teaching Herbarium will count as a 1:1 substitution or be given extra credit. Students must provide a list (genus and species) of the specimens in their herbarium, and note to which of the required taxonomic groups (or substitutions) they belong. Student herbaria are due the day of the final exam (12/17).

Field trips: We will be taking many MANDATORY field trips to view California seaweeds. If a student cannot make a particular field trip, it is their responsibility to contact me beforehand.

SCHEDULE

Date	Lecture	Lab/Field	Assignments
8/27	Introduction to the algae	Intro to methods	H: 1-15
9/3	Labor day – NO CLASS		
9/10	Photosynthetic physiology	MBA field trip (1300-1600), MB Harbor field trip (1630-2000)	
9/17	Reds 1	Lab 1	H: 48-101; AH: 279-744
9/24	Reds 2	Lab 2	H: 48-101; AH: 279-744
9/29	*** Stillwater Cove field trip (Saturday from 1530 to 1930) ***		
10/1	Reds 3	Lab 3	H: 48-101; AH: 279-744
10/8	Midterm	Lab Practical	
10/15	Greens	Lab 4	H: 300-340, 391-435, 452-454; AH: 51-120
10/22	Seagrasses	Lab 5	Herbarium checkup
10/27	*** Pigeon Pt. field trip (Saturday from 1400 to 1830) ***		
10/29	Browns 1	Lab 6	H: 165-218; AH: 121-278
11/5	Browns 2	Lab 7	H: 165-218; AH: 121-278
11/12	Veteran's Day – NO CLASS		
11/19	Free day – NO CLASS		
11/26	*** Southern California field trip (0900 on 11/26 to 1700 on 11/28) *** *** History of Phycology ***		
12/3	Browns 3	Lab 8 (Phyco Lunch)	H: 165-218; AH: 121-278
12/8	*** Soberanes Pt. field trip (Saturday from 1200 to 1700) ***		
12/10	Project Presentations		Specimens due!!
12/17	Final exam	Lab practical	Papers due!!