

## BIOLOGY 320: SURVEY OF ALGAE – SPRING 2007

*“Invigorated by molecular biology and biogeochemistry, phycology now claims center stage in some of the most exciting developments in modern biology.”*  
Andrew Knoll. 2000.

**TIME:** MWF 1100 hrs                      **LOCATION:** Biosciences Rm. 2449  
**LECTURER:** Dr. Michael W. Hawkes (in charge of course)  
**OFFICE:** BioSc. 2526                      **PHONE:** 604-822-5430  
**EMAIL:** [mhawkes@interchange.ubc.ca](mailto:mhawkes@interchange.ubc.ca)

### LABORATORY

Dr. Todd Harper      **OFFICE:** BioSciences Rm. 1119      **PHONE:** 604-827-5608  
(in charge of laboratory)                      **EMAIL:** [jtharper@interchange.ubc.ca](mailto:jtharper@interchange.ubc.ca)

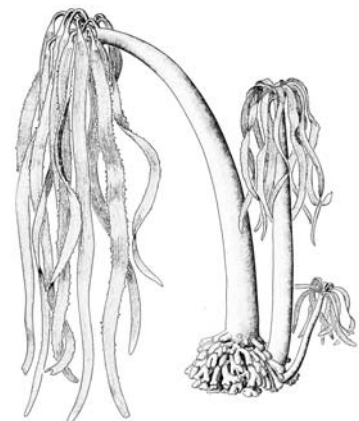
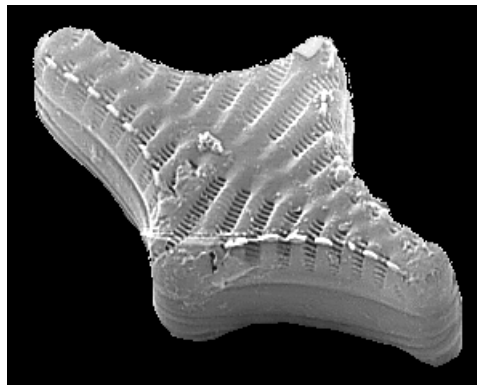
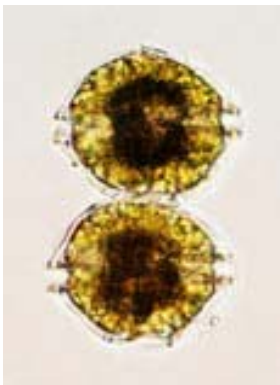
### TEACHING ASSISTANTS

Heather Esson [hjesson@interchange.ubc.ca](mailto:hjesson@interchange.ubc.ca)

**TEXT:** Graham, L.E. & L.W. Wilcox. 2002. *Algae*. Prentice-Hall: Upper Saddle River, N.J. 640 pp.

### COURSE SYNOPSIS

Biology 320 will investigate the natural history and biology of the algae. A taxon-based framework will be used to examine algal biodiversity at all levels of organization, from molecules to ecosystems. We will investigate key morphological, anatomical, ultrastructural, reproductive, biochemical, ecological and evolutionary features of representatives from many algal phyla. Other aspects of algal biology that will be discussed include biogeography, phylogeny (especially serial endosymbiosis and plastid origins) and systematics, reproductive biology and life history diversity, physiology, and uses (from ecosystem services to economic aspects). Lab investigation will emphasize morphological, ultrastructural, and reproductive diversity of the algae.



**OBJECTIVES:**

- To give the student an integrated picture, from an organismal perspective, of algal biodiversity and biology
- To raise awareness of the significance of algae in the evolutionary history of eukaryotes
- To examine the data which support a green algal origin for land plants
- To appreciate the impact that algae have on global biogeochemical cycles as well as their important contributions to past and present ecosystems.
- To understand the important role of algae in human affairs, from economic and medicinal aspects to ecosystem services

*“Present knowledge argues overwhelmingly for a cyanobacterial origin of all algal plastids.”*

Bhattacharya & Medlin.

*“...using cyanobacterial and algal models, our understanding of photobiology has expanded to the point where approaches to the deepest questions of photosynthetic function have been revealed.”*

Andrew Knoll. 2000.

*“Botanists grown complacent about the alternation of plant generations can rekindle their sense of wonder with the genetic and morphological complexities of red algal life cycles.”*

Andrew Knoll. 2000.

**EVALUATION**

**Lecture:** 2 Mid-term exams: 10% each, Final exam: 30%

**Laboratory:** 15% lab midterm, 35% lab final

**FEES:** There will be a laboratory fee of \$15.00, to be collected during the first week of classes; this is used to help defray part of the cost of slides, cover slips, the laboratory and lecture handouts.

## STUDY GUIDELINES

You will be learning about algae from the lectures, laboratories, textbook reading, and field trip.

**For the lecture examinations**, you should take the class lectures as your focus, and use the other sources to further explain and expand lecture topics. Details from assigned reading in the textbook should be 'filtered' based on what was covered in lecture.

**For the laboratory examinations**, the laboratory manual outlines the important topics, along with the added notes from the laboratory itself. **As is the case with most courses when a laboratory is present it is an essential part of the course, and you cannot pass the course unless you also pass the laboratory.**

## IMPORTANT DATES

**9 February.** Lecture Mid-term #1

**13/24 February.** Lab Mid-term (Labs 2-4)

**19-23 February.** Mid-term break.

**14 March.** Lecture Mid-term #2

**27/28 March.** Final lab exam.

**12 April.** Last day of classes.



*"There are good things to see in the tide pools and there are exciting and interesting thoughts to be generated from the seeing. Every new eye applied to the peephole which looks out at the world may fish in some new beauty and some new pattern, and the world of the human mind must be enriched by such fishing."*

John Steinbeck. 1948. (In the preface to the 2<sup>nd</sup> edition of E.F. Ricketts & J. Calvin. *Between Pacific Tides*).

## USEFUL ALGAL REFERENCES & WEB SITES

### COURSE TEXT & OTHER READING

- Graham, L.E. & L.W. Wilcox. 2000. *Algae*. Prentice Hall: Upper Saddle River, N.J. 640 pp.
- Knoll, Andrew K. 2000. Bully for *Batophora*. *Am. J. Botany* 87: 754-756.
- Wilson, E.O. 1989. The coming pluralization of biology and the stewardship of systematics. *BioScience* 39: 242-245.

### FIELD GUIDES, KEYS, FLORAS & SYNOPSIS USEFUL FOR IDENTIFICATION OF PACIFIC NORTHWEST SEAWEEDS

- Abbott, I.A. & G.J. Hollenberg. 1976. *Marine algae of California*. Stanford Univ. Press: Stanford.
- Druehl, L.D. 2000. *Pacific Seaweeds*. Harbour Publishing: Madeira Park, 190 pp.
- Gabrielson, P.W. T.B. Widdowson, and Sandra C. Lindstrom. 2006. Keys to the Seaweeds and Seagrasses of Southeast Alaska, British Columbia, Washington, and Oregon. Phycological Contribution Number 7. PhycOID. iv + 209 pp.
- Harbo, R.M. 1999. *Whelks to whales. Coastal marine life of the Pacific Northwest*. Harbour Publishing: Madeira Park, B.C. 245 pp.
- Lamb, A. and B. Hanby. 2005. *Marine life of the Pacific Northwest. A photographic encyclopedia of invertebrates, seaweeds and selected fishes*. Harbour Publishing: Madeira Park, B.C. [extensive seaweed section in collaboration with Michael Hawkes].
- Mondragon, J. and J. Mondragon. 2003. *Seaweeds of the Pacific coast. Common marine algae from Alaska to Baja California*. Sea Challengers: Monterey, California. 97 pp.
- O'Clair, R.M. & S.C. Lindstrom. 2000. *North Pacific seaweeds*. The Plant Press: Auke Bay, Alaska. 162 pp.
- Scagel, R.F., P.W. Gabrielson, D.J. Garbary, L. Golden, M.W. Hawkes, S.C. Lindstrom, J.C. Oliveira & T.B. Widdowson. 1993. *A synopsis of the benthic marine algae of British Columbia, southeast Alaska, Washington and Oregon*. Phycological Contribution No. 3, U.B.C., Dept. of Botany: Vancouver.
- Sept, J.D. 1999. *The beachcomber's guide to seashore life in the Pacific Northwest*. Harbour Publishing: Madeira Park, B.C. 235 pp.
- Sept, J.D. 2002. *The beachcomber's guide to seashore life of California*. Harbour Publishing: Madeira Park, B.C. 312 pp.



### **OTHER USEFUL REFERENCES FOR INTRODUCTORY PHYCOLOGY**

- Cole, K.M. & R.G. Sheath (eds.). 1990. *Biology of the red algae*. Cambridge Univ. Press: Cambridge. 517 pp.
- Connor, J. & C. Baxter. 1989. *Kelp Forests*. Monterey Bay Aquarium: Monterey.
- Lee, R.E. 1999. *Phycology*. 3rd edition. Cambridge Univ. Press: Cambridge
- Lobban, C.S. & P.J. Harrison. 1994. *Seaweed ecology and physiology*. Cambridge Univ. Press: Cambridge. 366 pp.
- Lobban, C.S. & M.J. Wynne. (Eds.). 1981. *The biology of seaweeds*. Blackwell Scientific Publ.: Oxford.
- Ricketts, E.F., J. Calvin & J.W. Hedgpeth (revised by D.W. Phillips). 1985. *Between Pacific tides*. 5th ed. Stanford Univ. Press: Stanford.
- South, G.R. & A. Whittick. 1987. *Introduction to Phycology*. Blackwell Scientific Publ.: Oxford.
- Van den Hoek, C., D.G. Mann, & H.M. Jahns. 1995. *Algae: an introduction to phycology*. Cambridge Univ. Press: Cambridge.
- Wehr, J. & R. Sheath. 2002. *Freshwater Algae of North America: Ecology and Classification*. Academic Press: San Diego. 800 pp.

### **USES & ECONOMIC ASPECTS OF ALGAE**

- Arasaki, S. & T. Arasaki. 1983. *Vegetables from the Sea*. Japan Publ. Inc.: Tokyo.
- Blunden, G. 1991. Agricultural uses of seaweeds and seaweed extracts. Pp. 65-81 In: M.D. Guiry & G. Blunden (Eds.). *Seaweed resources in Europe: uses and potential*. John Wiley & Sons: Chichester.
- Chapman, V.J. 1980 (3rd ed.). *Seaweeds and Their Uses*. 304 pp. Chapman & Hall: London.
- Cheney, D.P. & T.F. Mumford, Jr. 1986. *Shellfish & Seaweed Harvests of Puget Sound*. 164 pp. Puget Sound Books & Univ. Wash. Press: Seattle.
- Indergaard, M. 1983. The aquatic resource. I. The wild marine plants: a global bioresource. Pp. 137-168 In: Cote, W.A. (Ed.), *Biomass utilization*.
- Lembi, C.A. & J.R. Waaland. (Eds.). 1988. *Algae and human affairs*. Cambridge Univ. Press: Cambridge. 590 pp.
- Madlener, J.C. 1977. *The Seavegetable Book*. 288 pp. Clarkson N. Potter Inc.: New York.



## WEB SITES OF INTEREST

**Biology 320 web site:** <http://www.botany.ubc.ca/Biol320/>

**DeCew's Guide** to the Seaweeds of British Columbia, Washington, Oregon, and northern California. <http://ucjeps.berkeley.edu/guide/dq-toc.html>

[Note: At present this just covers the greens and browns]

**UBC Phycological Herbarium:**

<http://www.botany.ubc.ca/herbarium/algae/index.html>

**Tree of Life:** <http://tolweb.org/tree/phylogeny.html>

***Index Nominum Genericorum*:** <http://ravenel.si.edu/botany/ing/ingForm.cfm>

**Mike Guiry's Seaweed site:** <http://www.seaweed.ie>

Much information and many excellent links to the world of seaweeds, their biology, and uses. The databases are especially useful.

**Smithsonian Algae home page:** <http://www.nmnh.si.edu/botany/projects/algae/>

**Phycological Society of America:** <http://www.psaalgae.org/>

**International Phycological Society:** <http://www.intphycsoc.org/>

**Partnership for Interdisciplinary Studies of Coastal Oceans:**

<http://piscoweb.org/index.html>

**University of Washington's Friday Harbor Labs:**

<http://depts.washington.edu/fhl/>

**Bamfield Marine Sciences Centre:** <http://www.bms.bc.ca/information/bmsc/>

