COURSE: Spring 2010, FISH 4900, Directed Studies, 1 credit hour

TOPIC: Metabolic Theory of Phytoplankton

TIME: To be determined (1 hour per week)

OFFICE HOURS: F, 9:00am-11:00am, Swingle 321, or by appointment

INSTRUCTOR: Dr. Alan Wilson, Swingle 321, wilson@auburn.edu, 334-844-9321

COURSE OBJECTIVES:
The course objectives represent a variety of tasks and skills that I expect students to have developed and mastered by the end of the course. Through participating in this course, you will (1) practice and develop your critical thinking skills (through in-class discussions, conducting an experiment, writing a manuscript, and presenting a seminar on your research project), (2) learn how to read and interpret the scientific literature, and (3) broaden your understanding of metabolic theory and the broad group of organisms called "phytoplankton".

REQUIRED READINGS:
Articles from the peer-reviewed literature (see below) will be used to introduce the student to the field of metabolic theory and the group of organisms called "phytoplankton". These papers will be made available to the student.

1. Ahrens MA, Peters RH (1991) Patterns and limitations in limnoplankton size spectra. Canadian Journal of Fisheries and Aquatic Sciences 48: 1967-1978.
2. Banse K (1976) Rates of growth, respiration and photosynthesis of unicellular algae as related to cell size - review. Journal of Phycology 12: 135-140.
3. Beardall J, Allen D, Bragg J, Finkel ZV, Flynn KJ, et al. (2009) Allometry and stoichiometry of unicellular, colonial and multicellular phytoplankton. New Phytologist 181: 295-309.
4. Geider RJ, Platt T, Raven JA (1986) Size dependence of growth and photosynthesis in diatoms - a synthesis. Marine Ecology Progress Series 30: 93-104.
5. Glazier DS (2005) Beyond the '3/4-power law': variation in the intra- and interspecific scaling of metabolic rate in animals. Biological Reviews 80: 611-662.
6. Irwin AJ, Finkel ZV, Schofield OME, Falkowski PG (2006) Scaling-up from nutrient physiology to the size-structure of phytoplankton communities. Journal of Plankton Research 28: 459-471.
7. Jennings BR, Parslow K (1988) Particle-size measurement: the equivalent spherical diameter. Proceedings of the Royal Society of London, Series A: Mathematical and Physical Sciences 419: 137-149.
8. Lewis WM (1976) Surface/volume ratio: implications for phytoplankton morphology. Science 192: 885-887.
9. Marañón E, Cermeño P, Jodríguez J, Zubkov MV, Harris RP (2007) Scaling of phytoplankton photosynthesis and cell size in the ocean. Limnology and Oceanography 52: 2190-2198.
10. Nielsen SL (2006) Size-dependent growth rates in eukaryotic and prokaryotic algae exemplified by green algae and cyanobacteria: comparisons between unicells and colonial growth forms. Journal of Plankton Research 28: 489-498.
11. Niklas KJ (1994) Plant allometry: the scaling of form and process. Chicago: The University of Chicago Press.
12. Reich PB (2001) Body size, geometry, longevity and metabolism: do plant leaves behave like a animal bodies? Trends in Ecology & Evolution 16: 674-680.
13. Schmidt-Nielsen K (1984) Scaling, Why is animal size so important. Cambridge, London, New York, New Rochelle, Melbourne, Sydney: Cambridge University Press.
14. Speakman JR (2005) Body size, energy metabolism and lifespan. Journal of Experimental Biology 208: 1717-1730.
15. Sunda WG, Huntsman SA (1997) Interrelated influence of iron, light and cell size on marine phytoplankton growth. Nature 390: 389-392.
16. Tang EPY (1995) The allometry of algal growth rates. Journal of Plankton Research 17: 1325-1335.
17. Thessen AE, Bowers HA, Stoecker DK (2009) Intra- and interspecies differences in growth and toxicity of *Pseudo-nitzschia* while using different nitrogen sources. Harmful Algae 8: 792-810.
18. West GB, Brown JH (2005) The origin of allometric scaling laws in biology from genomes to ecosystems: towards a quantitative unifying theory of biological structure and organization. Journal of Experimental Biology 208: 1575-1592.
19. West GB, Brown JH, Enquist BJ (1997) A general model for the origin of allometric scaling laws in biology. Science 276: 122-126.
20. West GB, Brown JH, Enquist BJ (2001) A general model for ontogenetic growth. Nature 413: 628-631.
21. Wilson AE, Kaul RB, Sarnelle O *In Revision* Growth rate consequences of colonality in a harmful phytoplankter. PLoS ONE.
22. Wilson AE, Wilson WA, Hay ME (2006) Intraspecific variation in growth and morphology of the bloom-forming cyanobacterium *Microcystis aeruginosa*. Applied and Environmental Microbiology 72: 7386-7389.

23. Yang RJ, Wang XL, Zhang YY, Zhan YH (2006) Influence of cell equivalent spherical diameter on the growth rate and cell density of marine phytoplankton. Journal of Experimental Marine Biology and Ecology 331: 33-40.

GRADING:

Course grades are based on each student's cumulative performance for the following assignments:

Activity	Points	Grading scale
Attendance	10	A = 90-100%
Article discussion	10	B = 80-89%
Lab experiments	40	C = 70-79%
Final paper	20	D = 60-69%
Oral presentation	20	F = 0-59%
Total points	100	

STUDDENT PARTICIPATION & ASSIGNMENTS EXPECTATIONS:

The course grade will be based on participation in lecture and lab, research article evaluations, quizzes, a presentation, lab reports, and midterm and final exams as described below:

(1) *ATTENDANCE*: The student is expected to attend and be prepared for all classes.

(2) *ARTICLE DISCUSSION*: After perusing the articles used in the course, the student will discuss each paper's findings with the instructor.

(3) *LAB EXPERIMENTS*: Using a novel approach developed by the instructor, the student will conduct 1 to 3 lab experiments aimed at elucidating the growth rate responses of individual colonies of the cyanobacterium, *Microcystis aeruginosa*, to changing environmental conditions.

(4) *FINAL PAPER*: The student will prepare a manuscript describing the findings of their lab experiment(s). Pending the findings of the experiments, the manuscript may be submitted to a peer-reviewed journal.

(5) *ORAL PRESENTATION*: The student will present a 10 minute seminar describing the findings of their lab experiment(s).

COURSE CHANGES:

I reserve the right to modify the course to enhance the learning experience where I deem appropriate.

ACADEMIC HONESTY:

Title XII, Chapter 1200 of the SGA Code of Laws clearly defines the Auburn University student academic honesty code (available at http://auburn.edu/tigercub/) which states "*In accordance with those virtues of Honesty and Truthfulness set forth in the Auburn Creed, I, as a student and fellow member of the Auburn family, do hereby pledge that all work is my own, achieved through personal merit and without any unauthorized aid. In the promotion of integrity, and for the betterment of Auburn, I give honor to this, my oath and obligation."*

ACCOMMODATIONS FOR DISABILITIES:

If you have a disability and/or a special need that requires accommodations, please inform me immediately so that I can develop a plan to work with you and arrange an appointment with a campus disabilities counselor.

COURSE SCHEDULE:

Week	Activity
Weeks 1 - 2	Peruse papers and discuss with instructor
Week 3	Learn axenic transfer of phytoplankton and experimental techniques to measure phytoplankton growth
Weeks 4 - 6	Conduct short-term lab experiments
Weeks 7 - 14	Complete manuscript describing experiment
Week 15	Student seminar, final paper due