Botany 330 Take-Home Final Exam

I. Introduction. As you now know, these essay questions are designed to foster integrative thinking, comprehend the peer-reviewed literature, and express findings in a clear way to a peer audience. The essays are meant to model the kinds of short reports that you might write in a future professional situation. In almost any biology-related field, you are likely to be expected to summarize important information for the rest of your work group in a concise, yet readable way, and to do so by mandated deadlines.

It is important to have your drafts edited by the instructor before you produce the final product. If you comply with specified deadlines and editorial recommendations, you should be able to earn all or most of the available points for lecture exams! As you now know, it is not advisable to wait until close to deadlines to start writing! You can benefit your work in this and other courses by starting to work on 330 essays soon after the midterm exam and continuing to work steadily toward semester’s end. An early start is particularly important for anyone who had many editorial issues to deal with during the midterm essay exam process.

II. Essential components. Each of your answers is expected to combine relevant material from the lectures and textbook with content from a particular, very recent peer-reviewed article. The textbook reflects compendia of information that you might rely upon in a future professional situation, the lectures reflect authoritative oral information that you might need to include (like the company president’s recent speech), and the peer-reviewed articles display the latest thinking, techniques, and results in a field. Obtaining information from three reliable sources is a good way to cross-check information and detect information that has become outdated.

So, don’t forget to include all three sources of material (text, lectures, article) in your essays. It is common for people to become so focused on the articles that they forget to incorporate text or lecture information.

Now that you are experienced with this process, pay close attention to the content of abstracts, introductions, materials & methods, results, and discussion components of the 5-6 papers you are reading closely. This process will help you when you are in the position of writing an article yourself!

III. Deadlines. All drafts and final essays must be 1-3 double-spaced pages long, with 12-point type. Upload drafts to the Botany 330 Learn@UW Dropbox into the file marked “final exam drafts”. Drafts are due Wednesday, Dec. 14 at 3:00 pm, edited drafts will be available at Learn@UW by 5 pm on Friday Dec. 16, and final essays are due Monday, Dec. 19 by 5:00 pm (the scheduled final exam time). Ten points will be deducted from the potential 100 points if any part of the final exam draft or final version is late.
When submitting drafts or final essays, please link all of your 5-6 essay files together and incorporate your surname in the filename, so no essay gets lost.

IV. Resources. Most of the recent publications pertinent to the questions below are provided in pdf form on the lab computer, which you can download to a flash drive for personal use. You might have to read one or two articles as digital files on the web source. Most articles are also provided in hard copy form for you to examine when deciding which publications to write about; those hard copies must remain in the classroom.

The articles were chosen for currency and relevancy to issues of wide concern. The journals represent the publication sources considered important in the field. In the future, these are among the sources you would consult to provide authoritative and carefully peer-reviewed information.

For the final exam you may, if you wish, choose a different topic for ONE of the required essays. Be sure to discuss your alternate topic and supporting literature with Dr. Graham at least two weeks before the draft essay is due.

Before starting to write your essays, please read through the document “Editorial Issues” located on the Botany 100 course website. This action may help you to avoid making common errors in English usage. Because this is a Comm B course, essays will be graded on English expression as well as content.

V. Ethics and scholarly responsibilities. You must cite the article author(s) appropriately within your essays and at the end (authors, date, title, journal name, volume, pages). It is not necessary for you to cite lectures or the textbook. For citation placement and frequency, regard the articles as excellent guides.

You are not expected to obtain additional information for inclusion in your essays, but if you do, make sure that it has been peer-reviewed and cite it. “Peer-review” means that reviewers who are experts in the field have carefully checked the material before publications. Such reviewers often ask authors to clarify confusing statements, provide additional results, or improve data presentation. Most website material has not been peer-reviewed and is often out of date, so consult instructor before using it. Collaboration with your peers in the composition of these essays is specifically prohibited, though it is perfectly fine to discuss articles.

You are not expected to necessarily agree with the conclusions of authors; an alternative opinion can sometimes be justified. Extra credit points can be earned by including well-reasoned discussion of ways in which paper data could be interpreted differently than authors suggest, or suggesting future experiments that need to be done.

Finally, essay content should be professionally unemotional and objective. Summaries that include personal opinions are welcome, but must be justified by
recent peer-reviewed data. Personal attacks on authors (known as *ad hominem* attacks) are not acceptable.

1. Briefly survey the diversity of stramenopile algae, then focus on eustigmatophytes, describing their characteristics and importance. Discuss the use of the eustigmatophyte *Nannochloropsis* in producing renewable biofuel, as discussed in the Brown et al. (2010) in *Energy Fuels* (a publication of the American Chemical Society).

2. Define and briefly discuss the role of horizontal gene transfer in the evolutionary history of algae. What major mechanisms of horizontal gene transfer apply to algae? What are the ecological consequences of rampant HGT in an algal lineage? Use the Michel et al. 2010 *New Phytologist* article on *Ectocarpus* cell wall biochemistry to illustrate the important of HGT.

3. Discuss the biogeochemical importance of halogen elements in marine algae, particularly large seaweeds. What ecological functions do halogens serve? The La Barre et al. 2010 review article from *Marine Drugs* should be integrated into this answer.

4. Survey the general ecological importance of coralline red algae (particularly in coral reef maintenance), then discuss calcification of red algae in general, citing examples of taxa. Explain how calcification occurs, how it fosters photosynthesis, and what physical conditions affect calcification, with information from the Kamenos and Law 2010 article from *Journal of Phycology*.

5. Describe how the green flagellate *Chlamydomonas* has been used as a model organism in basic studies of cell biology. The discussion should include examples of fundamental information about all eukaryotes or all photosynthetic eukaryotes that has come from studies of *Chlamydomonas*. The discussion should include information about the *Chlamydomonas* genome and how it has been used in comparative genomic studies. Finally, include the 2011 Tejada-Jimenez et al. paper from *PNAS*, which describes a way in which humans are similar to *Chlamydomonas*! Or, write about the Wakabayashi et al. 2011 *PNAS* paper on *Chlamydomonas* phototaxis.

6. Define “flagella” and survey the occurrence of flagella (or not) in these major algal phyla: euglenoids, cryptomonads, haptophytes, dinoflagellates, chrysophytes, red algae, brown algae, green algae. Briefly survey the functions of flagella (which can include sensory functions such as “smell” and “sight”). Then discuss mechanoreception by flagella, the subject of the 2011 Fujiu et al. *Nature Cell Biology* article.
7. Describe structural, reproductive, biochemical, and genetic features of the streptophyte algae (= charophycean green algae) that seem to have been inherited by land plants. Discuss the importance of osmotrophy to land plants (mention the plant placental junction and its function, a fundamental feature of all land plants). Use the 2010 Graham et al. article from the *American Journal of Botany* to describe sugar utilization by charophycean algae and early-diverging land plants.

8. Define “periphyton,” explaining what general types of algae and other organisms are involved. What are some environmental features that influence the diversity of algae that make up periphyton (include both marine and freshwater examples)? Use the 2011 *Nature* article by Cardinale to explain how periphyton responses to variability in N availability can be experimentally determined, and the ecological relevance of this information.

9. Survey the importance of characean algae (aka “charophyte” algae) such as *Chara* and *Nitella*. What is the basis of their fossil record and what does that record say about the evolutionary history of this group? Where do such macroalgae occur today, how do they interact with other organisms, and what stresses do they face? Discuss the 2009 article by Torn et al. from *Estuarine, Coastal and Shelf Science*.

10. Provide an overview of epibionts that occur on algae. What benefits do some provide, and what problems do others cause for their algal host? How do algae foster beneficial epibionts and deter harmful ones? What ecological factors impact the buildup of epibiont films? Use the 2010 Wahl et al. article from *Marine Ecology Progress Series* to discuss a specific example of a host’s interaction with its epibionts.

11. Generally describe the major types of macroalgae that form nuisance or invasive growths in freshwaters and coastal areas, including coral reefs. Examples should be given from brown, red, and green algae. What ecological factors foster the growth of macroalgal blooms? The 2010 article from *Harmful Algae* by Lapointe and Bedford provides a specific example.

12. Survey what is generally known about seaweed biogeography, including the major factors influencing seaweed biomass and diversity. Where are the “hotspots” of macroalgal diversity around the world? Discuss the specific results found in the 2010 study of Northern Hemisphere Rocky shores by Konar et al. published in *PLoS ONE*.

13. Provide a brief overview of the major environmental factors that influence the occurrence of non-nuisance seaweeds. Then, focusing on non-invasive seaweeds that occur on reefs, give examples from the green, red, and brown seaweeds. Discuss the experimental approach described in the 2010 article by Smale et al. (*Journal of Experimental Marine Biology and Ecology*) to
analyze reef macroalgae in Western Australia, and its importance in monitoring biodiversity.

14. Summarize the occurrence of algae in terrestrial (subaerial) habitats. Then explain the ecological significance of aeroterrestrial algae. Finally, discuss the importance of aeroterrestrial algae in the ancient origin of land plants, as described by the Graham et al. article (American Journal of Botany).