Botany 330 Take-Home Final Exam 2016

I. Introduction. 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.

In these essays, you are writing for a reader who is a professional and has earned at least an undergraduate degree in biological science, in other words, a peer. ESSAYS SHOULD NOT BE WRITTEN FOR THE GENERAL PUBLIC. Please use technical language and high-level concepts that you have learned in your previous biology courses!

It is important to have your drafts edited by the instructor before you produce the final product. You will be told exactly what changes are needed to achieve an excellent grade. If you comply with specified deadlines and editorial recommendations, you should be able to earn all or most of the available points for essay exams!

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 Botany 330 essays right away and continuing to work steadily toward the midterm due dates.

II. Essential components. Each of your answers is expected to combine relevant material from the textbook with content from a particular, very recent peer-reviewed article, in approximately equal amounts. The textbook reflects compendia of information that you might rely upon in a future professional situation and the peer-reviewed articles display the latest thinking, techniques, and results in a field. Obtaining information from more than one reliable source is a good way to cross-check information and detect information that has become outdated.

Don’t use any other sources of information to write your essays, because such sources are unlikely to be as accurate and current.

So, don’t forget to include both sources of material (text & article) in your essays. It is common for people to become so focused on the articles that they forget to incorporate essential background information from the text. Text information is likely to come from >1 chapter; use search terms to find all relevant material.

When discussing articles, it is very important to include at least an overview of methods used in the study, because without that information, it would be difficult for a peer reader to evaluate the accuracy of the results.
III. Deadlines
Drafts of essays are due on or before 5 pm, December 2. Ten points will be deducted from the potential 100 points if all 5 (undergrads)-6 (grads) drafts have not been turned in by 5 pm on this date.

*Please link all 5-6 of your draft essay files together and incorporate your surname in the filename to reduce odds of misplacing files.* (It is common for people to upload essays one at a time or to name them cryptically, in which case grading is delayed by the amount of time needed to gather and rename files.) Edits will be returned via Learn@UW by Dec. 12, in time to incorporate suggested modifications into drafts of all essays. Most edits will be completed well before Dec. 12, so check Learn@UW to see if your edits are there earlier, then go right ahead with revisions.

The final exam essays are due by 5 pm on the date established for the Botany 330 final exam. Ten points will be deducted if any portion of the final version of the midterm exam is late.

(The purpose of the deadlines and deduction of points if deadlines are missed is to foreshadow processes that occur in workplaces. There are always deadlines in workplaces and consequences for missing them, so by imposing deadlines we are not being mean, but rather trying to foster work habits that will benefit you later.)

*Please link all 5-6 of your final essay files together and incorporate your surname in the filename to reduce odds of misplacing files.*

V. Resources. The articles you will write about were chosen for currency and relevancy to issues of wide concern. The journals represent the highest-rated & most demanding publication sources. In the future, these are among the sources you can trust to provide authoritative and carefully peer-reviewed information.

Before starting to write your essays, please **read through the document “Editorial Issues”** located on the Botany 330 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. We recommend printing out the editorial issues document and posting it at your workspace for easy reference.

VI. Ethics and scholarly responsibilities. You must cite the article author(s) appropriately within your essays in this form: (Sandrini et al. 2015). See “Editorial Issues” to understand why “et” is never followed by a period, but “al.” always has a period. This might seem picky, but it is core biological literacy.

Notice where literature citations occur in scientific articles: immediately following material that has been addressed in the citation. Do not credit article authors for knowledge generated by previous workers, such as information provided in article introduction sections. Only cite article authors for the work they actually did. If an
entire paragraph is related to such work, only cite authors at the end of the paragraph (not in every sentence).

At the end of each essay provide article author names, date, article title, journal name, volume, & pages. For simplicity, it is not necessary for you to cite the textbook.

For this exam, do not use any sources of information other than your own copy of the 3.1 edition of the digital textbook Algae, or the assigned articles. The reason for this is that these sources are the most current and reliable.

Collaboration with your peers in the composition of these essays is specifically prohibited, though it is perfectly fine to discuss articles amongst yourselves or with instructors.

It is also prohibited for you to have your essays edited or “polished” in any way by anyone other than current Botany 330 course instructors. Don’t ask friends to help or use professional editing services. The reason for this is to ensure than you will receive the maximum practice in writing and revising, to benefit your future success.

You are not expected to necessarily agree with the conclusions of authors; a skeptical view or alternative opinion might be justified. Essay content should be professionally unemotional. Personal opinion is fine, but only if it can be justified by peer-reviewed literature. Personal attacks on authors (known as ad hominem attacks) are not acceptable.

1. What is the past and present significance of the red algae? Use Chapters 4 and 15 to describe at least five ways in which the red algae are of modern environmental or economic significance; include coralline carbonate production and cementation of coral reefs. Describe the evolutionary history of the red algae, particularly of the Bangiophycidae, as background for a consideration of the Yang et al. (2015) article “Divergence time estimates and the evolution of major lineages in the florideophyte red algae,” Scientific Reports 6: 21361: doi: 10.1038/srep21361 (2016). Explain why and how this analysis was performed. Based on this evidence, for how long have various lineages of red algae (e.g. corallines) been performing important environmental roles?

2. What is the environmental impact of heterotrophic green algae? Describe at least three genera of trebouxiophyte “green” algae that have become non-photosynthetic and discuss their impacts on humans or other animals (Chapter 17). How do these algae obtain organic molecules? Focus on Prototheca and its effects on the dairy industry, then explore the Shahid et al. (2016) article “Characterization of Prototheca zopfii genotypes isolated from cases of bovine mastitis and cow barns in China, Mycopathologia 181:185-
195 (an interesting case of a paper about algae published in a journal focused on pathogenic fungi). To adequately discuss the molecular detection techniques used, you may need to review Chapter 5.

3. What marine macroalgae are considered to be invasive species and why? Use chapters 15, 18, and 22 to summarize information about invasive red and green macroalgal species, citing at least five genera. Focus on *Codium* by first describing body structure and reproduction, then describe the work by McDonald et al. (2015) “The first detection of the invasive macroalga *Codium fragile* subsp. *fragile* (Suringar) Hariot in Western Australia,” *BiolInvasions Records* 4:75-80. Explain how these authors confirmed the identity of this invasive species.

4. How do green algae produce cellular lipids and why is this important? Describe at least three genera of green algae whose cellular lipid production is considered important in the formation of fossil fuel deposits and/or renewable biofuels. Then focus on the chlorophycean alga *Dunaliella*, describing its structure and ecology (Chapter 19) and previous uses in technology (Chapter 4). Explain why and how Davidi et al. (2014) reported “Origin of β-carotene-rich plastoglobuli in *Dunaliella bardawil*,” in *Plant Physiology* 164:2139-2156. This article takes cellular approaches that you would need to describe in some detail. If you answer this question, don’t also choose question 5, which requires similar background.

5. How do green algae produce cellular lipids and why is this important? Describe at least three genera of green algae whose cellular lipid production is considered important in the formation of fossil fuel deposits and/or renewable biofuels. Focus on the chlorophycean alga *Chlamydomonas*, explaining how and why this genus has been so useful as a laboratory model system (Chapters 4 and 19). Then discuss how and why Bajhaiya et al. (2016) reported “High-throughput metabolic screening of microalgae genetic variation in response to nutrient limitation,” published in the journal *Metabolomics* 12:9. This work takes chemical approaches that you would need to describe in some detail. If you answer this question, don’t also choose questions 4 or 6, which require similar background.

6. How are algal model systems used to obtain fundamental cell biology knowledge? Use information from Chapter 4 to describe algal model systems in general and Chapter 19 to describe *Chlamydomonas* as a particularly useful model system. What features of *Chlamydomonas* foster its use as a model system? Describe at least five fundamental features of cell biology that were discovered with the use of Chlamydomonas. Then use the Wan and Goldstein (2016) article “Coordinated beating of algal flagella is mediated by basal coupling,” *Proc Natl Acad Sci USA* E2784-E2793 to provide a more detailed additional example. Explain why and how this work was accomplished. If you
choose this question, do not also select question 5, which requires similar background.

7. What were the earliest streptophyte algae like? Use Chapter 16 to discuss the evolutionary history of streptophytes, which include all land plants and closest green algal relatives. Focus on the genus *Mesostigma*, describing molecular evidence in support of the hypothesis that it models the flagellate ancestor from which all streptophyte arose. Explain why and how Yang et al. (2016) reported “Rickettsial endosymbiont in the ‘early-diverging’ streptophyte green alga *Mesostigma viride*, *Journal of Phycology* 52:219-229. Discuss *Mesostigma* genes that likely arose by horizontal gene transfer (Chapter 5) from bacterial endosymbionts, and evidence bearing on the timing of the bacterial endosymbiosis (ancient or modern).

8. How does the study of modern streptophyte algae indicate what the microbiome of early land plants was like? Use Chapter 3 to discuss the concept of a microbiome and how microbial associations may benefit algal/plant growth and survival. Use Chapter 5 to describe environmental genomics techniques used to characterize microorganisms. Describe the evolutionary relationship between various lineages of streptophyte algae and land plants. Explain why and how Knack et al. (2015) reported that “Microbiomes of streptophyte algae and bryophytes suggest that a functional suite of microbiota fostered plant colonization of land, *International Journal of Plant Science* 176:405-420. What do the results suggest about the origin of the first plant microbiomes? This question would be particularly relevant to botany majors.

9. How has recent climate change affected marine phytoplankton communities? Begin by using Chapter 21 to define phytoplankton and provide some examples of prominent marine phytoplankton groups and genera. Explain why marine phytoplankton algae are globally important. Use the Barton et al. (2016) article “Anthropogenic climate change drives shift and shuffle in North Atlantic phytoplankton communities,” *Proc. Natl. Acad. Sci. USA* 113:2964-2969, to provide recent examples of climate change effects.

10. How has climate change affected marine macroalgal communities? Use Chapter 22 to provide an overview of marine macroalgae and marine turfs, providing at least one example genus from red, brown, and green macroalgae, and red, brown and green turf species. Also use the chapter to discuss major environmental effects on these algae, ending with climate. Then segue to the Wernberg et al. (2016) article “Climate-driven regime shift of a temperate marine ecosystem” published in Science 353:169-172. Describe why and how this work was done, and how the results apply to public policy.