Botany 330 Final Exam 2017

I. Introduction. These essay questions are designed to foster integrative thinking, comprehend the peer-reviewed scientific literature, and express findings in a clear way to a peer audience of scientists. 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 will be expected to summarize important information for the rest of your work group in a concise, yet readable way, and by mandated deadlines.

In these essays, you are writing for a reader who has earned at least an undergraduate degree in biological science; you are NOT writing for the general public, or general college students. Please use good English, and employ technical language and high-level concepts from Bot. 330 and your previous biology courses!

Draft essays that have been submitted by deadlines will be edited to let you know exactly what changes you must make 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!

Past experience indicates that procrastination may be your worst enemy. All of the information you need to write the Bot. 330 final exams is available to you on the course website and in your digital textbook. Don’t wait until close to deadlines to start writing. Read any parts of your textbook that you have not already assimilated right away!

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 about equal amounts. The textbook reflects compendia of information that you might regularly rely upon in a future professional situation and the peer-reviewed articles display the latest thinking, techniques, and results related to a more focused problem.

Don’t use any other sources of information to write your essays, unless you receive instructor permission, because other sources are likely less 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 will come from multiple chapters; use digital searches to find all relevant material.

When discussing articles, it is very important to discuss major methods used in the study, because without that information, it would be difficult for a peer reader to evaluate the accuracy of the results. So, don’t forget methods!

III. Format. The format of final exam draft and final essays is the same as for the midterm: 2-4 double-spaced pages, 12-point easy-to-read typeface such as Times
New Roman. Outlines are not acceptable as drafts. Upload draft files (whose filenames incorporate your surname: e.g. Trestfinalexamdraft) to the Botany 330 Learn@UW assignment marked “final exam drafts”.

Undergraduates must answer 5 of the questions posed below; graduate students must write 6. (It is a graduate school requirement that in mixed courses, graduate students must perform work not required of undergraduates.)

IV. Additional Deadlines. Drafts of the 5-6 essays are due on or before 5 pm, December 15. Points will be deducted if all drafts have not been turned in on time.

Please link all draft essay files together and incorporate your surname in the filename to reduce odds of misplacing files. Example: Grahamdraftfinal. Edits will be returned via Learn@UW by December 19, though most edits will be completed well before then, so check Learn@UW to see if your edits are there earlier, then go right ahead with revisions.

The final version of all final exam essays is due by 5pm December 21 in the Learn@UW assignment “final exam final version”. Ten points will be deducted if any part of the final exam is late.

Note: 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 aim to foster work habits that will benefit you later.

V. Recommended Process.
• Start by reading the entire digital textbook if you haven’t done that already, to know where essential material is located.
• Next, choose a final exam question, noting key words that you can use as search terms to locate all relevant textbook information.
• Take notes from relevant sections of the textbook, a step that will aid your understanding of the associated article.
• Read the associated article, taking notes on research goals, methods, and results most relevant to the exam question.
• Organize text and article notes in a logical sequence that first provides reader with essential overview background information from textbook, then a specific example (the article).
• Make sure you haven’t made any of the errors noted in the course document “Editorial Issues,” common writing/science mistakes made by past Bot. 330 students.
• Examples of common English usage errors to avoid: 1) “Algae” is a plural word for which the singular is “alga;” so, “algae are beautiful”, NOT “algae is beautiful.” (Ditto for bacterium, bacteria and fungi, fungus.) 2) The subject “None” is a contraction of “no one,” hence takes a singular verb: “None of
these algae **is** known to be toxic,” NOT “None of these algae **are** known to be toxic.”

- Examples of common science errors to avoid: 1) hypothesis (yet to be substantiated) vs theory (in science, a body of well-established knowledge); 2) in photosynthesis, the product oxygen derives from water (NOT CO$_2$).
- Write a first version and then revise at least twice before submitting as a draft essay, aiming to increase clarity and remove excess verbiage.
- Correct all spelling and grammar errors indicated by your word processor.

**VI. Ethics and scholarly responsibilities.** Please cite the article author(s) appropriately within your essays in this form: (Brown et al. 2016).

Notice the locations of literature citations in scientific articles (and your textbook). Follow these models. Do not credit article authors for knowledge generated by previous workers, e.g. information provided in article introduction sections.

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

*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. However, essay content should be professionally unemotional. Any personal opinion must be supported by peer-reviewed literature. Personal attacks on authors (known as *ad hominem* attacks) are not acceptable.

*Do not use quotations,* because quotations are rarely employed in scientific writing for peers. You might have learned to use quotations in writing for a non-science course, or perhaps writing about science for the general public. By contrast, as you can see from reading scientific articles and your textbook, quotations are rarely used in writing for science peers. Instead, paraphrase, a process that shows that you comprehend the material. *Again, no quotations!*

1. The production of calcium carbonate coccoliths by coccolithophorids is ecologically-, geologically-, and industrially-important, but the cellular mechanisms involved in calcification by haptophytes have been unclear. Begin by explaining why coccolithophorids are ecologically, geologically, and
industrially significant. (Include a discussion of the value to haptophytes of producing coccoliths.) Follow with a description of what has been known about cellular development of coccoliths and organic scales. Discuss the methods and findings of Gal et al. (2016), "Macromolecular recognition directs calcium ions to coccolith mineralization sites."

2. Diatoms are widely recognized for their ecological, geological and industrial importance, but how diatoms have adapted to stressful environments remains unclear. Begin by describing the ecological, geological and industrial importance of diatoms, eventually focusing on sea ice diatoms. Follow with a description of methods and findings of Mock et al. (2017) “Evolutionary genomics of the cold-adapted diatom Fragilariopsis cylindrus. Be sure to discuss the importance of the comparison with genomics of temperate diatoms.

3. Kelps are known for industrial and ecological importance. Begin by describing industrial applications of kelp, and follow with a discussion of the ecological roles of kelp species. Provide at least three examples of kelp genera together with their known biotic associations and geographical distributions. Discuss the methods and findings of the Krumhansl et al. (2016) article, “Global patterns of kelp forest change over the past half-century.” How is global environmental change likely to affect kelp distribution?

4. Acquisition by certain early eukaryotes of a primary plastid dramatically changed these organisms’ genomes and cell biology. Begin by discussing current concepts of primary plastid origins (single or multiple) and at least three key lineages of primary plastid algae. Describe at least three cellular changes that occurred in the host or endosymbiont during the transformation of a prokaryotic endosymbiont into a primary plastid. Consider the methods and findings of the Sumiya et al. (2016) paper, “Chloroplast division checkpoint in eukaryotic algae,” which describes work done with a red alga. Note that these authors uncritically accept the “single primary plastid origin hypothesis,” which allows them to assume that the work also applies to the glaucophyte and green lineages. What evidence cited by these authors suggests that the observations may apply primarily to red algae?

5. Comparative analysis of chloroplast genomes are widely employed in phylogenomic analyses to comprehend the diversification of land plants, but the value of chloroplast genomes for understanding early green algal diversification has not been clear. Describe what is known about early diversification of Viridiplantae (green algae + land plants), and focus on prasinophytes, then the genus Pyramimonas. Explain the importance of this genus. Discuss methods and results reported by Satjarak and Graham (2017)
“Comparative DNA sequence analyses of *Pyramimonas parkeae* (Prasinophyceae) chloroplast genomes.”

6. Cyanobacterial blooms have such strong societal impacts that biological phenomena that might affect such blooms are of wide interest. Some researchers have cited evidence that allelopathic repression of competing eukaryotic algae might play a role in bloom formation. Start by providing an overview of cyanobacterial blooms: which genera are common bloom-formers, what features of these genera foster bloom formation, what physical and biological conditions foster bloom formation, and what effects do blooms have on other organisms? Segue to a discussion of the evidence for possible allelopathic effects and how this might happen in nature. Discuss evidence from the Dunker et al. (2017) article “A fateful meeting of two phytoplankton species...”; an investigation that employed a trebouxiophyte green alga. Does this information aid the prevention of cyanobacterial blooms or help to comprehend their biological effects?

7. The chlorophycean green algal genus *Chlamydomonas* is widely known as a model photosynthetic eukaryote in cell biology. Begin by surveying the structure, ecology, and relationships of *Chlamydomonas*, following with comments about how widely information obtained from *Chlamydomonas* can be extrapolated. Discuss how *Chlamydomonas* has been used to understand the genetic basis of photosynthesis, flagellar function, and light receptors. Focus upon cryptochrome and then the methods and findings reported by Zou et al. (2017) “An animal-like cryptochrome controls the *Chlamydomonas* sexual cycle.” Evaluate the relevance of these observations to plant biology.

8. The streptophyte green algae include species regarded as closely related to land plants, and therefore are useful sources of information about how plant traits originated. Begin with a survey of the streptophyte green algae, providing at least three examples of genera other than *Klebsormidium*. Describe features of those genera of interest to plant evolution. Then focus on the genus *Klebsormidium*; discuss what has been known about its structure, reproduction, ecology, relationships, and genomics. Focus on the Ohtaka et al. (2017) report “Primitive auxin response without TIR1 and Aux/IAA in the charophyte (meaning "streptophyte") alga *Klebsormidium nitens*.” What does this investigation reveal about the evolution of plant auxin response pathways?

9. The question of how diverse, related organisms (e.g. phytoplankton algae in a pond) co-exist has puzzled ecologists for decades. Discuss what has been known about co-existence of diverse phytoplankton species based on structural features. Describe investigations and hypotheses that have attempted to explain higher than expected species diversity. Consider the methods and findings of Narwani et al. (2017) “Ecological interactions and coexistence are predicted by gene expression similarity in freshwater green
algae.” How has the addition of molecular methods affected our understanding of freshwater phytoplankton community ecology? What are some caveats of this work (e.g. are lab bi-cultures adequate models of natural behavior in multispecies associations)?

10. Most people know that alien species are of global ecological concern, but few realize that humans play a major role in the spread of invasive algal species. Discuss what is known generally about invasive marine phytoplankton and macroalgal species. Provide at least 5 examples of algal species that can be invasive, and discuss their ecological impacts. Explain how humans have been involved in these species’ spread. Use the Seebens et al. (2016) article “Predicting the spread of marine species introduced by global shipping” as an example of how people study the roles of human activities in the spread of invasive algal species.