Botany 330 Take-Home Final Exam

This exam is like the mid-term, so you already know what to do. But the instructions are repeated here for your convenience.

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! Sample essays written by past students will be posted as examples of correct level.

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 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 final exam due date (see syllabus).

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, in approximately equal amounts. 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information from three reliable sources is a good way to cross-check information and detect information that has become outdated.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.
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. Length and submission specifications. 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”.

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

IV. Deadlines. Draft essays are due on or before December 5 at 5 pm. Ten points will be deducted from the potential 100 points if all 5-6 drafts have not been turned in by this deadline.

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 December 12, in time to incorporate suggested modifications into the final version of all essays.

The final version of all final essays is due at the date and time scheduled for the final exam (see syllabus). Ten points will be deducted if any portion of the final exam is late. This is because instructors have deadlines for turning in grades.

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. 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.

The articles 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 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. We recommend printing out the document and posting it in your workspace for easy reference.
VI. Ethics and scholarly responsibilities. You must cite the article author(s) appropriately within your essays in this form: (Graham et al. 2013). 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 lectures or the textbook.

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 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; an alternative opinion can sometimes be justified. Essay content should be professionally unemotional. Personal opinion is fine if it can be justified by peer-reviewed literature. Personal attacks on authors (known as ad hominem attacks) are not acceptable.

Question 1. Discuss the evolutionary importance of the red algae, including their role in donating plastids to other eukaryotes. Discuss ongoing controversy surrounding the concept that red and green algae are sister lineages. Finally, summarize the article by Collen et al. (2013) “Genome structure and metabolic features in the red seaweed Chondrus crispus shed light on evolution of the Archaeplastida.” Discuss the findings of this research regarding cellulose synthase genes, differences between red and green algal cellulose synthesis, and relevance to the disputed evolutionary history of red and green algae. If you choose this question, don’t also answer Q2.

Question 2. Discuss the evolutionary importance of the red algae, including their role in donating plastids to other eukaryotes. Discuss ongoing controversy surrounding the concept that red and green algae are sister lineages. Summarize the article by Sturm et al. (2013) “A novel type of light-harvesting antenna protein of red algal origin in algae with secondary plastids.” Discuss the findings of this work in relation to the disputed evolutionary history of red and green algae. If you choose this Q, don’t also answer Q1.
Question 3. Survey the coralline red algae, explaining the major types and their ecological significance. Describe what is known about the process by which corallines become calcified. Summarize the Halfar (2013) article. “Arctic sea-ice decline archived by multicentury annual-resolution record from crustose red algal proxy.” Explain how calcification contributes to the utility of crustose red algae in recording past conditions.

Question 4. Discuss the ecological importance of ulvophycean green algae, focusing on their roles in marine systems versus freshwaters. Describe at least three examples of marine ulvophycean green algal genera that are thought to have moved from marine to freshwaters or terrestrial environments. Summarize the report of Zhu et al. (2013) “Phylogenetic position of Jaoa, a green algal genus endemic to China.” Discuss the ecological importance of habitat transitions of Jaoa and other ulvophyceans. What is the likelihood that Jaoa will continue to be endemic to China? What is the likelihood that more types of ulvophyceans actually live in freshwaters or on land?

Question 5. Describe at least three genera of green algae that have lost photosynthesis. What alternate nutritional paths have these taxa taken? Summarize the article by Pombert et al. (2014) “A lack of parasitic reduction in the obligately parasitic green alga Helicosporidium.” What insights does this work offer toward understanding the transition from autotrophy to heterotrophic nutrition?

Question 6. Survey the flagellar pattern variation that occurs in green algae, including position changes arising from evolution of different types of basal body organization. Provide two examples of green algal cells that possess more than two flagella. Focus on Chlamydomonas and what Geyer et al. (2013) report in “Cell-body rocking is a dominant mechanism for flagellar synchronization in a swimming alga.” Explain why Chlamydomonas is a good model system for this and other research.

Question 7. Describe features that distinguish the major classes of green algae. Describe features that link all green algae to plants. Summarize the Stirk et al. (2013) article “Auxin and cytokinin relationships in 24 microalgal strains,” which happen to all be green algae of different classes.

Question 8. Define the term “secondary compounds” and list several types of secondary compounds that algae produce. Focus on the secondary products known as flavonoids and their hypothesized functions. Discuss the findings of the Goiris et al. (2014) article “Detection of flavonoids in microalgae from different evolutionary lineages.” Why would these results be surprising to most plant biologists?

Question 9. Discuss the evolutionary divergence of the streptophyte algae and their importance to the evolutionary history of land plants. Focus on Klebsormidium, including discussion of its structure, reproduction, and habitats. Summarize the Hori
Question 10. Discuss the evolutionary divergence of the streptophyte algae and their importance to the evolutionary history of land plants. Focus on the Coleochaetales, including discussion of their diversity, structure, reproduction and habitats. Summarize the Doty (2014) article “Immunofluorescence localization of tubulin cytoskeleton during cell division and cell growth in members of the Coleochaetales (Streptophyta).” How does the cytoskeletal system of these algae resemble that of land plants, and how is it different?

Question 11. Discuss the evolutionary divergence of the streptophyte algae and their importance to the evolutionary history of land plants. Focus on the Zygnematales and Desmidiales, including discussion of their diversity, structure, reproduction, and habitats. Summarize the Sorensen et al. article “Stable transformation and reverse genetic analysis of Penium margaritaceum: a platform for studies of charophyte green algae, the immediate ancestors of land plants.” Explain the advantages of this organism for learning about the ancestry of land plants.

Question 12. Discuss the role of phytoplankton in carbon and silica cycling in marine systems, defining “carbonate oceans” and “silica oceans.” Describe the geo-engineering concept that fertilizing Southern Ocean phytoplankton with iron could be used to reduce concentration of carbon dioxide in Earth’s atmosphere and some of the concerns ecologist have about such efforts. Summarize the results of the Assmy et al. (2013) article “Thick-shelled, grazer-protected diatoms decouple ocean carbon and silicon cycles in the iron-limited Antarctic Circumpolar Current.” What does this work imply about results of iron fertilization?

Question 13. Discuss the mineral requirements of algae (including carbon dioxide), and then focus on those of open-ocean marine diatoms. Discuss the ecological importance of marine diatoms, and how they might be affected by nutrient limitation. Summarize the findings of the Thamatrakoln et al. (2013) article “Death-specific protein in a marine diatom regulates photosynthetic responses to iron and light availability.” Include a discussion of cyclic electron flow in your summary.

Question 14. Describe the mineral requirements of algae (including carbon dioxide). Discuss concerns that some experts have expressed about the impacts of rising atmospheric carbon dioxide levels on marine phytoplankton populations. Summarize the article by Trimborn et al. (2014) “Photophysiological responses of Southern Ocean phytoplankton to changes in CO2 concentrations: Short-term versus acclimation effect.”

Question 15. Discuss differences in mineral limitation of phytoplankton growth in freshwater versus marine systems. Focus on evidence that mineral nutrients affect the food quality of marine phytoplankton of various types. In these contexts, summarize the Bi et al. (2014) article “Linking elements to biochemicals: Effects of
nutrient supply ratios and growth rates on fatty acid composition of phytoplankton species.”

Question 16. Describe the types of terrestrial habitats that algae inhabit and the types of algae known to occur in terrestrial habitats. Discuss how the algae survive drought. Text chapter 23 focuses on these topics, and though there will not be a lecture specifically on chapter 23, terrestrial algae are covered throughout the course and that material should be included. Summarize the results of the study by Lin et al. (2014) “Tolerance of soil algae and cyanobacteria to drought stress.”

Question 17. Formulate a question of your own that relates to lecture material presented since the first exam, and for which the answer must incorporate relevant textbook information and at least one recent, peer-reviewed article. If you choose this option, please discuss the topic and proposed article with instruction before starting to write.