

## Botany 330 Take-Home Final Exam

These essay questions are designed to foster integrative thinking and your ability to comprehend the peer-reviewed literature. Each of your answers should combine relevant material from the lectures and textbook with content from a particular very recent publication.

Recent publications pertinent to the questions below are provided in pdf form on the lab computer from which they can be downloaded to a flash drive, and in hard-copy form that should remain in the classroom. You should cite the publication author(s) appropriately within the essay (e.g. Kim et al. 2006) and at the end (authors, date, title, journal name, volume, pages). You are not expected to obtain additional information in order to answer these questions, 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. Information that has not been peer-reviewed is not acceptable. Much website information has not been peer-reviewed, so consult instructor before including it. Collaboration in your writing of essays is specifically prohibited.

Undergraduates should answer any 5 of the questions listed below; graduate students should answer 6 questions. You should start working on this exam as soon as possible after finishing the midterm exam. It is not advisable to wait until close to the due date (the date scheduled for course final exam).

Because this is a Comm. B course for undergraduates, drafts are expected for pre-grading, which is required to receive full points. It is fine to turn in draft essays one at a time, and you might consider submitting them well ahead of the due date. Pre-draft outlines and multiple drafts are also welcome and will be expeditiously edited. Drafts of the first midterm must be received at the latest a week before the exam due date. Drafts will be returned in time to allow revisions.

Drafts and final answers should be double-spaced with 12-point type, but legible handwritten drafts or answers are acceptable. Please turn in hard copy (rather than electronic files; there are reasons). Printing on both sides of the paper is fine for the final version, but drafts should use only one side so that editorial marks don't bleed through. Most answers should be two-three pages in length. Please read the editorial issues document on the course website before starting to write. Write generic and species names in proper scientific form (italicized or underlined; first letter of generic name capitalized).

1. Briefly discuss the diversity and phylogeny of red algae. Focusing on the Cyanidiales, discuss their tendency to occupy extreme environments and include material from the Qin et al. paper on arsenic cycling (PNAS, 2009).
2. Briefly describe the diversity and phylogeny of green algae, then focus on prasinophytes, including information from comparative genomic analyses, among them the Worden et al. paper (Science, 2009).

3. Briefly outline what is known about chlorophycean (as opposed to prasinophycean, ulvophycean, trebouxiophycean, or charophycean) phylogeny. Then focus on the genus *Volvox* and its use in understanding the evolution of multicellularity, including information from the Herron et al. paper (PNAS, 2009).
4. Briefly summarize what is known about ulvophycean phylogeny, then focus on the genus *Cladophora* and its ecological roles in marine and freshwaters. Include a discussion of the use of FTIR spectroscopy to evaluate the chemical constitution of *Cladophora* cells in the Murdock et al. paper (Vibrational Spectroscopy, 2008).
5. Survey the utility of the genus *Chlamydomonas* for understanding the molecular basis of eukaryotic photosynthesis and flagellar structure and motion. Include material from the Polin et al. paper (Science, 2009).
6. Briefly survey what is known about charophycean algae and their importance as the closest protistan relatives of land plants. Then focus on how these algae contribute to our understanding of the origin of the plant cell wall, including the first appearance and distinctive biochemistry of plant and charophycean cellulose. Also cite material on hemicelluloses from the Fry, et al. paper (The Plant Journal, 2008).
7. Describe what is known about phytoplankton and periphyton communities of humic lakes. Summarize the factors that limit the growth of humic lake algae, including light limitation as discussed by Karlsson et al. (Nature, 2009) and relevant algal adaptations.
8. Briefly describe the controversy surrounding predictions about responses of calcifying organisms to increasing ocean acidity, arising from higher atmospheric carbon dioxide content. Then focus on research performed with coccolithophorids grown in lower than normal pH and why responses of calcified haptophytes are important, citing results from the Iglesias-Rodriguez et al. paper (Science, 2008).
9. Briefly survey the physical forces that influence phytoplankton distribution in aquatic habitats. Then focus on the study by Durham, et al. (Science, 2009), summarizing it and explaining why it is important.
10. Explain why trait-based ecology is useful and particularly relevant to phytoplankton, with the use of the Litchman and Klausmeier paper (Annual Review of Ecology and Systematics, 2008).
11. Describe the ecological importance of kelp forests. Then focus on the work of Graham et al. (PNAS, 2007) on newly discovered deep water kelp populations.
12. Describe the roles of cyanobacteria in diverse terrestrial ecosystems. Include material from the Rehakova et al. paper on desert soil cyanobacteria (Phycologia, 2007), describing methods used to characterize cyanobacterial communities.