

Botany 330 Take-Home Midterm 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 Information that has not been peer-reviewed is not acceptable. Much website information has not been peer-reviewed, so consult instructor before including it.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. It is not advisable to wait until close to the due date (the same day as the lab exam) to start writing answers, because you will need that time to study for the lab 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. 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. Discuss iron limitation of phytoplankton growth in the oceans and proposals to use iron fertilization to reduce the greenhouse impacts of carbon dioxide. Include a summary of the results of the ocean experiments described in the paper by Pollard, et al. (Nature, 2009).
2. Discuss the diversity of algal pathogens and their impacts on algal blooms, and proposals to use biotic agents to reduce blooms. Include a summary of the results described in the paper by Chambouvet et al. (Science, 2008).

3. Describe major molecular tools that are used in algal biology, including material on gene silencing from the Molnar, et al. paper (The Plant Journal, 2009).
4. Discuss the use of algae to produce renewable biofuels, including material from the Hu, et al. paper (The Plant Journal, 2008).
5. Describe how molecular sequence information is used in algal systematics and evolutionary studies. Include a synopsis of the Gribble and Anderson paper (Phycologia, 2007).
6. Describe the function of algal light harvesting pigments and proteins, including content from the Guskov et al. paper on cyanobacterial photosystem II (Nature Structural and Molecular Biology, 2009).
7. Discuss the role of horizontal gene transfer (including massive transfers occurring during endosymbiosis) in algae. Include material from the Moustafa et al. paper on green algal genes in diatoms (Science, 2009).
8. Discuss evidence for and against a single event of single primary and secondary endosymbiosis in the origin of major algal lineages. Include material from Kim and Graham (PloS One, 2008).
9. Discuss the biogeochemical significance of *Emiliania* blooms in ocean waters. Include material from the Frada et al. paper (Proceedings of the National Academy of Sciences of the USA, 2008).
10. Discuss mixotrophy (including particle feeding) in early-diverging haptophytes, including material from the Liu et al. paper (PNAS, 2009).
11. Describe the role of endosymbiotic dinoflagellates in the biology of reef-forming corals, including material from the Voolstra et al. paper (Molecular Ecology, 2009).
12. Discuss the role of silicon in the biology of diatoms and global biogeochemistry, including results of the Rabosky and Sorhannus study (Nature, 2009).
13. Describe the evolutionary history of diatoms, including information on diatom genome sequences. Include material from the review by Armbrust (Nature, 2009).
14. Discuss kleptoplastidy, the collection and use by organisms of plastids obtained from algal cells. Include a summary of the results described by the Rumpho et al. paper on *Vaucheria* and sea slugs (PNAS, 2008).
15. Discuss the use of genetic information obtained from algae to make ecological inferences, including results of the Fraser et al. study on kelp biogeography (PNAS, 2009).