Bio 350M/388M Plant Molecular Biology Fall 2002
Exam I, September 26

Please answer 10 of the following 12 questions. They are all worth about 10 points. Please be as complete, but to-the-point as possible. You may draw diagrams if you wish but do not provide diagrams alone for an answer without explanatory text. **You may also write on the back of the pages if necessary.**

1. Describe the overall structure, size, and coding capacity of a typical chloroplast genome from an angiosperrm (or higher plant).

2. Discuss the endosymbiotic hypothesis for the formation of eucaryotic cells, making sure to include the origin of chloroplasts. Name a few features of chloroplasts and/or mitochondria that support this hypothesis. Finally, can we see results of the endosymbiotic process ongoing in some recently evolved (say, within the last 50 million years) plants?

3. What is secondary endosymbiosis? What kinds of organisms show it? Could this process be extended to produce a photosynthetic animal? Are there any animals that do photosynthesis?

4. Distinguish between *cis* splicing and *trans*-splicing in plant organelles. Give an example of each. Do they involve the same types of introns? Are these examples likely to be recently evolved or ancient gene states?

5. What is meant by lateral or horizontal DNA transfer? How do organelle introns fit into this topic? Why might they be particularly likely to undergo lateral transfer? What plant genome(s) seem to be particularly prone to receiving DNA laterally?

6. Why do some experts consider group II introns to be the likely precursors to nuclear mRNA introns? You should describe the group II splicing mechanism as part of your answer and anything else that invokes a parallel with splicing of nuclear mRNA introns.

7. Discuss the types of genes that are usually found in chloroplast genomes. Give a few examples. Explain the nomenclature system.

8. What is the Shine-Dalgarno sequence? What is its function? Where is it found? Does it have a role in chloroplast and/or plant mitochondrial translation?

9. What proteins were found in the complex that binds to the 5' untranslated region of the *psbA* mRNA, and what are their roles? How is *psbA* translation regulated by light and dark? Why is this regulation useful?

10. What happens to photosynthesis at very high light intensities? Why does this invoke an increase in D1 synthesis? What is D1?

11. Discuss how, and at what levels, the nucleus could control gene expression in the chloroplast. How have mutants and/or transgenic plants provided evidence for nuclear gene control of specific organelle genes?

12. Describe 3 weird things about angiosperm mitochondrial DNA, genes, or gene expression, that do not apply to liverwort mitochondrial DNA.