**From hermaphrodites to males and females: Study guide and reading assignments**

***Required readings:***

Aryal and Ming. 2014. Plant Sci: 217-56-62.

1. Full paper
2. The degree of outcrossing is diagrammed in the class notes. Be able to define all terms used in this slide. Why is a continuum shown – starting to the right of 0% and to the left of 100%?
3. What lines of evidence point to the ancestral state of angiosperm flowers as being hermaphroditic?
4. Compare and contrast angiosperms and gymnosperms in terms of floral structure and resulting degree of heterozygosity.
5. Reflect on the basal condition of angiosperm flowers and pay close attention to the points in growth and development when different species selectively abort floral organs. What implications does timing of selective abortion have on manipulating the process to achieve self-fertility?
6. Briefly describe three benefits and three drawbacks to outcrossing. How do these benefits and drawbacks compare to those for sexual vs. asexual reproduction?
7. Explain how something as simple as floral architecture can affect the degree of outcrossing.
8. Where in/on a plant does the self-incompatibility reaction occur?
9. Using the terms “n” and “2n” explain the differences between gametophytic and sporophytic incompatibility.
10. Based on the *Brassica* example provided, briefly explain the structure of the S locus in terms of numbers of loci and numbers of alleles. Why is the S locus a “complex locus”? Why is the term “haplotype” used in the context of the S locus?
11. Compare general definitions of self-incompatibility and male sterility in the context of perfect flowers.
12. Define moneoecy. How simple is it to make maize into a plant with perfect flowers? Is the example give likely to show quantitative or qualitative inheritance?
13. In natural ecosystems, what advantages are there to a plant like *Corylus* combining monoecy and self-incompatibility?
14. What challenges does self-incompatibility pose to breeding hazelnuts (filberts)? What tools do breeders/geneticists have to deal with self-incompatibility? How do farmers deal with self-incompatibility in this species?
15. What is diagnostic of an incompatible reaction in hazelnut and what does this have to do with double fertilization? Why might hazelnut breeders want to clone the “S” locus?
16. How many alleles are currently known at the S locus in hazelnut? Why (or why not) is it theoretically possible that there are new S alleles yet to be discovered (or engineered)?
17. Define dioecy. How does an X, Y sex determination system ensure ~ = numbers of males and females? What distinguishes a Y chromosome from an X chromosome?
18. Why is suppression of recombination an important consideration for evolution of sex chromosomes?
19. What roles do dioecy and ploidy play in hop breeding? In hop production?
20. Hops are dioecious, and female plants are desired for commercial production. Currently male and female plants cannot be distinguished during juvenile growth. What are the prospects of being able to track a single allele with a molecular marker to select seedlings based on their sex?
21. What are “feminized” seeds in *Cannabis*? Why are they economically valuable and how are they created?
22. Do you think it would be an economically viable breeding objective to develop apomictic, feminized seeds? Why or why not?
23. Explain how and why doubled haploids are used to produce super male asparagus.
24. Compare and contrast male sterility and self-incompatibility in terms of underlying genetic mechanisms and consequences for self-pollination in a hermaphroditic plant.
25. Why would make sterility be valuable in agriculture/horticulture and perhaps not so valuable in a natural ecosystem?
26. Define the acronym “CMS” and explain which cytoplasmic organelle is frequently associated with male sterility.
27. What is the role of genes in the nucleus in a CMS system?
28. Why are producers of hybrid seed interested in male sterility?
29. What is the genetic basis of male sterility and fertility restoration in rice?
30. Be able to explain the CMS hybrid seed production systems shown in the lecture slides.
31. If the female parent for hybrid seed production is sterile, how is seed of this parent maintained from year to year?
32. What were the pros and cons of the “T” cytoplasm for hybrid seed production in maize?
33. Why, or why not, is genetic vulnerability a phenomenon limited to T-cytoplasm CMS in corn?

**The following questions relate to the assigned reading by Aryal and Ming**.

1. In the abstract, the authors identify key points regarding unisexuality in plants in terms of evolution, regulation, and mechanism. Rephrase these key points, in your own words.
2. How many flower types are found in papaya?
3. What is epigenetics and how does it related to sex determination in papaya?
4. Why is papaya proposed as a model system for studying sex determination in plants?