

PLSC 731
Plant Molecular Genetics
Spring 2016
Exam 1
Due: March 24, 2016, 11am

Exam Rules:

- a. Prior to answering the following questions, you can study any class materials (notes, papers, etc). You can have the three papers with you when you are studying
- b. Once you have decided to answer the questions, you must put away all of your study materials. You are **NOT ALLOWED** to use those study materials when you answering the questions.
- c. If you do not understand these rules, **PLEASE CONTACT DR. McCLEAN**. If you do use study materials while answering the questions, your grade will be reduced 50%.
- d. Sign the statement at the bottom of this page, and submit it when you turn in your exam.

1. Molecular geneticists are always looking for additional markers. This is especially true for those working in species with limited genomic resources. Cabrera et al. (2009) describe the development and utility of COS (conserved orthologous set) markers. Very carefully read this paper, and develop an essay that addresses the following issues in this order: a) What is the value of COS markers for within family analysis? b) Describe the steps involved in developing COS markers. c) Discuss the evidence from this paper that demonstrates that COS markers are useful as a within family research tool. d) Do these experiments provide sufficient evidence to support this claim? e) How can these markers be used for synteny studies beyond a within family comparison? **(25 points)**

2. Watermelon is an important economic crop that includes members of seven different *Citrullus* species. Zhang et al. (2016) performed a molecular analysis of a large collection of *Citrullus* genotypes. 1) Provide a **thorough** summary of the experimental and statistical approaches used by the research team, and 2) discuss their results in the context of plant breeding. **(25 points)**

3. The powdery mildew is a major disease of wheat. As such, it has been the focus of intense genetic analysis to understand the genetic control of the disease. Ma et al. (2015) describe the discovery of a new powdery mildew resistance gene. Summarize the genetic experiments the group used to map the gene. The summary should describe all of the experimental tools, procedures, and results that allowed them to place the gene within an interval on chromosome arm 5DS. Finally, describe how the team determined this resistance gene is not the same as others mapped previously. **(30 points)**

4. Create a table that lists all molecular markers discussed in class, the advantages and disadvantages of each, and the type of inheritance for each marker. Include the COS markers from question 1 above. **(20 points)**

References

- Cabrera, A., Kozik, A., Howad, W., Arus, P., & Iezzoni, A. F. (2009). Development and bin mapping of a Rosaceae Conserved Ortholog Set (COS) of markers. *BMC Genomics*, 10(1), 1.
- Ma, P., Xu, H., Xu, Y., Li, L., Qie, Y., Luo, Q., ... & An, D. (2015). Molecular mapping of a new powdery mildew resistance gene Pm2b in Chinese breeding line KM2939. *Theoretical and Applied Genetics*, 128(4), 613-622.
- Zhang, H., Fan, J., Guo, S., Ren, Y., Gong, G., Zhang, J., ... & Xu, Y. (2016). Genetic diversity, population structure, and formation of a core collection of 1197 *Citrullus* accessions. *HortScience*, 51(1), 23-29.

I have never received nor given aid in completing this exam. _____