PLSC 731
Plant Molecular Genetics - Spring 2020
Exam 1
<u>Printed Copy Due</u>: March 13, 2020, 12 pm in Dr. McClean's office
10% DEDUCTION FOR LATE SUBMISSION

Exam Rules:

a. Prior to answering the four questions, you can study **ANY** class materials (notes, papers, interweb resources). You can have the three papers and exam with you when you are studying
b. You are **NOT ALLOWED** to use any study materials when you answering the questions. You **CAN** use the three research papers when answering the questions.
c. **PLEASE CONTACT DR. McCLEAN** if you do not understand these rules. Your grade will be reduced 50% if you use study materials while answering the questions.
d. Each answer is limited to one page. Font: 12pt, Times Roman; 1 inch margins all around.
e. Sign the statement at the bottom of this page, and submit it when you turn in your exam.

1. An abundant source of molecular markers is essential for modern plant molecular genetics. For many parts of the world, where SNP technologies are prohibitively expensive, gel-based markers are preferred. InDel (or insertion/deletion) markers are one such class or markers, and a collection of those markers were developed for chickpea by Jain et al. (2019). Develop an essay that discusses features of the paper in the following order: a) the methodology used to develop the chickpea InDel markers; b) justification for selecting InDel markers where alleles differ 20 bp; and c) evidence that shows the marker set is useful. (**25 points**)

2. *Camelina sativa* is seen as a potential sustainable plant-based source of oil for biofuels. The level of genetic diversity of *C. sativa* must be assessed to suggest that it is variable enough to improve by modern plant breeding technologies. Read the Luo et al. (2019) paper carefully, and develop an essay that addresses these topics in the following order: a) what technical procedures did the research team use to assess genetic diversity? b) discuss the statistical methods and criteria used with those methods to assess the level of diversity within the diversity panel and consider the correctness of the conclusions with regards to genetic diversity; c) based on the level of diversity described in the paper, how successful do you believe *C. sativa* breeders will be in improving the crop. (**25 points**)

3. Powdery mildew severely impacts production of wheat in China and elsewhere in world. Therefore, molecular tools that enable marker-assisted selection is a high priority for wheat geneticists and breeders dealing with this disease. Wu et al. (2018) describe research aimed at mapping a resistance gene that protects Chinese wheat lines against Chinese isolates that cause wheat powdery mildew. Develop an essay that: a) details the methodology used (including the genetic populations, genetic analyses, and genomic tools) and an assessment of the appropriateness of the methods; b) present the evidence used to determine the causative gene is located on chromosome 2AL; and c) describe the molecular nature of one of the genes located in the candidate gene interval. (**30 points**)

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

References

Jain et al (2019) InDel markers an extended marker resource for molecular breeding in chickpea. PLoS One https://doi.org/10.1371/journal.pone.0213999

Luo et al (2019) Genetic diversity and population structure of a *Camelina sativa* spring panel. Frontiers in Plant Science 10:184.

Wu et al (2018) Development of molecular markers linked to powdery mildew resistance gene Pm4b by combining SNP discovery from transcriptome sequencing data with bulked segregant analysis - BSR-Seq - in wheat. Frontiers in Plant Science 9:95.

I have not received nor given aid in completing this exam. _____