PLSC 731 - Plant Molecular Genetics
Exam 2 – 2022

Points: 100 pts

Due: Tuesday, May 10, 2022; 12:00 pm (Submit by e-mail to: phillip.mcclean@ndsu.edu).

Rules: You CANNOT DISCUSS this exam with anyone else or give assistance to anyone else. You can use ANY resource you would like while studying for and writing the exam. All answers must be entirely your own; no direct quotes from any source are allowed. All answers must use the following format: MS Word (NO pdf) format; Times Roman, 12 point font; one-inch margins all around; double space between paragraphs.

1. Describe in detail the approach you use to review a professional, peer-reviewed manuscript. Explain your reasons for this approach? What criteria do you use to determine the value of a manuscript? (**15 points; ½ page maximum**)

2. Compare QTL mapping using a biparental population and a genome-wide association study. Include a discussion of the experimental steps for each and how the two approaches can be useful when used together to address a research problem. What are the advantages and disadvantages of the two mapping approaches? (**15 points; maximum ½ pages**)

3. Develop a definition of the word "gene". Your definition should include components based on classical Mendelian genetic theory, modern molecular theory base on the Central Dogma of Molecular Genetics, and our knowledge of genetics based on genomics research. Your definition should not reference specific research results but rather consist of the higher order concepts that are derived from that basic research. (**20 points; definition: maximum of 75 words; supporting narrative (if you feel it is necessary: maximum of 150 words**)

4. The duplication history of plant genomes is a major theme in plant evolution that also informs plant molecular genetics and biology. Develop an essay that discusses the topic in the following order. A) How was it discovered that plants have a genome duplication history? B) Summarize the general theory regarding the duplication history of both dicots and monocots. C) Describe the possible functional changes that duplicated genes can undergo and the consequences of duplications on plant form and function. D) Lastly provide a research approach that utilizes what is known about the evolutionary history of two related species to develop a marker linked to a gene of interest in your species. (**20 points; maximum 1 page**)

5. Plant genetics and molecular genetics research has evolved over the recent past. New marker technologies and new genetic mapping approaches are significantly changing how scientists approach the problem of understanding the genetic control of important traits. These new tools and discoveries are also changing how selection is practiced for plant improvement. Write an ***integrative essay*** that compares and contrasts historical and recently emerging plant molecular genetic techniques and tools. Also describe how these have been used to understand the genetic factors controlling important agricultural traits. In addition, describe how the new and emerging techniques may be used in applied plant genetics. ***Provide at least one example from the literature (along with accompanying details) to illustrate the change***. You can reference any source you feel is appropriate, although you do not have to provide a reference list. (**30 points; maximum 1 page**)