BIOL 352 (Section 201): Final Exam Study Guide and Review questions

FINAL EXAM: TIME: 7:00 PM-9:30 PM; DATE: APRIL 20, 2016;
LOCATION: BIOSCIENCE 2000 (PLEASE NOTE A CHANGE IN THE LOCATION)

Final Exam Study Guide:

The final exam will cover material covered up to the last lecture on April 6th and will also include the pre-midterm and tutorial material.

- You are responsible for the reading material listed in the outlines for each lecture, and the material provided in the lecture notes, tutorials, and labs. Be prepared to integrate the learning material from various sources.
- The Study Questions given in the lectures and tutorials are a good way to review most of the topics covered. Reading in the text and assigned papers is designed to expand upon and support this material
- Emphasis will be placed on understanding of general concepts, experimental approaches, and ability to interpret new information and data in light of what you know.
- You should supplement your class notes with details and questions from the textbook, reading assignments and the BIOL 352 web site material.
- You are allowed to bring one-page, letter-sized, single-sided help sheet to the exam.

The final exam questions will test some of the objectives given below:

- Familiarity with terms, concepts, and basic principles covered in lectures. Ability to make connections between different topics covered.
- Problem-solving (e.g. explain experimental results which are presented, explain how to approach a particular problem, predict results from an experiment, etc). Ability to use information in new situations and to solve problems, depth of knowledge concerning basic concepts, understanding of approaches used to investigate plant physiology, plant development and plant cell biology and genetics.
- Ability to integrate information.
- Use of appropriate experimental methods/techniques to support hypotheses/results
- Ability to analyze a given set of data in the form of a Table or Figure pertaining to topics covered in lectures/tutorials.

Course Evaluation:

35% lab: based on written lab reports and attendance (evaluated by Dr. Santokh Singh and TAs)

5% Clicker questions

5% Quizzes/assignments

20% Midterm Exam (In-class) covering lectures 1-11: 50 min

35% Final exam – cumulative (April 20, 2016)

Final Exam Review questions:

Category I: Multiple-choice questions.

Category II: Short answer questions.

Some examples of review questions for the Final Exam:

Category 1: Multiple-choice questions.

1a. Expression of *SHORTROOT* RNA occurs in the stele but the SHORTROOT protein activates transcription of *SCARECROW* in the endodermis. Which of the following experiments is best suited to show this non-cell autonomous activity of SHORTROOT?

A. Immunofluorescence labelling SCR.
B. Use the SHR Promoter to drive *GUS* expression.
C. Western (protein) Blotting of SHR.
D. Use the SHR promoter to drive *SCR-GFP* expression.
E. Use the SHR promoter to drive *SHR-GFP* expression.

1b. Pick 2 of the wrong answers from Q1a and describe why they are wrong.

2. Which of the following statements is incorrect?

A. The *knotted1* mutation is a gain-of-function mutation identified in Maize.
B. *KNOTTED* expression is the strongest in new leaf primordial.
C. *KNOTTED1* is a homeobox domain family protein.
D. There are many homeobox domain family protein members involved in meristem establishment.
E. *knotted1* was identified by excessive cell proliferation in leaves.

3a. The *sln1c* mutant barley is a GA response mutant. Which one of the following statements about the *sln1c* mutant is incorrect?

A. The *sln1c* mutant is a GA constitutive mutant.

B. The *sln1c* mutant has a mutation in the GRAS repressor domain.
C. The *sln1c* mutant shows a loss-of-function of the repressor protein.
D. The *sln1c* mutant has a mutation in the DELLA domain.
E. The *sln1c* mutant is taller than WT.

3b. Discuss the reasons why other answers are wrong.

4. Which of the following statements about ABA is incorrect?

A. ABA is a 15-carbon compound synthesized from a carotenoid intermediate.
B. ABA shares its biosynthesis pathway with three other plant hormones: cytokinins, gibberellins and brassinosteroids.
C. ABA is inactivated by oxidation to form phaseic acid and dihydrophaseic acid.
D. The ABA deficient *vivpary14 (vp14)* mutant of maize exhibits enhanced seed dormancy.
E. ABA represses GA-induced expression of GAMYB in barley seed.

5. Which of the following statements about ethylene signaling is incorrect?

A. The carboxy-terminal half of ethylene receptors is related to bacterial two-component system histidine kinases.
B. A copper ion cofactor is required for high affinity binding of ethylene to its receptors.
C. In the absence of ethylene, both the ethylene receptors and CTR1 (*c*onstitutive *t*riple *r*esponse 1) act as negative regulators of the ethylene response pathway.
D. The recessive *ctr1* mutant of Arabidopsis exhibits a constitutive ethylene response in the absence of ethylene.
E. CTR1 acts downstream of EIN2 (*e*thylene *in*sensitive2).

Category II: Short answer questions.

1. Describe a simple bioassay method for detecting BR activity. How would you use this bioassay to determine the BR concentration in anthers of pea flowers?

2. Seeds of GA-insensitive Arabidopsis mutants fail to germinate in the presence or absence of GA. However, BR (24-epiBL) promotes seed germination of such mutants. In addition, BR reverses the inhibitory effect of ABA on seed germination. From these experimental observations, predict the most likely action of BR in seed germination.

3. How would you distinguish between the following ethylene mutants?
   (A) Ethylene-biosynthesis and ethylene–response mutants
   (B) Ethylene-insensitive and ethylene–constitutive mutant?

4. Explain why a mutation in only one of the three GA receptor genes, *GID1a, GID1b, and GID1c* does not affect either stem length or the anther development, whereas mutations in all three genes (triple mutant) produce dwarf and male sterile plants.

5. What is the physiological significance of multiple ABA receptors?

6. How does ABA increase the concentration of cytosolic ABA in stomatal guard cells? What is the role of cytosolic calcium in ABA-induced closure of stomatal guard cells?

7. The triple cytokinin receptor-knockout Arabidopsis mutant, *ahk2/ahk3/cre1* is cytokinin-insensitive and displays a marked decline in growth of both root and shoot due to a decrease in cell division. However, partially cytokinin-insensitive mutants (e.g. single-receptor mutants) show root and shoot growth similar to the wild-type plants. Explain?

8. How does the auxin activated promoter-reporter fusion gene expression assay method function in determining the endogenous levels of auxin?

9. Explain why the BR biosynthesis mutants (*det2* and *cpd*) and sensitivity mutants (*bri1*) grow much slower than wild-type *Arabidopsis thaliana* plants?

10. Design a simple experiment to show that brassinolide (BL) and IAA exhibit a synergistic effect in promoting lateral root formation in *Arabidopsis thalian*a plants.

11. What are the key similarities and differences between the signalling mechanisms of ethylene and brassinosteroids?

12. Predict the phenotype of the following plants:
    a) *ctr1*
    b) *bri1*
    c) *det2*
    d) *vp14*

13. Explain how ABA antagonizes the action of GA in seed germination?