

## 2011 Plant Physiology Exam (for Department of Plant Pathology)

Total 100 pt.

Please write as much as you know for the following questions. If you forget the names for specific molecules, you may give the general names or even indicate them with X, Y, Z, etc. At least I know you understand the concepts.

1. Please describe the defense mechanisms, structurally, chemically, and molecularly, for plants against insect pests and pathogens. **(20 pt)**
2. Stomatal movements is one of the blue-light responses, please **diagram** to show the three distinct osmoregulatory pathways in guard cells, including potassium, sucrose, and starch. Please also **diagram** to show how stomatal aperture is affected by potassium and sucrose contents based on daily time changes. **(15 pt)**
3. Please **diagram** to show the tumor induction in dicot plants by *Agrobacterium tumefaciens*. **(10 pt)**
4. Ethylene is a plant hormone functioning in fruit ripening, flowering, root formation, environmental stress responses, and even defense responses. Please **diagram** to show the model of ethylene signaling in Arabidopsis, and also explain the two-component signaling system. **(10 pt)**
5. The ABC model may explain the determination of floral organ identity. Please **diagram** to show this model. Based on this model, a flower with multiple layers of petal could be obtained by simply inhibiting which type of gene? **(10 pt)**
6. Some plant pathogens compete iron with plants for nutrients, whereas mycorrhizal fungi exchange nutrient ions between host plant and the fungus. Please **diagram** to show the two processes (dicots vs. grasses) through which plant roots absorb iron. Please also **draw the longitudinal section** of the apical region of the plant root and indicate how the ectotrophic mycorrhizal fungi infecting the root. **(10 pt)**
7. Please **diagram** the pathways and explain how malic enzyme and PEP carboxylase provide plants with metabolic flexibility for the metabolism of PEP and pyruvate. **(10 pt)**
8. Please **diagram** to show the similarities of photosynthetic and respiratory electron flow in purple bacteria, chloroplasts, and mitochondria. **(15 pt)**