Case Studies & Problem Set: Application of Embryogenesis Concepts

Student Name: _____

CASE STUDY 1: Seed Storage and Viability

Scenario: A seed company, "GreenFuture Seeds," wants to extend the shelf life of their tomato seeds. They've noticed that after 2 years in storage, germination rates drop from 95% to 60%. Their current storage conditions are: room temperature (22°C), ambient humidity, and standard packaging.

Question 1: Based on your knowledge of seed dormancy and embryogenesis, what physiological factors within the seed contribute to loss of viability during storage?

Question 2: What specific storage conditions would you recommend to extend seed viability, and why? Consider temperature, humidity, and atmospheric conditions.

Question 3: How could the company test seed viability without waiting for germination results? Propose a laboratory method.

CASE STUDY 2: Agricultural Problem Solving

Scenario: A farmer notices poor germination in a new batch of corn seeds. Only 40% of seeds germinate, compared to the expected 90%. The affected seedlings that do emerge show stunted growth and abnormal development.

Question 1: Using your knowledge of monocot embryo structure, propose three possible defects that could have occurred during seed development to cause these symptoms.

Question 2: Which specific embryonic structures might be affected in the stunted seedlings? Explain how damage to each structure would manifest in growth abnormalities.

Question 3: What tests could the farmer conduct to determine the exact cause of the germination problem?

PROBLEM SET: Analytical Questions

Problem 1: Compare and contrast the nutritional strategies of albuminous and exalbuminous seeds. How do these differences affect seedling establishment and growth?

Problem 2: Explain the evolutionary advantage of having a dormant seed stage in the plant life cycle. Consider environmental factors, dispersal mechanisms, and competition.

Problem 3: A student examines a seed and cannot determine if it is monocot or dicot. The seed coat was damaged during collection. What internal features would you tell the student to look for to make this determination?

Problem 4: During germination, the radicle typically emerges before the shoot. What is the physiological and adaptive significance of this sequence?

Problem 5: Design an experiment to test the effect of light on seed germination. Include your hypothesis, experimental setup, control groups, and how you would measure results.

CRITICAL THINKING CHALLENGE

Scenario: Researchers discover a plant species whose seeds can remain viable for over 100 years. They want to understand the biological mechanisms behind this extreme longevity.

Challenge: Based on your knowledge of seed biology, propose three hypotheses that could explain this exceptional seed longevity. For each hypothesis, suggest an experimental approach to test it.

Submission Instructions

Complete all case studies and problems. Type your responses and submit through the LMS by the due date. Your responses should demonstrate clear understanding of plant embryogenesis concepts and their practical applications.

Grading Rubric:

- Accuracy of biological concepts (40%)

- Application to real-world scenarios (30%)
- Critical thinking and problem-solving (20%)
- Clarity and organization of responses (10%)

GBIO 100 - Developmental Biology Laboratory

Laboratory Exercise No. 4: Application Exercises - Due one week after lab completion