Case Study1: Evolutionary Trends in Invertebrates

Study the following scenario and answer the questions below:

A group of students collected different organisms from a pond. Specimen A has a body with pores and a canal system. Specimen B is radially symmetrical with cnidoblasts. Specimen C is dorso-ventrally flattened and triploblastic. Specimen D has a jointed exoskeleton made of chitin.

Q1. Identify the Phylum for Specimen A and mention the specific function of its canal system.

Q2. What is the functional significance of the "cnidoblasts" found in Specimen B?

Q3. Specimen C exhibits a specific body plan. What is the name of this plan, and why is this organism considered more advanced than Specimen B?

Q4. Specimen D belongs to the largest phylum of the Kingdom Animalia. Name the phylum and one respiratory organ found in its members.

Q5. Based on the evolutionary trend shown from Specimen A to D, explain how the complexity of the digestive system has changed.

Case Study: Diversity in Body Symmetry and Germ Layers

Study the following scenario and answer the questions below:

Organism P is aquatic, shows pentaradial symmetry as an adult, and has a water vascular system. Organism Q is a marine vertebrate with a cartilaginous endoskeleton, placoid scales, and lacks an operculum. Organism R is a bird with pneumatic bones and a four-chambered heart.

Q1. Identify the Phylum for Organism P and describe the primary function of its water vascular system.

Q2. To which class does Organism Q belong? Name the specific organ it uses for buoyancy.

Q3. Organism R is highly adapted for flight. Besides pneumatic bones, list two other adaptations that assist in its aerial mode of life.

Q4. Compare the symmetry found in the adult stage of Organism P with the symmetry typically found in the larval stage of organisms in the same phylum.

Q5. Explain the significance of the four-chambered heart found in Organism R in terms of physiological efficiency.

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Answer1 Specimen A belongs to Phylum Porifera. The canal system is essential for water transport, which brings in food, oxygen, and nutrients to the cells, while simultaneously removing metabolic wastes.

Answer2 Cnidoblasts (or cnidocytes) are specialized cells used for anchorage, defense, and the capture of prey. They contain stinging capsules called nematocysts.

Answer3 This is the acoelomate body plan (specifically belonging to Phylum Platyhelminthes). It is more advanced than Specimen B because it is triploblastic (having three germ layers) and exhibits bilateral symmetry and cephalization (the development of a head region).

Answer4 The phylum is Arthropoda. Respiratory organs in this phylum include gills, book gills, book lungs, or the tracheal system.

Answer5 The digestive system has evolved from intracellular digestion (in Porifera) to an incomplete digestive system with a single opening (in Cnidaria and Platyhelminthes) to a complete digestive system with two openings (mouth and anus) in more complex phyla like Arthropoda.

Case Study: Diversity in Body Symmetry and Germ Layers

Answer1 Organism P belongs to Phylum Echinodermata. Its water vascular system is critical for locomotion, capturing and transporting food, and respiration.

Answer2 Organism Q belongs to the Class Chondrichthyes (cartilaginous fishes). Unlike bony fish that use a swim bladder, these fish lack a specialized organ for buoyancy and must swim continuously to prevent sinking.

Answer3 Other adaptations include the presence of feathers (for insulation and aerodynamics) and the modification of forelimbs into wings.

Answer4 While adult Echinoderms exhibit radial symmetry (specifically pentaradial), their larvae exhibit bilateral symmetry.

Answer5 The four-chambered heart ensures complete separation of oxygenated and deoxygenated blood, which is essential for maintaining a high metabolic rate required for the high-energy demands of flight and endothermy.