

Case Study1: Diversity in Microorganisms and Protists

Study the following scenario and answer the questions below:

A microbiologist isolates three organisms from a water sample. Organism M is a unicellular, prokaryotic organism found in extreme saline conditions. Organism N is a unicellular, eukaryotic organism that acts as a primary producer in oceans. Organism O is a saprophytic fungus-like protist that forms an aggregation called 'plasmodium'.

- Q1. Identify the group for Organism M and state the specific structural feature that allows it to survive in extreme environments.
- Q2. Organism N is identified as a Chrysophyte. Name the two sub-groups it includes.
- Q3. Organism O is a Slime Mold. What happens to its 'plasmodium' during unfavorable conditions?
- Q4. Distinguish between the mode of nutrition of Organism N and a typical saprophytic fungus.
- Q5. Why was the Kingdom Protista created, and what makes it a "dumping ground" in biological classification?

Case Study2: Acellular Agents and Fungal Classification

Study the following scenario and answer the questions below:

A researcher studies a set of biological agents. Agent A is an obligate intracellular parasite containing genetic material protected by a protein coat. Agent B is a smaller, infectious agent consisting only of free RNA without a protein coat. Agent C is a multicellular fungus characterized by a coenocytic (multinucleate) mycelium and produces spores within a sporangium.

- Q1. Identify Agent A and Agent B. What is the fundamental difference in their structural composition?
- Q2. Agent C belongs to which class of Kingdom Fungi? Mention one characteristic feature of its hyphae.
- Q3. If Agent A infects a host, how does it differ from a living organism in terms of metabolic activity outside the host cell?
- Q4. Explain the difference between 'mycelium' and 'hyphae' in the context of fungi like Agent C.
- Q5. Why are prions considered more dangerous/stable than many viruses?

Case Study1: Diversity in Microorganisms and Protists

Answer1 Organism M belongs to Archaeobacteria. Its ability to survive in extreme environments (like high salinity) is due to a unique cell wall structure that lacks peptidoglycan, which provides resistance against harsh conditions.

Answer2: Chrysophytes include diatoms and golden algae (desmids).

Answer3: During unfavorable conditions, the plasmodium differentiates and forms fruiting bodies that bear spores at their tips. These spores possess extremely resistant walls, allowing them to survive for many years even under adverse conditions.

Answer4 Organism N (a photosynthetic protist) is autotrophic, manufacturing its own food using sunlight. A saprophytic fungus is heterotrophic; it secretes digestive enzymes into its environment to break down complex organic matter and then absorbs the resulting nutrients.

Answer5: Kingdom Protista was created to include all unicellular eukaryotic organisms. It is often called a "dumping ground" because its boundaries are not well-defined; it contains organisms that share characteristics with plants (photosynthetic), animals (heterotrophic), and fungi (saprophytic), making it a polyphyletic group.

Comparison of Prokaryotic vs. Eukaryotic Microbes

Feature	Archaeobacteria (M)	Chrysophytes (N)
Cell Type	Prokaryotic	Eukaryotic
Nuclear Membrane	Absent	Present
Cell Wall	Complex polysaccharides	Silica (in diatoms)

Case Study2: Acellular Agents and Fungal Classification

Answer1: Agent A is a Virus, and Agent B is a Viroid. The fundamental difference is that a virus possesses a protein coat (capsid) surrounding its genetic material, whereas a viroid consists of a low molecular weight RNA molecule that lacks a protein coat entirely.

Answer2: Agent C belongs to the class Phycomycetes. Its hyphae are aseptate and coenocytic, meaning they are continuous tubes filled with multinucleated cytoplasm.

Answer3: Outside a host cell, Agent A (the virus) is inert and possesses no metabolic machinery of its own. It cannot reproduce or carry out chemical reactions until it hijacks the machinery of a living host cell.

Answer4: A hypha is a single, thread-like filament that forms the body of the fungus, whereas the mycelium is the entire network or mass of aggregated hyphae that constitutes the fungal body.

Answer5 Prions are abnormally folded proteins that can induce misfolding in normal proteins. They lack nucleic acids and are remarkably resistant to standard sterilization methods (like heat or radiation) that would typically destroy the genetic material of a virus.