Question Set: Evidence of Common Ancestry and Diversity

Practice(s): Engaging in Argument from Evidence
Crosscutting Concept(s): Structure and Function
Disciplinary Core Idea(s): LS4.A Evidence of Common Ancestry and Diversity

1. The latest scientific evidence shows that cetaceans share common evolutionary ancestry with sheep, deer, and hippopotamuses. Is this research finding surprising to you? Why?

2. Convergent evolution
    a. Use your own words to define the term *convergence* in the context of evolution.
    b. What are some examples of convergent evolution in marine mammals?
    Answer for teacher's reference:
    Evolution of swimming appendages: Fins in pinnipeds, cetaceans, sirenians, etc.
    c. What are some examples of convergent evolution in other animal groups?
    Answer for teacher's reference:
    Evolution of wing structures in flying animals: Insects, pterosaurs (extinct), birds, bats, etc.

3. Does the term *marine mammal* provide any information about the group's evolutionary history? Explain your answer in detail.

Answer for teacher's reference:
The term *marine mammal* only tells us that marine mammals are all mammals and have the characteristics shared by all mammals. However, the term does not provide much useful information about the group's evolutionary ancestry. Similar to the terms "flying animals" (e.g., butterflies, bees, beetles, birds, bats, etc.) or "herbivores" (e.g., slugs, whales, surgeonfish, iguanas, etc.). These terms are useful for locomotion and diet function but not for questions of evolution.

4. Describe the evolutionary relationship between mammals and the following animal groups:
    a. Sea urchins and sea stars (phylum Echinodermata)
    b. Fish
    c. Reptiles

Answer for teacher's reference:
a. Mammals and echinoderms are both animals. More specifically, they are both deuterostomate animals (vs. protostomate animals like arthropods, nematodes, molluscs, annelids, and most other invertebrates). Mammals

and echinoderms are in different animal phyla, phylum Chordata and phylum Echinodermata, respectively.

b. Mammals and fish are both chordate animals (phylum Chordata). Furthermore, they are both vertebrates. However, fish are not tetrapods. Tetrapods (amphibians, reptiles including birds, and mammals) evolved from lob-finned fishes.
c. Mammals and reptiles are both animals, deuterostomes (or deuterostomate animals), chordates (phylum Chordata), vertebrates, and tetrapods. They are also both amniotes or animals with membrane-containing eggs. Early mammals evolved from a branch of reptiles (synapsids). All other synapsid groups have gone extinct except for mammals.