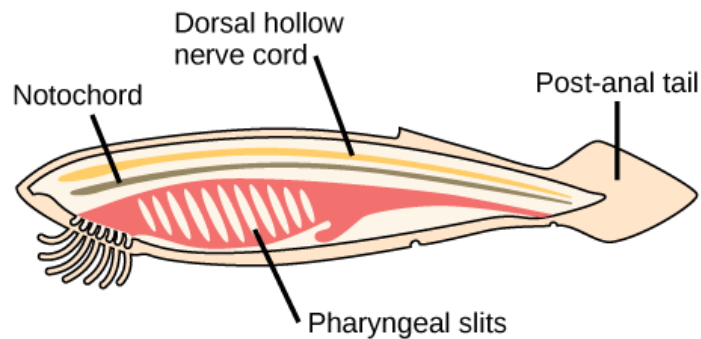


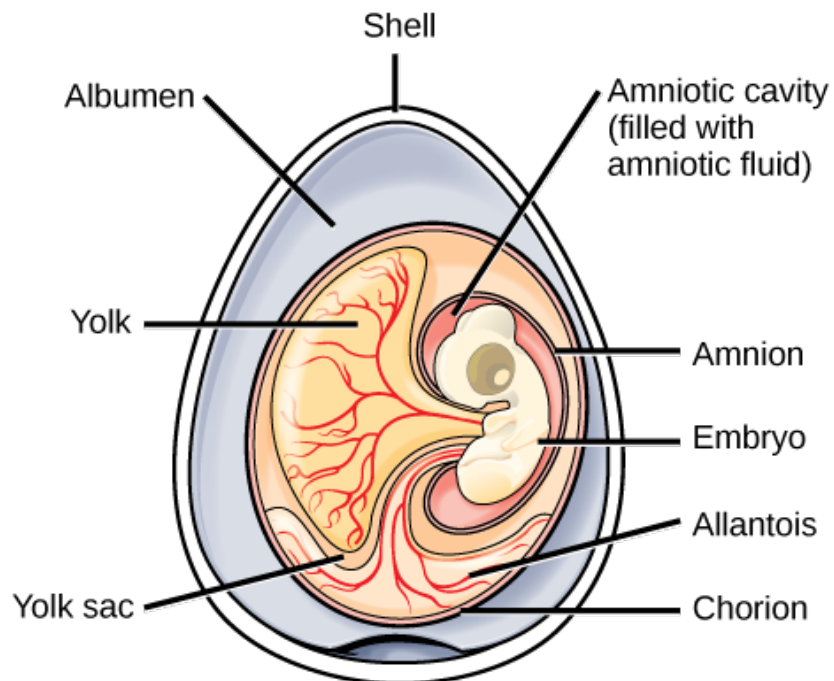
BiologyUnit 5: **Biological Diversity**Chapter 29: **Vertebrates****Visual Connection Questions**

1. Which of the following statements about common features of chordates is true?



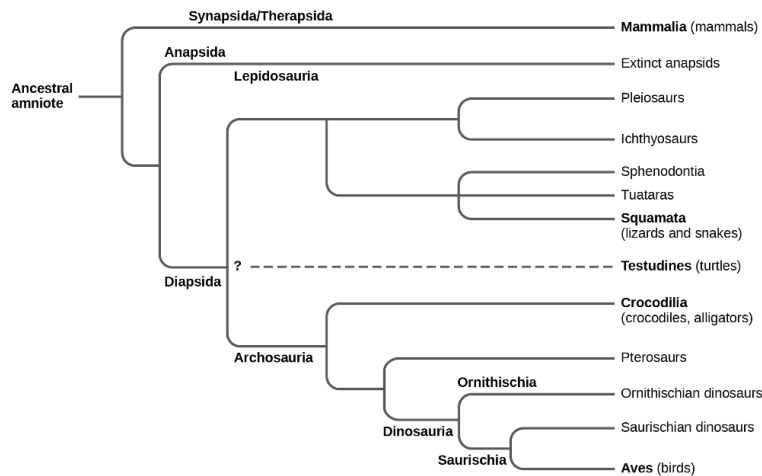
a. The dorsal hollow nerve cord is part of the chordate central nervous system.

2. Which of the following statements about the parts of an egg are false?



d. The amniotic cavity is filled with albumen.

3. Members of the order Testudines have an anapsid-like skull without obvious temporal fenestrae. However, molecular studies indicate that turtles descended from a diapsid ancestor. Why might this be the case?



The ancestor of modern Testudines may at one time have had a second opening in the skull, but over time this might have been lost.

Review Questions

4. Which of the following is not contained in phylum Chordata?

b. Echinodermata

5. Which group of invertebrates is most closely related to vertebrates?

a. cephalochordates

6. Hagfish, lampreys, sharks, and tuna are all chordates that can also be classified into which group?

a. Craniates

7. Members of Chondrichthyes differ from members of Osteichthyes by having a _____.

c. cartilaginous skeleton

8. Members of Chondrichthyes are thought to be descended from fishes that had _____.

b. a bony skeleton

9. A marine biologist catches a species of fish she has never seen before. Upon examination, she determines that the species has a predominantly cartilaginous skeleton and a swim bladder. If its pectoral fins are not fused with its head, to which category of fish does the specimen belong?

b. Osteichthyes

10. Which of the following is not true of *Acanthostega*?

d. It laid shelled eggs.

11. Frogs belong to which order?

a. Anura

12. During the Mesozoic period, diapsids diverged into_____.

c. lepidosaurs and archosaurs

13. Squamata includes_____.

d. lizards and snakes

14. Which of the following reptile groups gave rise to modern birds?

d. Archosaurs

15. A bird or feathered dinosaur is _____.

b. *Archaeopteryx*

16. Which of the following feather types helps to reduce drag produced by wind resistance during flight?

d. contour feathers

17. Eccrine glands produce _____.

a. sweat

18. Monotremes include:

d. platypuses

19. The evolution of which of the following features of mammals is hardest to trace through the fossil record?

b. Mammary glands

20. Which of the following is *not* an anthropoid?

a. lemurs

21. Which of the following is part of a clade believed to have died out, leaving no descendants?

a. *Paranthropus robustus*

22. Which of the following human traits is not a shared characteristic of primates?

b. Detection and processing of three-color vision

Critical Thinking Questions

23. What are the characteristic features of the chordates?

The characteristic features of the phylum Chordata are a notochord, a dorsal hollow nerve cord, pharyngeal slits, and a post-anal tail.

24. What is the structural advantage of the notochord in the human embryo? Be sure to compare the notochord with the corresponding structure in adults.

The notochord is a flexible structure that provides support for the embryo's body and formation of the neural tube. In the adults, the notochord has been replaced by the bony, rigid vertebral column. This loss of flexibility restricts the movement of adult humans, and would make it unlikely that the embryo would fit within the small space it is allotted inside the uterus.

25. What can be inferred about the evolution of the cranium and vertebral column from examining hagfishes and lampreys?

Comparison of hagfishes with lampreys shows that the cranium evolved first in early vertebrates, as it is seen in hagfishes, which evolved earlier than lampreys. This was followed by evolution of the vertebral column, a primitive form of which is seen in lampreys and not in hagfishes.

26. Why did gnathostomes replace most agnathans?

Evolution of the jaw and paired fins permitted gnathostomes to diversify from the sedentary suspension feeding of agnathans to a mobile predatory lifestyle. The ability of gnathostomes to utilize new nutrient sources may be one reason why the gnathostomes replaced most agnathans.

27. Explain why frogs are restricted to a moist environment.

A moist environment is required, as frog eggs lack a shell and dehydrate quickly in dry environments.

28. Describe the differences between the larval and adult stages of frogs.

The larval stage of frogs is the tadpole, which is usually a filter-feeding herbivore. Tadpoles usually have gills, a lateral line system, long-finned tails, and lack limbs. In the adult form, the gills and lateral line system disappear, and four limbs develop. The jaws grow larger, suitable for carnivorous feeding, and the digestive system transforms into the typical short gut of a predator. An eardrum and air-breathing lungs also develop.

29. Describe how metamorphosis changes the structures involved in gas exchange over the life cycle of animals in the clade Anura, and what evolutionary advantage this change provides.

Frogs (Anura) begin their lives as tadpoles, organisms restricted to an aquatic environment that use gills to breathe. After metamorphosis, most frogs develop lungs and lose their gills, although they will also continue to perform gas exchange through their skin. The lungs of an adult frog allow the animal to move out of the water, and become terrestrial. This limits competition between adults and tadpoles by opening new living space and food sources to the adult.

30. Describe the functions of the three extra embryonic membranes present in amniotic eggs.

The chorion facilitates the exchange of oxygen and carbon dioxide gases between the embryo and the surrounding air. The amnion protects the embryo from mechanical shock and prevents dehydration. The allantois stores nitrogenous wastes produced by the embryo and facilitates respiration.

31. What characteristics differentiate lizards and snakes?

Lizards differ from snakes by having eyelids, external ears, and less kinematic skulls.

32. Based on how reptiles thermoregulate, which climates would you predict to have the highest reptile population density, and why?

Reptiles are ectotherms, dependent on external sources to regulate their body temperature (i.e. their environment). The highest density of reptiles will therefore be in regions of the world with moderate temperatures, rather than areas that experience temperature extremes.

33. Explain why birds are thought to have evolved from theropod dinosaurs.

This is suggested by similarities observed between theropod fossils and birds, specifically in the design of the hip and wrist bones, as well as the presence of a furcula, or wishbone, formed by the fusing of the clavicles.

34. Describe three skeletal adaptations that allow for flight in birds.

The sternum of birds is larger than that of other vertebrates, which accommodates the force required for flapping. Another skeletal modification is the fusion of the clavicles, forming the furcula or wishbone. The furcula is flexible enough to bend during flapping and provides support to the shoulder girdle during flapping. Birds also have pneumatic bones that are hollow rather than filled with tissue.

35. How would the chest structure differ between ostriches, penguins, and terns?

Ostriches and penguins are flightless birds, but ostriches are entirely terrestrial while penguins dive and swim in the ocean to find food. Therefore, penguins and flight birds like terns have similar chest structures with a keel sternum and relatively large pectoral muscles (penguins use their wings to “fly” through water). Conversely, since ostriches move by running, they do not have a keel to their sternum. They also have smaller pectoral muscles than would be predicted for a flying bird their size, but have larger thigh muscles.

36. Describe three unique features of the mammalian skeletal system.

The lower jaw of mammals consists of only one bone, the dentary. The dentary bone joins the skull at the squamosal bone. Mammals have three bones of the middle ear. The adductor muscle that closes the jaw is composed of two muscles in mammals. Most mammals have heterodont teeth.

37. Describe three characteristics of the mammalian brain that differ from other vertebrates.

In some mammals, the cerebral cortex is highly folded, allowing for greater surface area than a smooth cortex. The optic lobes are divided into two parts in mammals. Eutherian mammals also possess a specialized structure that links the two cerebral hemispheres, called the corpus callosum.

38. How did the evolution of jaw musculature allow mammals to spread?

The muscles that close the jaw in mammals evolved to allow chewing to occur. Chewing meant mammals could now grind food with their teeth (molars), allowing them to eat a more diverse diet. This would have protected them in the event of a mass extinction (still have food sources available) and allow them to colonize new environments (consume new food sources). Chewing also allowed mammals to break down food into smaller pieces to speed digestion, reducing the time between consumption and energy extraction.

39. How did archaic *Homo sapiens* differ from anatomically modern humans?

Archaic *Homo sapiens* differed from modern humans by having a thick skull and a prominent brow ridge, and lacking a prominent chin.

40. Why is it so difficult to determine the sequence of hominin ancestors that have led to modern *Homo sapiens*?

The immediate ancestors of humans were *Australopithecus*. All people past and present, along with the australopithecines, are hominins. We share the adaptation of being habitually bipedal. The earliest australopithecines very likely did not evolve until 5 million years ago. The primate fossil record for this crucial transitional period leading to australopithecines is still sketchy and somewhat confusing. By about 2.5 million years ago, there were at least two evolutionary lines of hominins descended from early australopithecines.