Lesson 10 Learning Objectives
After completing this lesson, you should be able to:
Describe characteristics of chordates. Identify three subphyla of chordates. Identify seven classes within the subphylum Vertebrata. Describe why tunicates and lancelets are chordates, but not vertebrates. Describe how vertebrates differ from non-vertebrate chordates. Describe four characteristics of all fishes. Describe jawless fishes and jaw evolution in fishes. Compare the skeletons of cartilaginous fishes and bony fishes. Describe the evolutionary significance of lobe-finned fishes. Describe the functions of the swim bladder and lateral line in fishes. Give examples and describe five characteristics of amphibians. Compare the methods of fertilization, eggs and skin of reptiles vs. amphibians. Know fossil reptiles from which mammals and birds descended. Use the terms ectotherm, endotherm, homeotherm and poikilotherm to describe temperature regulation. Describe similarities and differences between birds and reptiles. Identify bird adaptations for flight. Identify two characteristics of all mammals. Compare monotremes, marsupials and placental mammals and give an example of each. Describe unique features of primates and hominids. Identify two genera of hominids and when each first appeared. Describe three traits that are unique among humans.

Step 1: Textbook Questions
To answer the questions below, read Chap. 35 pgs. 694 – 727. (Yes, it’s a long chapter.)

Also, look at the great posters we have on the walls in the Biology Learning Center!

35.2 The chordates
1. Name the four features that characterize the chordates (four characteristics that all chordates have at some time in their lives). Describe how each characteristic may be modified in vertebrates.
35.3 The nonvertebrate chordates

2. Identify the subphylum in which tunicates are classified. What is their habitat?

3. Describe how adult tunicates feed.

4. How do tunicates get their name?

5. Explain why we classify tunicates as chordates. How do larval and adult stages differ?

6. Identify the subphylum in which lancelets are classified. What is their habitat?

7. How do lancelets feed?

8. Explain why we classify lancelets as chordates.
35.4 The vertebrate chordates
9. Name the subphylum in which vertebrates are classified.

10. Describe the vertebral column and head of vertebrates.

11. Describe how vertebrates differ from other chordates with regard to internal organs.

12. Describe how vertebrates differ from other chordates with regard to the endoskeleton. Describe the advantages to having an endoskeleton.

35.5 Fishes
Note: Is it fish or fishes? When we talk about one individual of one species of fish, the singular is FISH. When we talk about several individuals of one species of fish, the plural is FISH. However, when we talk about several different species of fish, the plural is FISHES.

13. Name the most diverse and successful vertebrate group. How long ago did they appear, and what did they look like?
14. Name and briefly describe the five characteristics all fishes have in common.

**Note:** The book uses a more detailed classification for fishes than I think you need to know – please refer to Table 35.1 on page 700. I prefer to use the classification of **Class Agnatha for the jawless fishes, Class Chondrichthyes for the cartilaginous fishes, and Class Osteichthyes for the bony fishes.** Your book uses two classes for jawless fishes (Cephalaspidomorphi and Myxini) and two classes for the bony fishes (Actinopterygii and Sarcoterygii). You are **not** responsible for knowing the classes listed in your book.

15. Name and describe the two types of fishes in the Class Agnatha. Describe their habitat and feeding habits. (See Table 35.1)

16. Briefly describe the evolution of jaws in primitive fish. Describe how the jaws of cartilaginous and bony fishes are different than that of their ancestors.

17. Describe how the swimming design of cartilaginous and bony fishes is different than that of their ancestors. Your textbook no longer has this information! Cartilaginous and bony fishes are more streamlined, with the head acting as a wedge to cleave through the water, and the body tapering to the tail and creating very little turbulence. They also have mobile fins of better design, including fins for propulsion, stabilization, and as rudders and brakes.
18. Describe the common fishes in the class Chondrichthyes. Describe their skeleton, skin, and teeth.

19. Describe reproduction in the class Chondrichthyes.

20. Describe the skeleton of fishes in the class Osteichthyes. How many species of Osteichthyes exist today? [Remember from the note on the last page: Your textbook breaks the class Osteichthyes into two classes: Actinopterygii and Sarcopterygii.]

21. Describe the habitat of bony fishes. Where did they evolve?

22. Distinguish between ray-finned and lobe-finned fishes.

23. Describe the swim bladder in bony fishes.

24. Describe the lateral line system in bony fishes.
35.6 Amphibians
25. Name the common types of amphibians (class Amphibia).

26. Name the five characteristics of living amphibians.

27. Name five major adaptations that occurred that allowed vertebrates to successfully become terrestrial.

28. Describe the habitat of amphibians.

29. Describe reproduction in amphibians.

35.7 Reptiles
30. Describe the amniotic egg of reptiles. Describe why this is an evolutionary improvement over the amphibian egg. What classes of animals have an amniotic egg?
31. Describe the skin of reptiles. What are scales made of?

32. Describe how the breathing of reptiles differs from that of amphibians.

You do not need to learn all the names of all the fossil reptiles. However, you do need to know the main groups that gave rise to modern birds and mammals. Fill in the blanks below using the following groups of reptiles:
- pelycosaur
- therapsid
- dinosaur
- archosaur

33. Birds are descended from ____________, which are descended from __________.

34. Mammals are descended from ____________, which are descended from __________.

35. Describe how reptile eggs are fertilized. [Also note: most reptiles lay eggs, but a few bear live young.]

36. Explain how the circulatory system of reptiles is improved over that of fish and amphibians.
37. Compare and contrast the following terms: (See Chapter 42, p. 879)
Ectothermic and endothermic

Homeothermic and poikilothermic:

38. Use the terms above to describe reptiles and deep-sea fishes.

39. Describe the living groups of reptiles (class Reptilia). Describe their teeth and what they eat.

40. Explain why turtles have been successful for over 200 million years.

41. Describe the ways in which crocodiles resemble birds more than they do other living reptiles. Explain why crocodiles are still considered to be reptiles.
**35.8 Birds**
42. Describe the similarities and differences between birds (class Aves) and reptiles.

43. Describe the dual purpose of feathers, and describe how the skeleton of birds is modified for flight.

44. Name and describe the three main adaptations (other than feathers and hollow bones) than have enabled birds to cope with the heavy energy demands of flight.

**Note:** A few other important facts about birds: Birds eat a wide variety of food; some are carnivores, and some are herbivores. Birds have internal fertilization, and lay eggs.

**35.9 Mammals**
45. Describe the first two characteristics that are unique to mammals (class Mammalia), and how these characteristics help with survival.

46. In addition to hair and mammary glands, describe the other characteristics of modern mammals.
47. When did the first mammals appear? When did the "age of mammals" begin?

48. Describe the major differences between monotremes, marsupials and placental mammals? Give an example of each.

35.10 Evolution of primates
49. What are two distinct features of primates?

50. What distinguishes hominids from apes?

51. Which of the living apes is considered to be the most closely related to humans?

52. What are the two genera (plural of genus) of hominids?

53. Where and when the Australopithecines live?

54. When did the first Homo species evolve from Australopithecine ancestors?

55. How old is the oldest known fossil of Homo sapiens?
56. Humans have a large brain relative to our size. Name three things that humans do that other animals can’t.

**Step 2: Multimedia Activity**
Use the textbook publisher's website to complete the following activities. Don’t worry that the numbering is different than the units in your text – these activities are from a previous version of the text.

**48.4 – ESP – Fishes**
57. Jaws are thought to have evolved from what structures?

58. What was the first type of vertebrates on earth? How did these vertebrates feed?

59. Why are jaws an advantage?

60. What is the evolutionary significance of lobe-finned fishes?

**48.4 – ESP – Amphibians**
61. Name three amphibian adaptations to life on land.

62. What stages of the amphibian lifecycle occur strictly in water?

**48.4 – ESP – Reptiles**
63. Name two reptile adaptations to life on land.
48.4 – ESP – Birds
64. What characteristic of birds distinguishes them from other vertebrate classes?

65. Are birds homeotherms or poikilotherms?

48.4 – ESP – Mammals
66. What characteristics of mammals distinguish them from other vertebrate classes?

67. Describe the differences between monotremes, marsupials and placental mammals.

23.1 – ESP – Evolution of primates
68. What unique combination of traits differentiates primates from other animals?

69. What unique combination of traits differentiates humans from other animals?

23.4 – ESP – Hominid history
70. How old is the earliest hominid fossil? The fossil belonged to which genus?

71. When did the genus Homo evolve?

72. How long ago did modern apes and Homo sapiens share a common ancestor?
73. What is the “out of Africa” hypothesis and what evidence supports it?

**Step 6: Self-Quiz**
Exam 5 will cover lessons 8-10. Use the online self quiz to review material from lesson 10 to prepare for your exam.