

# Chapter 34

## Vertebrate Evolution and Diversity

- 1) Which of the following is NOT a shared characteristic of all chordates?
  - A) pharyngeal slits
  - B) postanal tail
  - C) notochord
  - D) dorsal, hollow nerve cord
  - E) four-chambered heart
- 2) Pharyngeal gill slits appear to have functioned first as
  - A) the opening to the digestive system or mouth.
  - B) suspension-feeding devices.
  - C) components of the jaw.
  - D) gill slits for respiration.
  - E) portions of the inner ear.
- 3) In which class did jaws first occur?
  - A) Agnatha
  - B) Chondrichthyes
  - C) Osteichthyes
  - D) Ostracodermi
  - E) Placodermi
- 4) Which chordate group is postulated to be MOST like the earliest chordates?
  - A) Cephalochordata
  - B) adult Urochordata
  - C) Amphibia
  - D) Reptilia
  - E) Chondrichthyes



- 5) A new species of aquatic chordate is discovered that closely resembles an ancient form. It has the following characteristics: external "armor" of bony plates; no paired fins; and a suspension-feeding mode of nutrition. In addition to these characteristics, it will probably have which of the following characteristics?
  - A) legs
  - B) nojaws
  - C) an amniotic egg
  - D) metamorphosis
  - E) endothermy
- 6) The most primitive hominid
  - A) may have hunted dinosaurs.
  - B) lived 1.2 million years ago.
  - C) closely resembled a chimpanzee.
  - D) walked on two legs.
  - E) had a relatively large brain.
- 7) What is one characteristic that separates chordates from all other animals?
  - A) true coelom
  - B) hollow dorsal nerve cord
  - C) blastopore, which becomes the anus
  - D) bilateral symmetry
  - E) segmentation
- 8) Which of the following is characteristic of all chordates?
  - A) a jointed endoskeleton
  - B) a ventral nerve cord
  - C) gills
  - D) a notochord
  - E) two pairs of appendages
- 9) How are primates different from all other mammals?
  - A) placental embryonic development
  - B) hairy bodies
  - C) naked faces
  - D) ability to produce milk
  - E) opposable thumbs in many species

- 10) With which of the following statements would a biologist be MOST inclined to agree?
- A) Humans and apes probably represent divergent lines of evolution from common ancestors.
  - B) Humans evolved from New World monkeys.
  - C) Humans have stopped evolving and now represent the pinnacle of evolution.
  - D) Apes evolved from humans.
  - E) Humans and apes are the result of disruptive selection in a species of Gorilla.

*For the following questions, match the characteristic or description with the class. Each choice may be used once, more than once, or not at all.*

- A. *Amphibia*
- B. *Aves*
- C. *Chondrichthyes*
- D. *Mammalia*
- E. *Reptilia*

- 11) Some members have a cartilaginous endoskeleton.
- 12) internal fertilization, amniotic egg, skin that resists drying, evolved in late Carboniferous
- 13) three major groups: egg-laying, pouched, and placental
- 14) includes salamanders, frogs, and toads
- 15) includes snakes, turtles, and lizards
- 16) 16) Which one of the following has a two-chambered heart?
  - A) Osteichthyes
  - B) Amphibia
  - C) Reptilia
  - D) Aves
  - E) Mammalia

- 17) Why is the term *cold-blooded* NOT very appropriate for reptiles?
- A) The keratinized skin of reptiles serves to insulate and conserve heat.
  - B) The scales of reptiles serve to dissipate excess body heat by reradiation to the environment.
  - C) Reptiles regulate body temperature by using various mechanisms such as behavioral adaptations.
  - D) Reptiles swallow large prey whole to provide enough food to generate body heat.
- 18) Structures that are made of keratin include which of the following?
- l. avian feathers
  - IT. reptilian scales
  - m. mammalian hair
- A) l only
  - B) IT only
  - C) l and IT
  - D) IT and m
  - E) l, IT, and m
- 19) From which of the following groups are snakes most likely descended?
- A) dinosaurs
  - B) plesiosaurs
  - C) lizards
  - D) crocodiles
  - E) synapsids
- 20) Which of the following statements about human evolution is CORRECT?
- A) Modern humans are the only human species to have evolved on Earth.
  - B) Human ancestors were virtually identical to chimpanzees.
  - C) Human evolution occurred by phyletic change within an unbranched lineage.
  - D) The upright posture and enlarged brain of humans evolved simultaneously.
  - E) Fossil evidence indicates that early anthropoids were arboreal, were cat-sized, and lived about 35 million years ago.
- 21) Which sequence of evolutionary relationships is consistent with the fossil record?
- A) reptiles → amphibians - birds - fishes
  - B) reptiles - birds - fishes - amphibians
  - C) fishes - amphibians - reptiles - birds
  - D) fishes - birds - reptiles - amphibians
  - E) reptiles - birds - amphibians - fishes

- 22) When did the first amphibians appear on Earth?
- A) Eocene epoch
  - B) Paleocene epoch
  - C) Precambrian era
  - D) Devonian period
  - E) Permian period
- 23) All of the following are reptilian characteristics EXCEPT
- A) ectothermy.
  - B) brachiation.
  - C) amniote egg.
  - D) keratinized skin.
  - E) conical teeth that are relatively uniform in size.
- 24) When did dinosaurs and pterosaurs become extinct?
- A) Cretaceous "crisis"
  - B) Permian extinctions
  - C) Devonian "disaster"
  - D) Phanerozoic eon
  - E) Hadean eon
- 25) Which of the following is the era known as the "age of reptiles"?
- A) Cenozoic
  - B) Mesozoic
  - C) Paleozoic
  - D) Precambrian
  - E) Cambrian
- 26) Which of the following structures is or are characteristic of vertebrates?
- A) open circulation
  - B) pharyngeal slits
  - C) dorsal, hollow nerve cord
  - D) A, B, and C are all correct.
  - E) B and C are both correct.

- 27) Which of the following statements about mammalian evolution is CORREa?
- A) Mammals evolved from reptilian stocks even earlier than birds.
  - B) The first mammals were large predators like the saber-tooth tigers.
  - C) Mammals did not coexist with the dominant dinosaurs.
  - D) The early mammals were most similar to small, bipedal, ratite birds.
  - E) Mammals evolved from the marsupials during the Pleistocene epoch.
- 28) Why is it thought that the Neanderthals contributed little to the gene pool of modern humanity?
- A) Recent studies of human and Neanderthal DNA show significant differences in base sequences.
  - B) The fossils found in the Neander Valley were a hoax and the "Neanderthals" never really existed.
  - C) Neanderthals had degenerated brain capacity and thus could not have contributed to human ancestry.
  - D) There is no evidence that Neanderthals were capable of walking upright or using tools.
  - E) Humans, the "naked apes," have nothing in common with the Neanderthals, the "hairy apes."
- 29) The amniote egg first evolved in which of the following groups?
- A) fish
  - B) birds
  - C) reptiles
  - D) amphibians
  - E) egg-laying mammals (monotremes)
- 30) Which of the following are the only modern animals that may have descended directly from dinosaurs?
- A) lizards
  - B) crocodiles
  - C) snakes
  - D) birds
  - E) mammals
- 31) Which of the following classifications would NOT apply to both dogs and humans?
- A) class Mammalia
  - B) order Primata
  - C) phylum Chordata
  - D) kingdom Animalia
  - E) subphylum Vertebrata

32) Humans and apes are presently classified in the same category at all of the following levels EXCEPT

- A) class.
- B) genus.
- C) kingdom.
- D) order.
- E) phylum.

33) Which of the following are NOT considered apes?

- A) gibbon
- B) gorilla
- C) lemur
- D) orangutan
- E) chimpanzee

34) Which of the following structures are possessed by birds only?

- A) enlarged pectoral muscles and a four-chambered heart
- B) light bones and a four-chambered heart
- C) feathers and carinate sternum
- D) a short tail and mammary glands
- E) a large brain and endothermy

The following questions refer to the phylogenetic tree shown in Figure 34.1.

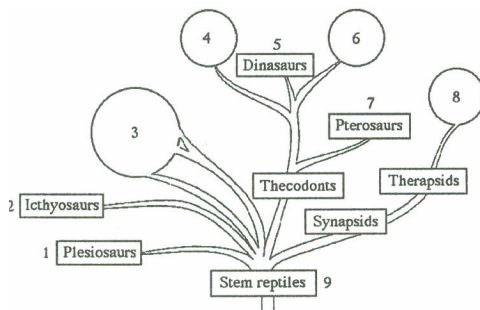


Figure 34.1

35) The organisms represented by 8 most likely are

- A) birds.
- B) all mammals.
- C) flying reptiles.
- D) modern reptiles.
- E) all mammals except humans.

- 36) Which organisms are represented by 6?
- A) birds
  - B) all mammals
  - C) flying reptiles
  - D) modern reptiles
  - E) all mammals except humans
- 37) Which number represents Coelosaurs?
- A) 3
  - B) 4
  - C) 6
  - D) 8
  - E) 9
- 38) Which pair of numbers represents extinct reptiles that had returned to an aquatic life?
- A) 1 and 2
  - B) 3 and 4
  - C) 5 and 7
  - D) 6 and 8
  - E) 7 and 9
- 39) Which pair of numbers most likely represents modern reptiles?
- A) 1 and 2
  - B) 3 and 4
  - C) 5 and 7
  - D) 6 and 8
  - E) 7 and 9



The next questions refer to Figure 34.2.

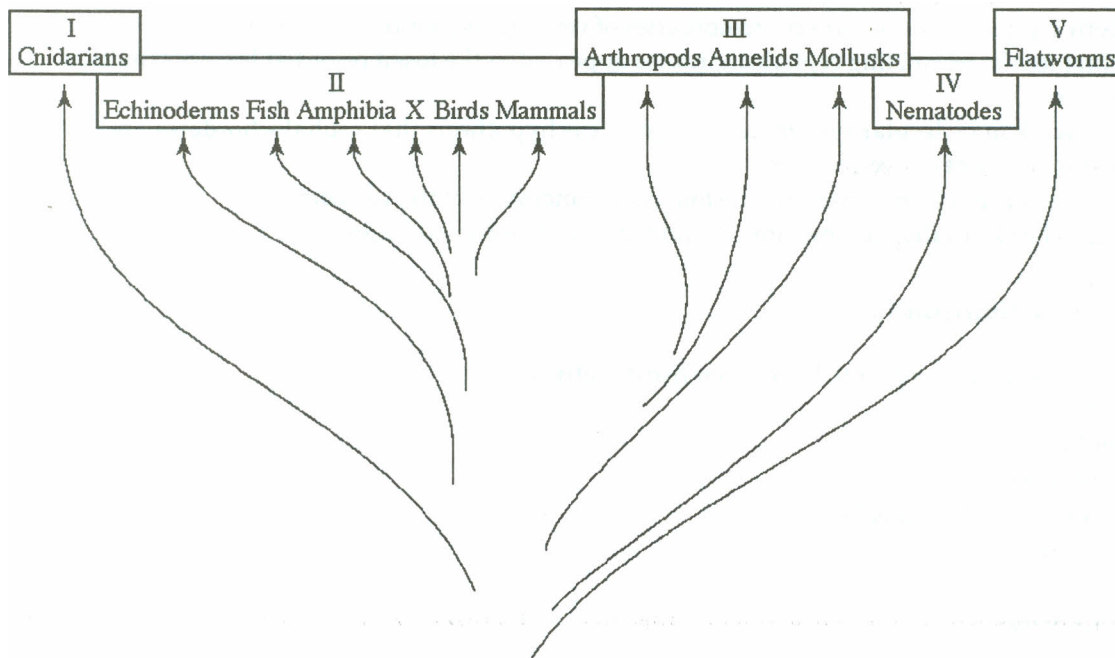


Figure 34.2

- 40) Which of the following is a CORRECT description of the class represented by X?
- A) endotherms; skin covered with feathers; embryo enclosed in protective membranes and a shell
  - B) endotherms; skin usually covered with hair; young nourished with milk secreted by the mother
  - C) ectotherms; skin usually covered with scales; embryo enclosed in protective membranes and a shell
  - D) ectotherms; naked skin; embryo not protected by membranes or a shell
  - E) ectotherms; bony skeleton; breathe by means of gills; usually have an air bladder
- 41) Excluding the echinoderms, all the animals in group II have which of the following characteristics in common?
- A) protostome embryo; coelom; radial symmetry; dorsal nerve cord
  - B) protostome embryo; no coelom; bilateral symmetry; ventral nerve cord
  - C) deuterostome embryo; coelom; bilateral symmetry; dorsal nerve cord
  - D) deuterostome embryo; pseudocoelom; asymmetry; ventral nerve cord
  - E) deuterostome embryo; no coelom; radial symmetry; dorsal nerve cord

42) Which of the following statements would be LEAST acceptable to most zoologists?

- A) **Modern cephalochordates are contemporaries of vertebrates, not their ancestors.** ~
- B) The first fossils resembling cephalochordates appeared in the fossil record at least 550 million years ago.
- C) Recent work in molecular systematics supports the hypothesis that cephalochordates are the closest relatives of the vertebrates.
- D) The modern cephalochordates are the immediate ancestors of the vertebrates.
- E) Cephalochordates display the same method of swimming as do fishes.

43) The lobe-finned fishes appear to have given rise directly to

- A) sharks.
- B) amphibians.
- C) stem reptiles.
- D) freshwater ray-finned fishes.
- E) placoderms.

44) The jaws of vertebrates were derived by the modification of

- A) scales of the lower lip.
- B) one or more gill arches.
- C) one or more gill slits.
- D) one or more of the bones of the cranium.
- E) one or more of the vertebrae.

45) The swim bladder of modern bony fishes

- A) both C and E below are correct.
- B) was modified from simple lungs.
- C) developed into lungs in some fishes.
- D) first appeared in sharks.
- E) provides buoyancy but at a high energy cost.

46) Bony fishes (Osteichthyes) originally evolved

- A) in a marine environment.
- B) directly from lampreys and hagfish.
- C) early in the Cambrian.
- D) directly from cephalochordates.
- E) in freshwater environments.

- 47) In which classes of vertebrates is fertilization exclusively internal?
- A) Chondrichthyes, Osteichthyes, and Mammalia
  - B) Amphibia, Mammalia, and Aves
  - C) Chondrichthyes, Osteichthyes, and Reptilia
  - D) Reptilia, Aves, and Mammalia
  - E) Mammalia, Aves, and Amphibia
- 48) Examination of the fossils of Archaeopteryx reveals that in common with modern birds it had
- A) both C and D are correct.
  - B) both D and E are correct.
  - C) a long tail containing vertebrae.
  - D) feathers.
  - E) teeth.
- 49) Differentiation of teeth is greatest in
- A) sharks.
  - B) bony fishes.
  - C) amphibians.
  - D) reptiles.
  - E) mammals.
- 50) A sheet of muscle called the diaphragm is found in
- A) both C and D below are correct.
  - B) both D and E below are correct.
  - C) birds.
  - D) mammals.
  - E) reptiles.
- 51) Which is NOT characteristic of all mammals?
- A) a four-chambered heart that prevents mixing of oxygenated and deoxygenated blood
  - B) give birth to live young (viviparous)
  - C) have hair during at least some period of their life
  - D) have glands to produce milk to nourish their offspring
  - E) have a diaphragm to assist in ventilating the lungs

- 52) Which of these is NOT a trend in primate evolution?
- A) enhanced depth perception
  - B) well-developed claws for clinging to trees
  - C) a shoulder joint adapted to brachiation
  - D) reduction of the number of young to a single birth at one time
  - E) a long period of parental care of offspring
- 53) The adaptation to arboreal life by early human ancestors can explain, at least in part, all of the following human characteristics EXCEPT
- A) limber shoulder joints.
  - B) dextrous hands with opposable thumbs.
  - C) excellent eye-hand coordination.
  - D) enhanced depth perception.
  - E) reduced body hair.
- 54) The major and dramatic alteration of hominid anatomy was primarily the result of
- A) an upright stance.
  - B) enlargement of the brain.
  - C) protracted postnatal development of offspring.
  - D) the development of speech.
  - E) the adoption of tool use.
- 55) *Australopithecus africanus* and *Homo habilis* differed in that
- A) All of the below are correct.
  - B) *Homo habilis* had a smaller brain.
  - C) *Homo habilis* was bipedal while *Australopithecus africanus* was not.
  - D) *Homo habilis* had an opposable thumb while *Australopithecus africanus* did not.
- 56) Based on current evidence, which of the following statements best describes the evolution of humans?
- A) Humans evolved from the chimpanzee.
  - B) Humans evolved in a single, orderly series of stages in which each stage became more advanced than its predecessor.
  - C) The various characteristics that we associate with humans evolved in unison over long periods of time.
  - D) Humans and apes diverged from a common ancestor about 6-8 million years ago.
  - E) Humans are more closely related to gorillas than to chimpanzees.

57) What is the single unique characteristic that distinguishes birds from other animals?

- A) a hinged jaw
- B) feathers
- C) an amniotic egg
- D) a superb sense of sight
- E) a gizzard

58) What are the most abundant and diverse vertebrates?

- A) bony fishes
- B) birds
- C) amphibians
- D) reptiles
- E) mammals

59) Which of these characteristics greatly added to vertebrate success on land?

- A) the amniotic egg
- B) the ability to maintain a constant body temperature
- C) two pairs of appendages
- D) claws
- E) a four-chambered heart

60) Which of these statements is a noted similarity between sharks and fishes?

- A) The skin is typically covered by flattened bony scales.
- B) They are both able to exchange gases while stationary.
- C) They are all great swimmers due to their flexibility.
- D) They both have a lateral line that is sensitive to changes in water pressure.
- E) A swim bladder helps control buoyancy.

61) How are the color patterns and awful taste of frogs advantageous?

- A) They help frogs avoid being eaten by predators.
- B) They increase gas exchange through the skin.
- C) They help attract a mate.
- D) They help regulate body temperature by reflecting and absorbing heat energy.

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62) Why do many reptiles thrive in deserts?

- A) Their bright coloration distracts enemies.
- B) A large number of prey and a limited number of predators are available in the desert.
- C) Their cartilaginous endoskeleton provides needed flexibility.
- D) The protein keratin helps prevent dehydration.
- E) They have an acute sense of sight.

63) What is/ are some consequences of cultural evolution?

- A) Deserts have been converted to farmland.
- B) The rate of extinction has increased dramatically.
- C) Humans have deterred the process of evolution.
- D) A and B are correct.
- E) A, B, and C are correct.

64) During the evolution of separate animal lineages, there has been a tendency for the maximum body size to increase. Why has this occurred?

- A) A more complex system that promotes more efficient use of metabolic energy has emerged.

- B) Adaptations usually result in better protection from predators.
- C) Most of the resulting lineages are carnivorous.
- D) Specializations for terrestrial living include adaptations for efficient gas exchange.
- E) Increased maternal care increases survival rate of offspring.

65) Which of these is NOT considered an amniote?

- A) amphibians
- B) reptiles
- C) birds
- D) mammals

66) Which of these is NOT a vertebrate?

- A) duck-billed platypus
- B) penguin
- C) salamander
- D) toad
- E) starfish



- 67) Why is the cartilaginous skeleton of sharks significant?
- A) It indicates that sharks are a primitive form of the bony fishes.
  - B) It is the result of a modification in the process that replaces cartilage with bone.
  - C) A cartilaginous skeleton gives the shark greater flexibility.
  - D) The resulting streamlined body maneuvers well in water.
  - E) The increased density causes a shark to sink if it stops swimming.
- 68) Why is the discovery of the fossil *Archaeopteryx* significant?
- A) It proves beyond reasonable doubt the phylogenetic relatedness of birds and reptiles.
  - B) It proves that birds are much older than we originally thought.
  - C) It provides evidence that mammals and dinosaurs coexisted.
  - D) It supports the idea that the first birds were ratites.
  - E) It proves that birds once had teeth.
- 69) What major factor makes the human position in animal evolution unique?
- A) A unique genetic composition facilitates the study of human evolution.
  - B) Humans have an extensive ability to manipulate their environment.
  - C) Use of historical knowledge helps to control extinctions.
  - D) Humans are so recent in origin that little evidence is available.
- 70) How would a biologist determine whether a fossil represents a reptile or a mammal?
- A) Look for the presence of milk-producing glands.
  - B) Look for the mammalian characteristics of a four-chambered heart and a diaphragm.
  - C) Because animals are eutherians, look for evidence of a placenta.
  - D) Use molecular analysis to look for the protein keratin.
  - E) Examine the teeth: Reptilian teeth are conical and uniform in size, while mammalian teeth have a variety of shapes and sizes.
- 71) Which of these statements about human evolution is TRUE?
- A) The ancestors of *Homo sapiens* were chimpanzees and other apes.
  - B) Human evolution has proceeded in an orderly fashion from an ancestral anthropoid to *Homo sapiens*.
  - C) The evolution of upright posture and enlarged brain occurred simultaneously.
  - D) Different features have evolved at different rates.
  - E) Mitochondrial DNA analysis indicates that modern humans are genetically very similar to Neanderthals.

- 72) It is often said that the present is the key to the past. What does this mean?
- A) Present observations guide the interpretation of evidence from the past.
  - B) A few teeth or bone fragments can be used to reconstruct the past accurately.
  - C) Phylogenetic relationships can be readily established using fossil evidence.
  - D) DNA from fossilized animals can be used to replicate extinct animals.
- 73) How does the study of urochordates and cephalochordates provide clues to the origin of vertebrates?
- A) It proves the hypothesis that chordate segmentation evolved independently of segmentation in annelids and arthropods.
  - B) The ample supply of fossil evidence enables biologists to retrace the origin of urochordates and cephalochordates.
  - C) Molecular studies indicate that cephalochordates and vertebrates evolved from a common sessile ancestor by adaptative radiation.
  - D) It supports the idea that a small number of genes may regulate development and thus influence evolution.
  - E) It indicates that chordate characteristics are present in both the larval and adult forms of urochordates and cephalochordates.
- 74) Why is the amniotic egg considered an important evolutionary breakthrough?
- A) It has a shell that increases gas exchange.
  - B) It allows incubation of eggs in a variety of places.
  - C) It prolongs embryonic development.
  - D) It provides insulation to conserve heat energy.
- 75) Which of these are characteristics of Phylum Chordata?
- A) notochord that provides skeletal support
  - B) a dorsal hollow nerve cord that develops into the central nervous system
  - C) pharyngeal slits that have become modified for gas exchange
  - D) a muscular postanal tail that contains skeletal elements and muscles
  - E) All of the above are characteristics of Phylum Chordata.
- 76) What is a distinctive feature of the class Chondrichthyes?
- A) an amniotic egg
  - B) unpaired fins
  - C) an acute sense of vision that includes the ability to distinguish colors
  - D) a cartilaginous endoskeleton
  - E) lack of jaws



- 77) The class Osteichthyes is characterized by
- A) a bony endoskeleton, operculum, and swim bladder.
  - B) a cartilaginous endoskeleton.
  - C) an amniotic egg.
  - D) teeth that are replaced regularly.
  - E) a maternal pouch called a marsupium.