

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) Ostracoderma
 - 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?
- 1. avian feathers
 - IT. reptilian scales
 - m. mammalian hair
- A) I only
- B) III only
- C) I and IT
- D) IT and m
- E) I, 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) Band 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.

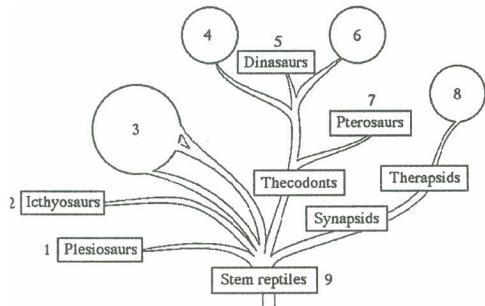


Figure 34.1

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 Cotylosaurs?

- 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.

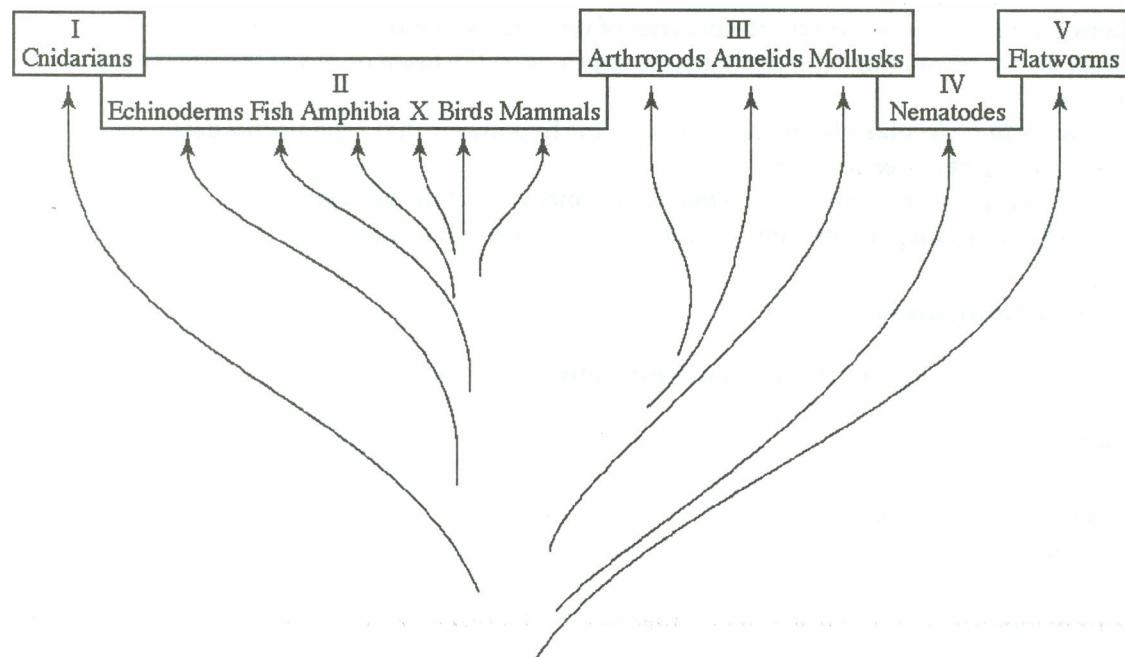


Figure 34.2

- 40) Which of the following is a CORRECT description of the class represented by X?
- endotherms; skin covered with feathers; embryo enclosed in protective membranes and a shell
 - endotherms; skin usually covered with hair; young nourished with milk secreted by the mother
 - ectotherms; skin usually covered with scales; embryo enclosed in protective membranes and a shell
 - ectotherms; naked skin; embryo not protected by membranes or a shell
 - 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?
- protostome embryo; coelom; radial symmetry; dorsal nerve cord
 - protostome embryo; no coelom; bilateral symmetry; ventral nerve cord
 - deuterostome embryo; coelom; bilateral symmetry; dorsal nerve cord
 - deuterostome embryo; pseudocoelom; asymmetry; ventral nerve cord
 - 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.



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- 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 dia phragm 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) dexterous 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.



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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 consequence(s) 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.

