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Chapter 2 Physiological Evolution of Animals

1) Which of the following is a parasitic protist that causes malaria?
A) *Paramecium*
B) slime mould
C) Platyzoa
D) *Plasmodium*
Answer: D
Page ref: 22

2) Which of the following characteristics apply to all protists?
A) They are animal-like.
B) They can photosynthesize.
C) They have a nucleus.
D) They have a cell wall.
Answer: C
Page ref: 22

3) Which protist is best described by its lifestyle?
A) *Euglen*a have features of animals and fungi.
B) *Paramecium* are ciliated hunters.
C) *Plasmodium* are free-living animal-like protists.
D) Amoebas are sedentary photosynthetic protists.
Answer: B
Page ref: 22

4) Which of the following pairs is correctly matched?
A) Choanoflagellates and Cnidarians
B) *Paramecium* and ciliated herbivore
C) ancestors of fungi and plants with no cell walls
D) choanocytes and flagellated cells in sponges
Answer: D
Page ref: 23

5) If multicellular organisms have distinct cell types, this means that
A) the different cell types express different genes.
B) each cell can be different.
C) some of the organism's cells will grow larger over time.
D) some cells will have cell walls and others won't.
Answer: A
Page ref: 23

6) In fungi and plants
A) the cell wall controls osmotic swelling.
B) the sodium-potassium pump regulates osmotic balance.
C) chemical messengers are not used to communicate.
D) collagen is used to build tissues.

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Answer: A
Page ref: 23-24

7) All animals
A) eat other animals.
B) are multicellular.
C) reproduce sexually.
D) are triploblastic.
Answer: B
Page ref: 24

8) The three cell types found in sponges are
A) cnidocytes, mesenchyme cells, and nematocyst cells.
B) choanocytes, mesenchyme cells, and pinacocytes.
C) choanocytes, cnidocytes, and nematocyst cells.
D) nematocyst cells, mesenchyme cells, and pinacocytes.
Answer: B
Page ref: 24

9) The first animals to show true tissues were
A) sponges.
B) placozoans.
C) cnidarians.
D) ctenophores.
Answer: C
Page ref: 24

10) One key advantage associated with bilateral symmetry in animals is
A) an increase in speed.
B) the presence of a coelom.
C) the evolution of limbs.
D) the evolution of cephalization.
Answer: D
Page ref: 25

11) In early gastrulation, a depression called a blastopore forms. If this blastopore forms the anus, the animals are referred to as
A) deuterostomes.
B) protostomes.
C) gastrostomes.
D) diploblasts.
Answer: A
Page ref: 25

12) Which of the following statements is correct?
A) In deuterostome animals, the blastopore becomes the mouth and the anus forms at a distant site.
B) In coelomate animals, the coelom is located between the endoderm and the mesoderm.
C) Arthropods show metamerism and tagmatization.
D) Deuterostomes include the arthropods, echinoderms, and chordates.

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Answer: C
Page ref: 25-28

13) Triploblastic animals are
A) acoelomate.
B) pseudocoelomate.
C) coelomate.
D) partially coelomate.
Answer: C
Page ref: 26

14) Platyhelminthes exhibit which of the following lifestyles?
A) free-living
B) free-living and ectoparasitic
C) ectoparasitic and endoparasitic
D) free-living, ectoparasitic, and endoparasitic
Answer: D
Page ref: 26

15) Platyhelminthes can live without a circulatory or respiratory system because
A) they rely on their digestive system.
B) they are dorsoventrally flattened.
C) the kidney excretes excess waste materials.
D) the epidermis secretes lubricants.
Answer: B
Page ref: 27

16) Which of the following statements best describes mollusks?
A) Mollusks include gastropods, bivalves, and cephalopods; they have a reduced coelom, and many move at a sluggish pace.
B) Mollusks include gastropods, bivalves, and cephalopods; many move at a sluggish pace, and all are aquatic.
C) Mollusks include gastropods and bivalves; several bivalves are terrestrial with adaptations to withstand severe dehydration.
D) Mollusks include gastropods and bivalves, have a mantle, and all are aquatic.
Answer: A
Page ref: 27

17) Which characteristics do annelids and arthropods have in common?
A) Both have feeding grooves.
B) Both exhibit metamorphosis.
C) Both are metameric.
D) Both have a chitin-based body covering.
Answer: C
Page ref: 27-28

18) Which of the following characteristics would be most beneficial for animals to successfully survive on land?

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A) The presence of a notocord and dorsal nerve cord.
B) The ability to undergo metamorphosis.
C) The presence of an open circulatory system.
D) The presence of an exoskeleton.
Answer: D
Page ref: 27-28

19) The most ancient deuterostomes are
A) annelids.
B) echinoderms.
C) mollusks.
D) arthropods.
Answer: B
Page ref: 28

20) Gans's and Northcutt's "new head" hypothesis proposes that
A) vertebrates have a diffuse nerve sensory system.
B) more complex teeth in the head evolved in response to a more predatory lifestyle.
C) the success of vertebrates was linked to specializations of the head.
D) B and C
Answer: C
Page ref: 28

21) Cartilaginous fish evolved from
A) agnathans.
B) placoderms.
C) ostracoderms.
D) lampreys.
Answer: B
Page ref: 29

22) Amphibians differ from other tetrapods in that amphibians
A) are much smaller.
B) have a more rigid spinal column.
C) depend on water for reproduction.
D) A and C
Answer: C
Page ref: 31

23) Which of the following animals are amniotes?
A) amphibians, mammals, birds, and reptiles
B) amphibians, birds, and reptiles
C) mammals, birds, and reptiles
D) birds and reptiles
Answer: C
Page ref: 31

24) Which of the following pairs is correctly matched?
A) modern mammals / anapsids

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B) all extant reptiles and birds / diapsids
C) extinct group of reptiles / synapsids
D) having one opening in the side of the skull / anapsids
Answer: B
Page ref: 31

25) In terms of reproduction, which group of mammals is most similar to their reptilian ancestors?
A) monotremes
B) marsupials
C) placental mammals
D) flying mammals
Answer: A
Page ref: 32

26) Which of the following statements correctly describes birds?
A) Birds are modern reptiles.
B) Birds differ from other reptiles in their thermal biology.
C) Birds are the only remaining representatives of the therapsids.
D) A and B
Answer: D
Page ref: 32

27) Birds and mammals are similar in that
A) both contain species that lay eggs.
B) both are endothermic.
C) both are part of a group of reptiles that includes the dinosaurs and crocodilians.
D) A and B
Answer: D
Page ref: 32

28) Would you expect gene duplication, such as seen in the *Hox* gene, to lead to significant changes in evolution of traits?
A) No, because a duplicated gene would most likely carry a deleterious mutation.
B) No, because a duplicated gene would be identical to the original gene and perform the original function.
C) Yes, because one gene would perform a specific function, but duplicated copies could perform new functions.
D) Yes, because the *Hox* gene controls all traits.
Answer: C
Page ref: 33

29) Which of the following statements is true with respect to myosin?
A) Plants, fungi, and animals share the same myosin families.
B) Myosin is found in all prokaryotes and eukaryotes.
C) Different classes of myosins are distinguished by differences in structural organization and amino acid sequence.
D) Cardiac α-myosin allows for greater contractile efficiency.
Answer: C
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30) Only certain organisms possess gene variants that are able to exchange Na^+ for K^+, thus making the Na^+/K^+ ATPase unique to
A) animals.
B) fungi.
C) plants and animals.
D) fungi and plants.
Answer: A
Page ref: 34

31) Collagen is best described as a(n)
A) intracellular matrix protein.
B) extracellular matrix protein and one of the earliest innovations observed in animals.
C) matrix protein that all animals have, with the exception of sponges.
D) intracellular matrix that is a basis for communication between cells.
Answer: B
Page ref: 35

32) In tetrapods, the steroid hormone, aldosterone, plays a role in
A) mineral balance.
B) water and vitamin balance.
C) mineral and vitamin balance.
D) water and mineral balance.
Answer: D
Page ref: 35

33) One of the biggest challenges facing terrestrial organisms is to
A) escape from predators.
B) survive food shortages.
C) reduce water loss.
D) find shelter.
Answer: C
Page Ref: 36

34) Which of the following organisms are able to thrive under the most diverse environmental conditions due to their remarkable biochemical adaptations?
A) prokaryotes
B) plants
C) fungi
D) invertebrates
Answer: A
Page ref: 36

35) Which of the following statements with respect to animals is correct?
A) In animals, anatomy and functional properties played a small role in their evolutionary success.
B) In animals, the ability to digest cellulose depends on symbiotic organisms.
C) There are few differences in metabolic rates among animals.
D) B and C

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Answer: B
Page Ref: 36

36) The _____ is considered to be the earliest life form.
Answer: progenote
Page Ref: 21

37) _____ are often called extremophiles, because they can survive in some of the harshest environments on earth.
Answer: Archaea
Page Ref: 21

38) The cell wall of fungi is composed of _____.
Answer: chitin
Page Ref: 23

39) The tissues of Cnidarians are termed _____ because they are derived from two embryonic body layers.
Answer: diploblastic
Page Ref: 24

40) The body plan of sponges is _____, while cnidarians are _____.
Answer: asymmetrical; radially symmetrical
Page Ref: 25

41) The body of annelids is divided into repeating segments called_____.
Answer: metamers
Page Ref: 27

42) In echinoderms and chordates, the mouth forms second; therefore, both are_____.
Answer: deuterostomes
Page Ref: 25, 28

43) The first group of vertebrates to successfully colonize land was the _____.
Answer: amphibians
Page Ref: 31

44) In reptiles and birds, the evolution of the _____ removed the dependence on water and allowed complete transition to life on land.
Answer: amniote egg
Page Ref: 32

45) Birds are most closely related to the group of reptiles known as _____.
Answer: archosaurs
Page Ref: 32

46) Which family of genes is involved in development?
Answer: *Ho*x
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47) Many eukaryotes have myosin 2, but only _____ use it to build muscle.
Answer: animals
Page ref: 33

48) The Na+/K+ ATPase enables animal cells to create an electrical potential across the_____.
Answer: cell membrane
Page Ref: 35

49) Aldosterone is a steroid hormone that is produced only in _____.
Answer: tetrapods
Page Ref: 35

50) Metabolic rate is measured as _____.
Answer: heat production per unit time
Page Ref: 36

51) We often hear the terms protists, protozoans, and metazoans; briefly explain the relationship among them.

Answer: When we think about the origin of animals, we often think of protists. Protists are single-celled, eukaryotic organisms that possess a membrane-bound nucleus and organelles. Protists are a very diverse group of distantly-related organisms, and hence assigned to more than 50 phyla. Some protists are animal-like and mobile, and because locomotion was considered a unique trait of animals, animal-like protists were once considered to be the ancestors of animals and were referred to as protozoans. Currently, the term protozoan has no meaningful evolutionary basis. The term metazoan was originally created to differentiate single-celled protozoans from multicellular animals. "Metazoan" and "animal" are often used synonymously.

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52) List the four key morphological traits that characterize all chordates. Discuss the important physiological transitions from early chordates to Craniata and their evolutionary implication.

Answer: All chordates have a notochord, dorsal nerve cord, postanal tail, and pharyngeal slits. When we compare early chordates to Craniata, we see several physiological transitions such as an increase in the complexity of the nervous system, the formation of a larger brain, a backbone derived from the notochord, an endoskeleton with the cranium, segmented muscles, and large blood vessels. The filter-feeding pharyngeal structures in lancelets and tunicates evolved into a diversity of structures, including gills of fish, jawbones, ear bones, muscles, nerves, and blood vessels. The evolution of these structures resulted in an extensive diversity of vertebrates.

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53) From an evolutionary perspective, briefly explain why amphibian physiology provides an important link between aquatic and terrestrial organisms.

Answer: Amphibians are intermediate between fish and reptiles in several ways. For example, amphibian larvae are aquatic and breathe via gills, just like fish. When in water, adult amphibians face similar osmotic challenges as do freshwater fish. Unlike fish, adult amphibians use lungs to breathe on land, may also use their skin as a gas-exchange surface, and excrete urea as a waste product. We see similarities between amphibians and reptiles when it comes to skeletons and muscles: Land tetrapods require more robust skeletons and musculature to support their bodies on land. Some amphibians, such as toads, have evolved a thickened body covering to avoid

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desiccation. Reptiles are even better adapted to dry conditions, having evolved tough scales to prevent water loss.
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54) Why is the sodium-potassium pump so important in the animal kingdom?
Answer: The sodium-potassium pump is also known as Na^+/K^+ ATPase. It is unique to animals because only animals possess the gene variants that can exchange Na^+ for K^+. In animal cells, the sodium-potassium pump creates an electrical potential across cell membranes and maintains the membrane ion gradients that are critical for the function of neurons and muscles. Sodium-potassium genes also allow for adaptations in relation to osmoregulation. For example, some species of fish can change the expression of their Na^+/K^+ ATPase genes when they change environments, thus allowing them to successfully move between freshwater and salt water at specific times in their life cycle.
Page Ref: 33-35

55) Discuss the evolutionary connection between bilateral symmetry and cephalization in animals.
Answer: As organisms became more complex, this complexity was associated with an increase in cephalization. Very early animals had simple nervous systems with little centralization for processing information. Bilaterally symmetrical animals show a concentration of sensory and nervous tissue in the anterior parts of their bodies. With the evolution of bilateral symmetry, animals were able to move in a forward direction, using the sensory anterior end to locate food or sense threats. For example, arthropods, which are bilaterally symmetrical, have a distinct head region that processes extensive sensory information. Vertebrates show even more extensive cephalization. In mammals, for example, the brain and central nervous system control breathing, feeding, reflexes, thermoregulation, and movement.
Page Ref: 36

56) Describe some key physiological adaptations that allowed animals to successfully colonize terrestrial environments.
Answer: Animals had to evolve physiological adaptations to successfully invade terrestrial environments. Desiccation is a risk for all land organisms, therefore, adaptations to conserve water were critical. Animals also had to overcome the challenge of controlling their internal osmolarity, independent of the external environment. Animals evolved a body surface that would prevent water loss (e.g., reptilian scales). An excretory system used to expel nitrogenous wastes out of water was also an important adaptation for land animals. When water was no longer available for support, skeletons and muscles evolved to allow locomotion on land. In addition, respiratory systems to exchange gases on land became a requirement for successful survival on land.
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