

Test Bank

to accompany

Animal Physiology, Fifth Edition

Hill • Cavanaugh • Anderson

Chapter 1

Animals and Environments: Function on the Ecological Stage

Multiple Choice

1. Which statement about the discipline of physiology is *false*?

- a. It is a key discipline for understanding how animals change over Earth's history.
- b. It is a key discipline for understanding the fundamental biology of all animals.
- c. It is a key discipline for understanding human health and disease.
- d. It is a key discipline for understanding the health and disease of nonhuman animals.

Answer: a

Textbook Reference: Chapter 1 Introduction

Learning Objective: 1.0.1 Explain the meaning of the statement that physiologists study “how animals work.”

Bloom's Level: 5. Evaluating

2. Which one of the following would be the most reasonable method of calculating how much energy a bird would require for a migration?

- a. Tracking a bird for the duration of the migratory path and estimating its energy usage over that distance
- b. Using a wind tunnel to measure metabolic rate at various flight speeds, then using that information to estimate energy usage during the migration
- c. Measuring resting metabolic rate in a lab setting and calculating its exercise rate to estimate total usage during the migration
- d. Measuring oxygen consumption with some sort of implanted device that the bird carries for the duration of the migration

Answer: b

Textbook Reference: Chapter 1 Introduction

Learning Objective: 1.0.2 Describe a procedure for quantifying a bird's energy cost to fly.

Bloom's Level: 5. Evaluating

3. Why is studying salmon migration important to humans?

- a. Studying salmon migration is important to salmon but not necessarily to humans.
- b. Salmon and humans can harbor many of the same diseases.
- c. Salmon are an important source of food for humans.
- d. Salmon are an important food source for many local vertebrate species.

Answer: c

Textbook Reference: 1.1 The Importance of Physiology

Learning Objective: 1.1.1 Illustrate the practical importance of physiological research for understanding both humans and wild animals.

Bloom's Level: 2. Understanding

4. To understand how a fish propels itself by applying forces to the water, physiologists would study its

- a. biomechanics.
- b. evolution.
- c. ecology.
- d. cell physiology.

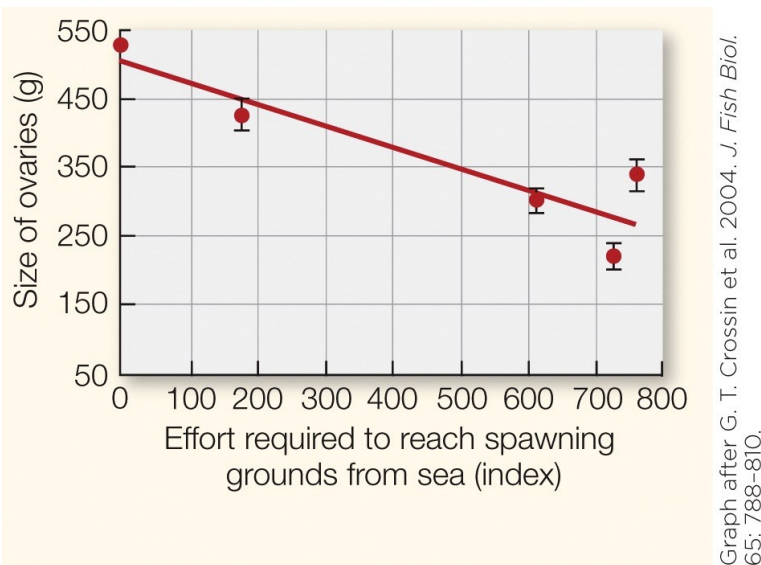
Answer: a

Textbook Reference: 1.2 The Highly Integrative Nature of Physiology

Learning Objective: 1.2.1 Prepare a 20-minute talk for a middle-school class on the theme of integration, in which you stress links between ecology and molecular biology.

Bloom's Level: 2. Understanding

5. Refer to the figure shown.



The data in the graph would be relevant to which subdiscipline of physiology?

- a. Evolution
- b. Cell physiology
- c. Morphology
- d. Ecology

Answer: d

Textbook Reference: 1.2 The Highly Integrative Nature of Physiology

Learning Objective: 1.2.1 Prepare a 20-minute talk for a middle-school class on the theme of integration, in which you stress links between ecology and molecular biology.

Bloom's Level: 2. Understanding

6. In the study of physiology, the term “_____” refers to the components of living animals and the interactions among those components that enable animals to perform as they do.

- a. feedback
- b. regulation
- c. natural selection
- d. mechanism

Answer: d

Textbook Reference: 1.3 Mechanism and Origin: Physiology’s Two Central Questions

Learning Objective: 1.3.1 Specify the two major questions that are addressed in the modern study of animal physiology.

Bloom’s Level: 1. Remembering

7. How is the light reaction in the firefly inhibited?

- a. Mitochondria prevent oxygen from reacting with luciferyl-AMP.
- b. Nitric oxide combines with oxygen to prevent reaction with luciferyl-AMP.
- c. ATP is prevented from combining with luciferin.
- d. Luciferase is prevented from catalyzing the reaction.

Answer: a

Textbook Reference: 1.3 Mechanism and Origin: Physiology’s Two Central Questions

Learning Objective: Not aligned

Bloom’s Level: 2. Understanding

8. Which of the following is *not* needed in the mechanism of light production in the firefly?

- a. Oxygen
- b. ATP
- c. Light
- d. Luciferin

Answer: c

Textbook Reference: 1.3 Mechanism and Origin: Physiology’s Two Central Questions

Learning Objective: Not aligned

Bloom’s Level: 2. Understanding

9. In the firefly, light is emitted when

- a. ATP combines with luciferin, forming luciferyl-AMP.
- b. released nitric oxide blocks the mitochondria’s use of oxygen.
- c. the electron-excited product of O₂ and luciferyl-AMP returns to its ground state.
- d. luciferase is activated by oxygen.

Answer: c

Textbook Reference: 1.3 Mechanism and Origin: Physiology’s Two Central Questions

Learning Objective: Not aligned

Bloom’s Level: 5. Evaluating

10. Which of the following is considered the “on” switch for the light-emitting reaction of the firefly?

- a. Oxygen
- b. Luciferase

- c. Nitric oxide
- d. ATP

Answer: c

Textbook Reference: 1.3 Mechanism and Origin: Physiology's Two Central Questions

Learning Objective: Not aligned

Bloom's Level: 3. Applying

11. A physiological mechanism or other trait that is a product of evolution and is advantageous is called

- a. an adaptation.
- b. natural selection.
- c. adaptive significance.
- d. evolution.

Answer: a

Textbook Reference: 1.3 Mechanism and Origin: Physiology's Two Central Questions

Learning Objective: 1.3.2 Explain with an example why the two questions are distinct rather than simply being corollaries of each other.

Bloom's Level: 1. Remembering

12. What is the adaptive significance of light emission in the firefly?

- a. Female fireflies emit light in such a way that distinguishes their species.
- b. All fireflies emit light to lure prey.
- c. Male fireflies emit light to attract mates.
- d. Male fireflies emit light to evade predators.

Answer: c

Textbook Reference: 1.3 Mechanism and Origin: Physiology's Two Central Questions

Learning Objective: 1.3.2 Explain with an example why the two questions are distinct rather than simply being corollaries of each other.

Bloom's Level: 2. Understanding

13. Which of the following is a similarity between an octopus and a fish?

- a. The evolutionary adaptation of excellent vision
- b. The mechanism of vision
- c. The processing of visual signals before reaching the optic nerve
- d. The neuroanatomy of the eye

Answer: a

Textbook Reference: 1.3 Mechanism and Origin: Physiology's Two Central Questions

Learning Objective: 1.3.2 Explain with an example why the two questions are distinct rather than simply being corollaries of each other.

Bloom's Level: 5. Evaluating

14. Research in the field of _____ physiology emphasizes synthesis across levels of biological organization.

- a. evolutionary
- b. comparative
- c. environmental

d. integrative

Answer: d

Textbook Reference: 1.4 This Book's Approach to Physiology

Learning Objective: 1.4.1 State the function of the "At Work" chapters in this book.

Bloom's Level: 2. Understanding

15. Which statement regarding animals is true?

- a. There is no distinction between an animal and its environment.
- b. Once adults, animals are structurally static.
- c. All animals require energy to maintain their organization.
- d. Body size is significant in the lives of only small animals.

Answer: c

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 5. Evaluating

16. Most cells of an animal

- a. are exposed to the external environment.
- b. are exposed to the internal environment.
- c. fluctuate between exposure to the external environment and the internal environment.
- d. turn over while being exposed to the internal environment.

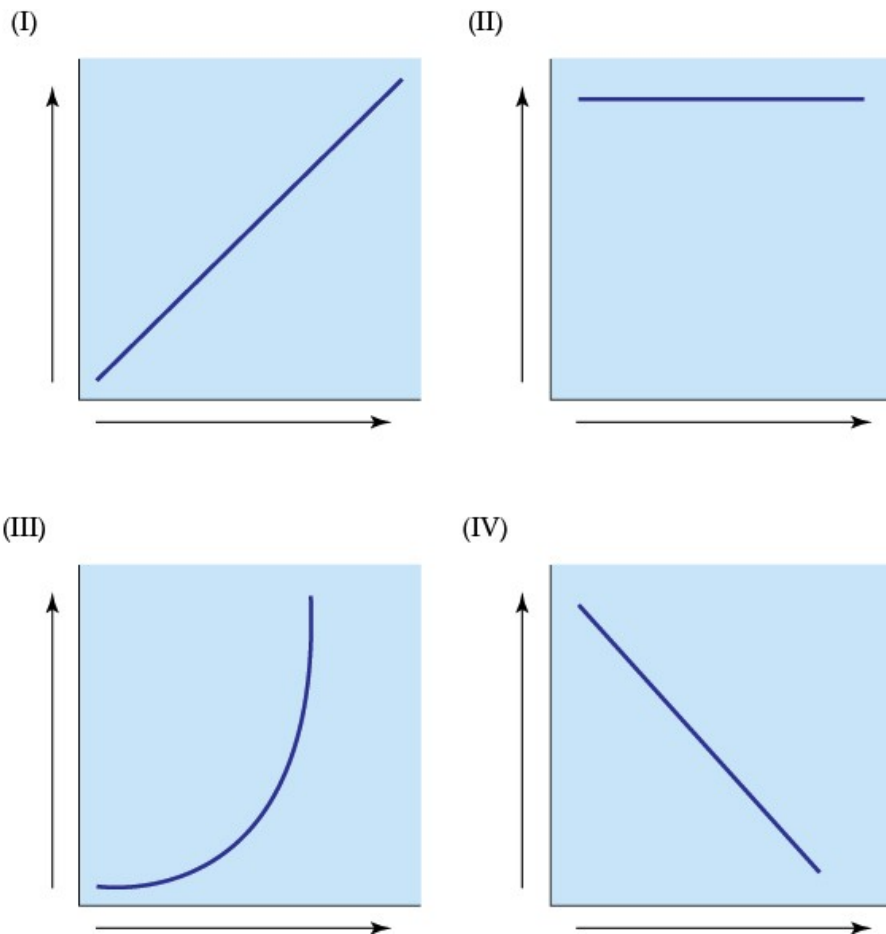
Answer: b

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 2. Understanding

17. Refer to the figure shown.



Which graph refers to a physiological trait that is regulated by an organism?

- a. I
- b. II
- c. III
- d. IV

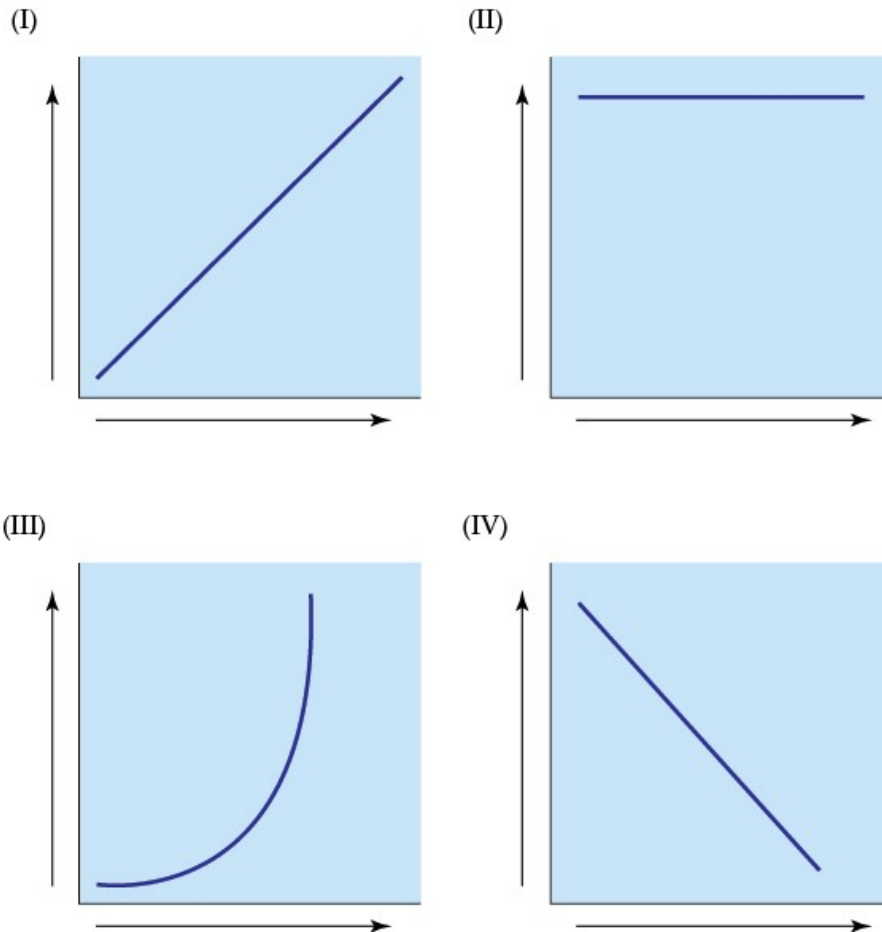
Answer: b

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 3. Applying

18. Refer to the figure shown.



A migrating salmon regulates its internal Cl^- concentration, shown in graph _____, while conforming to water temperature, shown in graph _____.

- a. I; II
- b. II; I
- c. II; IV
- d. I; III

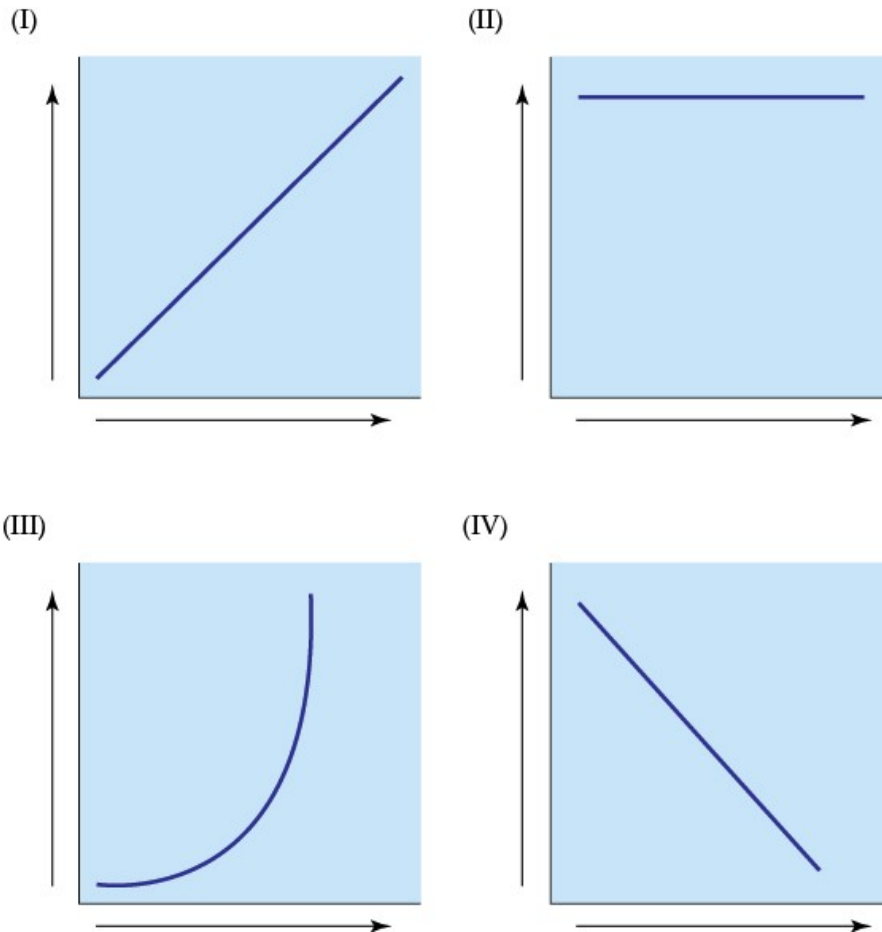
Answer: b

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 4. Analyzing

19. Refer to the figure shown.



Graph _____ shows an animal's regulation of its body temperature as the external temperature increases. Graph _____ shows no regulation of its body temperature as external temperature increases.

- a. I; II
- b. II; I
- c. II; IV
- d. II; III

Answer: b

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 3. Applying

20. Which statement regarding physiological conformity and regulation is true?

- a. All animals will eventually conform.
- b. Animals are either regulators or conformers.
- c. An animal cannot be both an ion regulator and a temperature conformer.
- d. Conforming is more metabolically expensive than regulating.

Answer: a

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 5. Evaluating

21. The functioning of regulatory mechanisms that automatically make adjustments to maintain internal constancy is called

- a. conformity.
- b. feedback.
- c. homeostasis.
- d. regulation.

Answer: c

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 1. Remembering

22. Physiological changes that occur by alteration of gene frequencies over the course of many generations are referred to as _____ changes.

- a. acute
- b. chronic
- c. evolutionary
- d. developmental

Answer: c

Textbook Reference: 1.5 Animals

Learning Objective: Not aligned

Bloom's Level: 2. Understanding

23. _____ is an example of “abandoning constancy” during thermoregulation.

- a. Sweating
- b. Shivering
- c. Hibernating
- d. Huddling

Answer: c

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 3. Applying

24. What is the principal advantage of conformity?

- a. The process requires a large amount of energy.
- b. It allows cells to maintain a steady state.
- c. Very little energy is used by this process.
- d. Cells are subject to changes in their conditions.

Answer: c

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 2. Understanding

25. Sweating in response to heat is an example of a(n)

- a. acute change.
- b. chronic change.
- c. evolutionary change.
- d. developmental change.

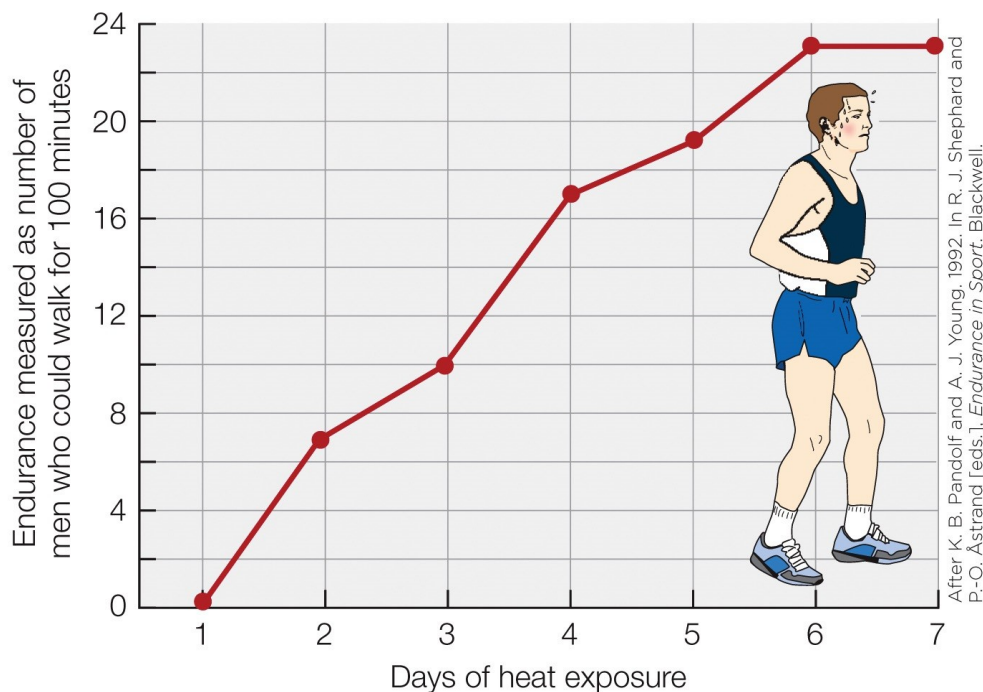
Answer: a

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 2. Understanding

26. Refer to the figure shown.



What type of physiological response does the figure refer to?

- a. Chronic response
- b. Acute response
- c. Evolutionary response
- d. Developmental response

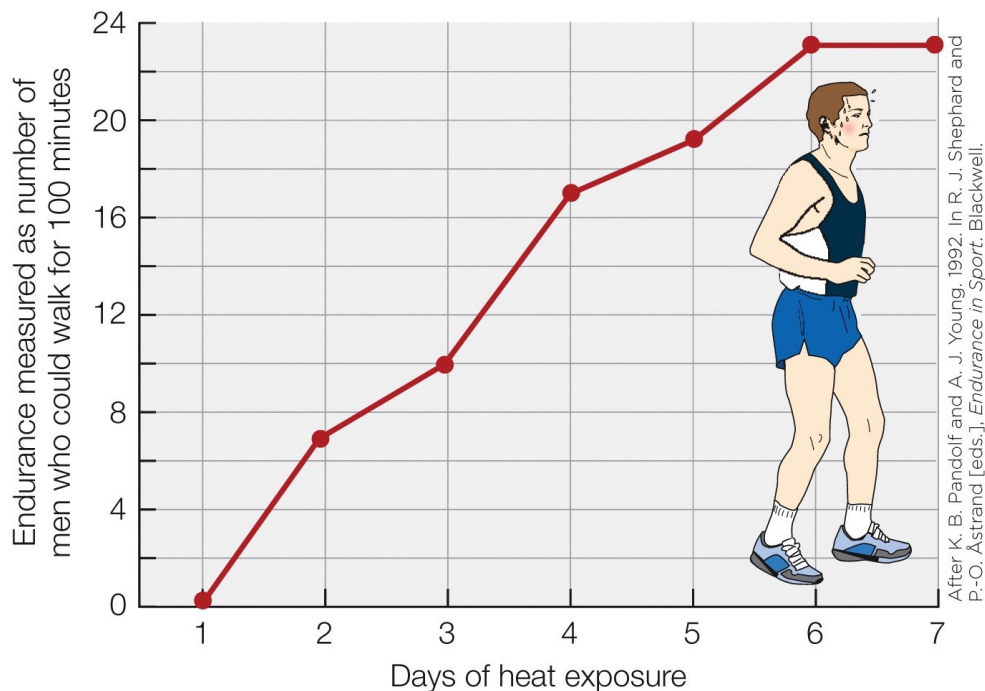
Answer: a

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 3. Applying

27. Refer to the figure shown.



If the heat exposure were removed, the line in the diagram would

- a. continue to show a plateau.
- b. drop sharply.
- c. gradually drop to its initial starting point.
- d. drop but be maintained somewhere at the middle level.

Answer: c

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 4. Analyzing

28. Which response is the longest lasting?

- a. Acute response
- b. Chronic response
- c. Evolutionary response
- d. Developmental response

Answer: c

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 2. Understanding

29. Which statement regarding the Antarctic fish species rock cod is *false*?

- a. Some species have no hemoglobin.
- b. The fish metabolically synthesize antifreeze to keep from freezing.
- c. The fish live their entire lives at body temperatures near -1.6°C .
- d. If acclimated slowly enough, the fish can survive in tropical waters.

Answer: d

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 5. Evaluating

30. Rainbow trout captured and brought into a lab aquarium undergo a chronic adjustment to the conditions in the lab. This process is called

- a. phenotypic plasticity.
- b. feedback inhibition.
- c. acclimatization.
- d. acclimation.

Answer: d

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 2. Understanding

31. During childbirth, muscular contractions acting to expel the fetus from the uterus induce hormonal signals that induce even more intense contractions. This is an example of

- a. homeostasis.
- b. negative feedback.
- c. a set point.
- d. positive feedback.

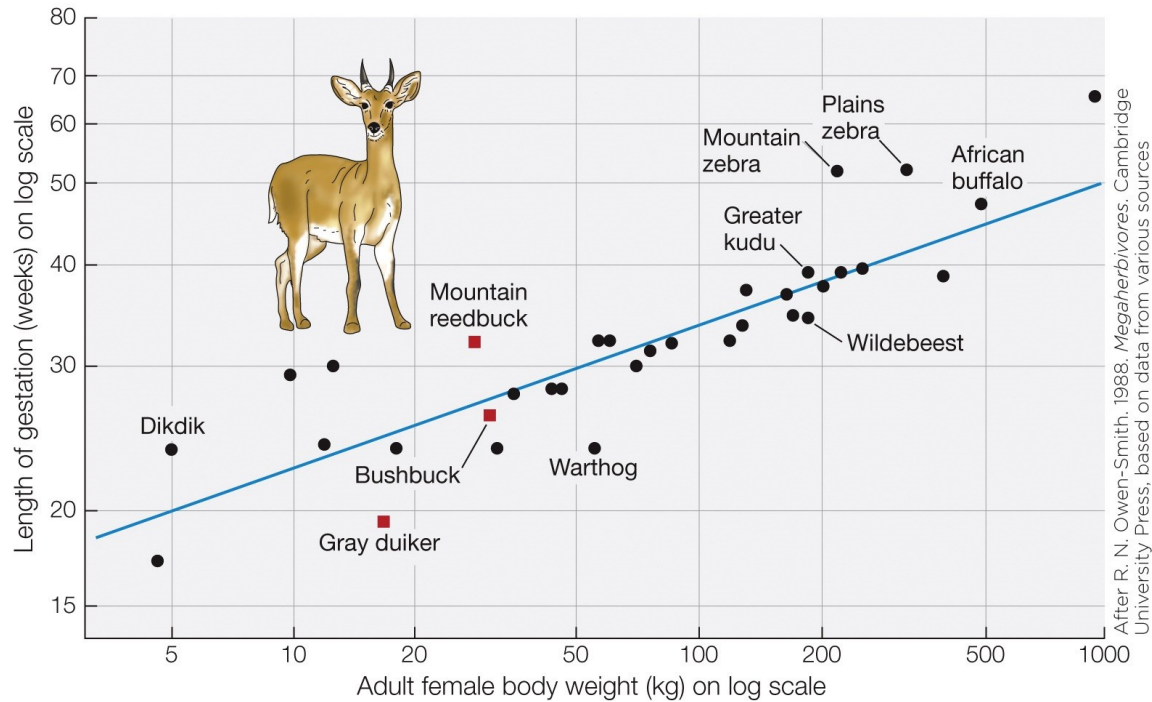
Answer: d

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.2 Explain why negative feedback is termed "negative."

Bloom's Level: 2. Understanding

32. Refer to the figure shown.



What statistical method was used to draw the trend line in the figure?

- Phylogenetically independent contrasts
- Ordinary least squares regression
- Weight-specific mean
- Logarithmic scaling

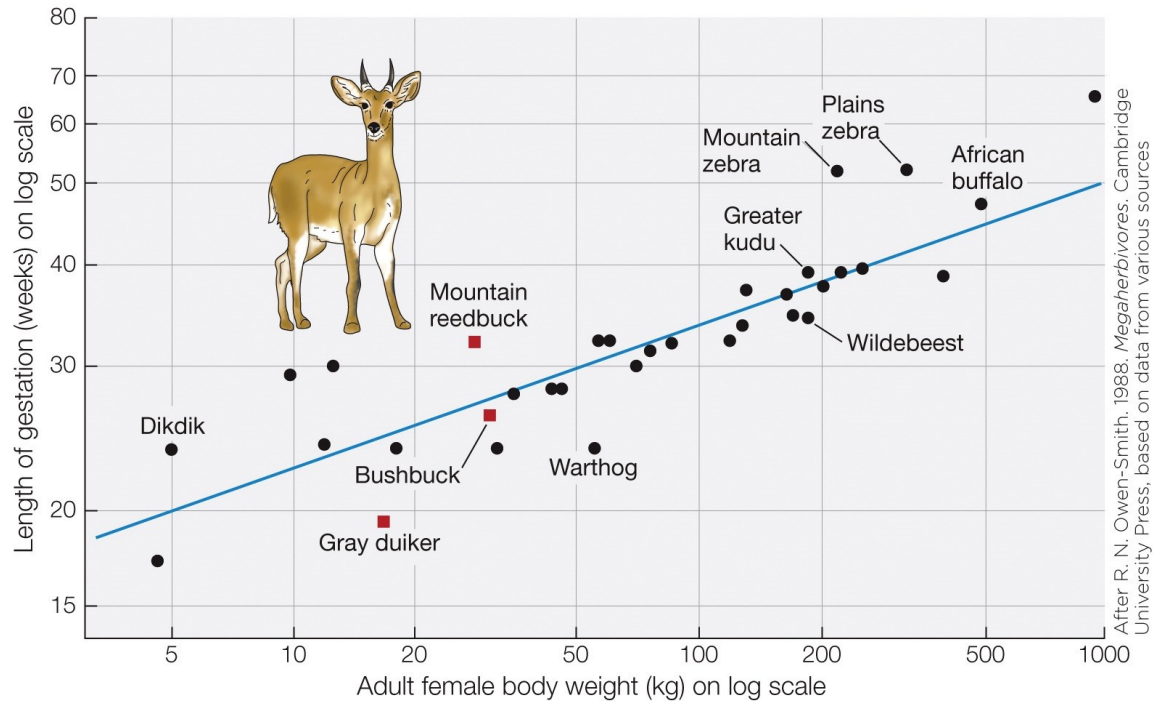
Answer: b

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.3 Analyze a trait of an animal (e.g., stomach size or longevity) to determine whether the trait is merely what is to be expected in view of the animal's body size.

Bloom's Level: 3. Applying

33. Refer to the figure shown.



According to the figure, what is the expected gestation period of a warthog?

- a. 20 weeks
- b. 24 weeks
- c. 30 weeks
- d. 55 weeks

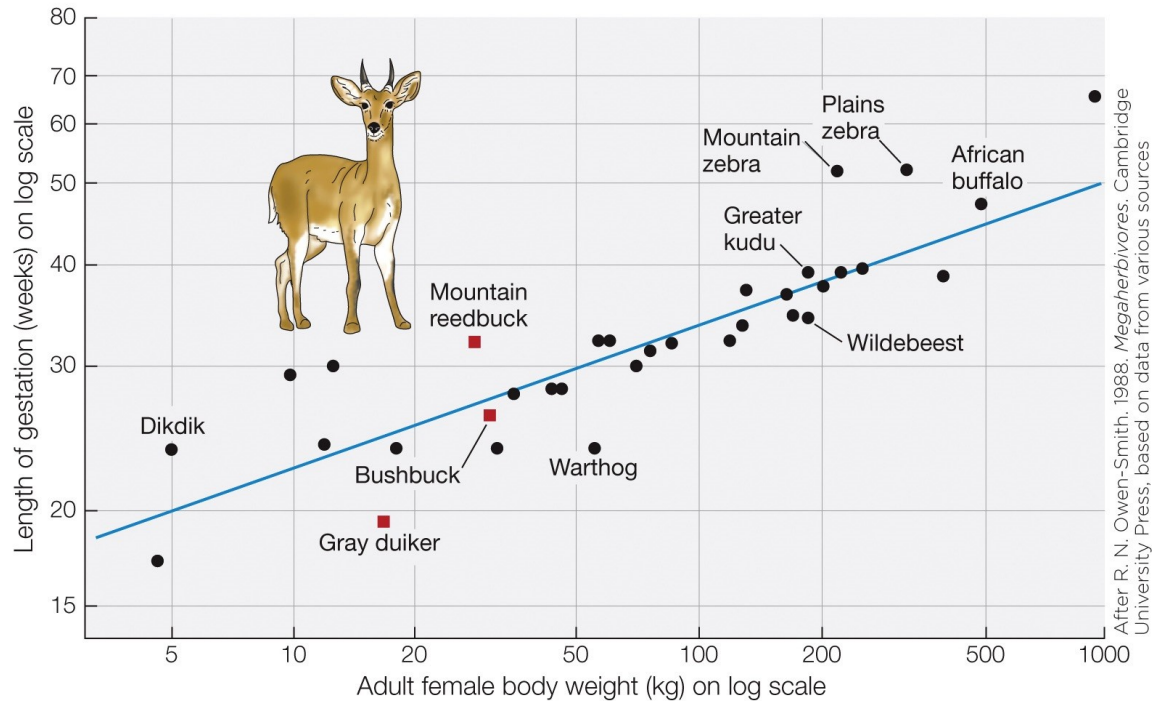
Answer: c

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.3 Analyze a trait of an animal (e.g., stomach size or longevity) to determine whether the trait is merely what is to be expected in view of the animal's body size.

Bloom's Level: 3. Applying

34. Refer to the figure shown.



Which species in the figure shows an actual gestation period that is furthest from its expected gestation period?

- Bushbuck
- Dikdik
- Warthog
- Mountain zebra

Answer: d

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.3 Analyze a trait of an animal (e.g., stomach size or longevity) to determine whether the trait is merely what is to be expected in view of the animal's body size.

Bloom's Level: 3. Applying

35. _____ can tolerate a body temperature of _____, one of the highest body temperatures recorded for any vertebrate animal.

- Humans; 50°C
- Thermophilic archaea; 100°C
- The desert iguana; 48.5°C
- Sea stars; 45.5°C

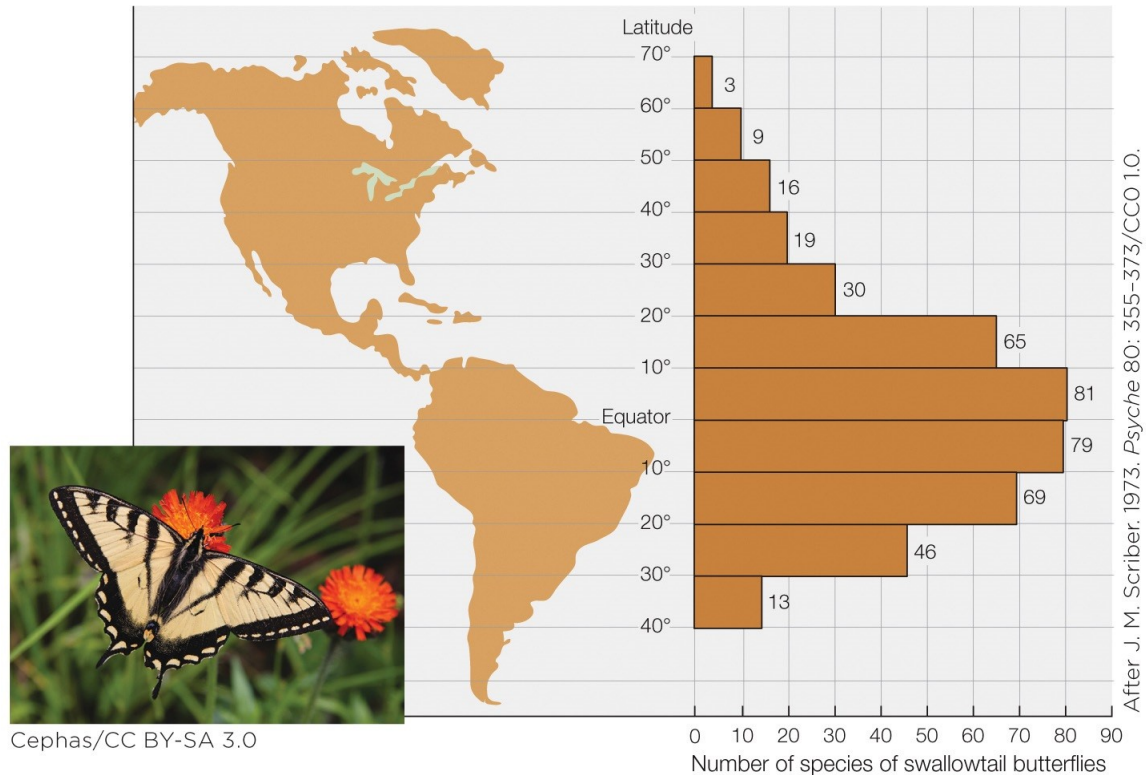
Answer: c

Textbook Reference: 1.6 Environments

Learning Objective: Not aligned

Bloom's Level: 1. Remembering

36. Refer to the figure shown.



This figure shows that

- a. the number of butterfly species increases as one moves toward the equator.
- b. butterfly populations are larger near the equator than at any other latitude.
- c. the number of butterfly species increases as latitude increases.
- d. the butterfly population increases as latitude increases.

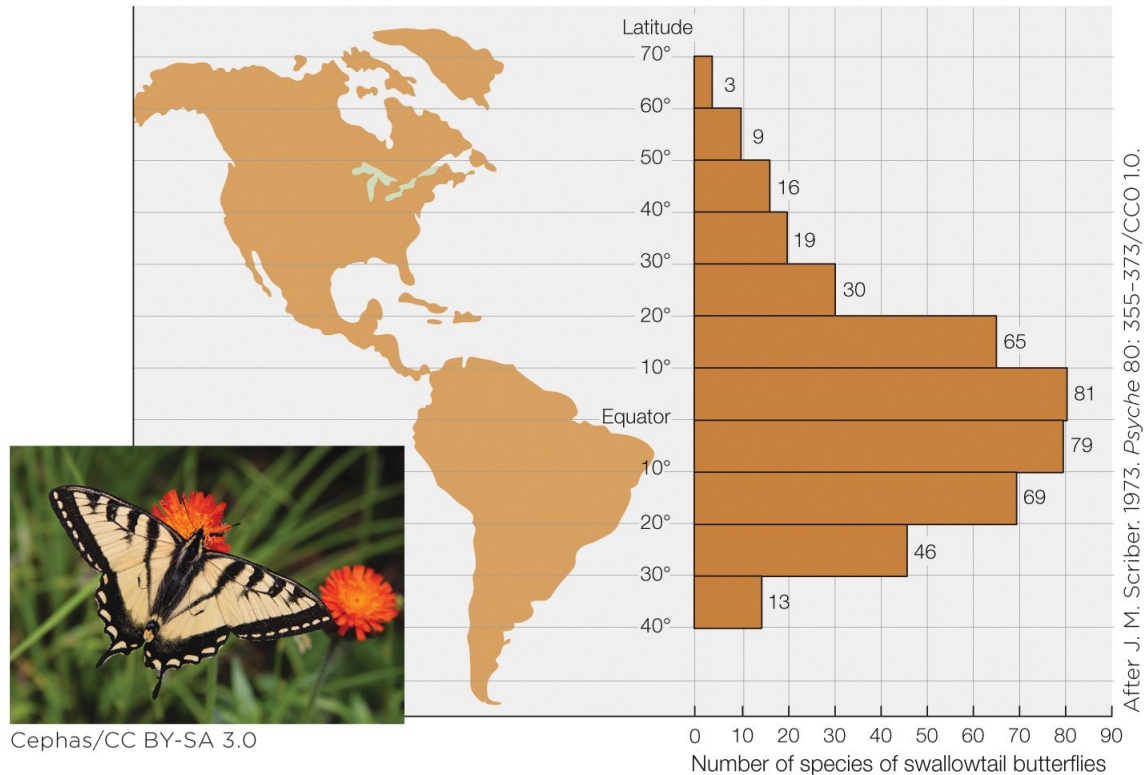
Answer: a

Textbook Reference: 1.6 Environments

Learning Objective: Not aligned

Bloom's Level: 3. Applying

37. Refer to the figure shown.



The environmental factor that is most responsible for the data shown in the figure is

- a. sunlight.
- b. food.
- c. temperature.
- d. water.

Answer: c

Textbook Reference: 1.6 Environments

Learning Objective: Not aligned

Bloom's Level: 4. Analyzing

38. In which habitat would O₂ concentration most likely be the lowest?

- a. A subnivean air space
- b. An open meadow at 4000 m elevation
- c. The bottom of a waterfall
- d. Pond water with a lot of algae

Answer: d

Textbook Reference: 1.6 Environments

Learning Objective: 1.6.1 Explain why animals require O₂ (oxygen).

Bloom's Level: 5. Evaluating

39. At altitudes above _____ m, people often find simply walking uphill to be a significant challenge.

- a. 5000
- b. 6500

- c. 9000
- d. 10,000

Answer: b

Textbook Reference: 1.6 Environments

Learning Objective: 1.6.1 Explain why animals require O₂ (oxygen).

Bloom's Level: 1. Remembering

40. In order to obtain O₂, water-breathers face a substantially greater challenge compared to air-breathers. Which of the following is *not* a reason for this difference?

- a. Water contains less O₂ per liter than air does.
- b. Water is denser than air.
- c. Water can become anoxic more readily than air can.
- d. Oxygen diffuses more slowly across respiratory surfaces in water than in air.

Answer: d

Textbook Reference: 1.6 Environments

Learning Objective: 1.6.1 Explain why animals require O₂ (oxygen).

Bloom's Level: 2. Understanding

41. Most invertebrates that live in the ocean, such as sea stars and corals,

- a. tend to lose water via osmosis.
- b. must drink water.
- c. must actively excrete water.
- d. do not gain or lose much water.

Answer: d

Textbook Reference: 1.6 Environments

Learning Objective: Not aligned

Bloom's Level: 2. Understanding

42. Which animal osmotically gains the most water per gram on a daily basis?

- a. Sea star
- b. Goldfish
- c. Coral
- d. Reef fish

Answer: b

Textbook Reference: 1.6 Environments

Learning Objective: Not aligned

Bloom's Level: 1. Remembering

43. Certain _____ can tolerate almost complete desiccation.

- a. toads
- b. tardigrades
- c. marine bony fish
- d. goldfish

Answer: b

Textbook Reference: 1.6 Environments

Learning Objective: Not aligned

Bloom's Level: 1. Remembering

44. The subnivean air space is an example of a(n)

- a. microenvironment.
- b. desert burrow.
- c. hibernating area.
- d. anoxic environment.

Answer: a

Textbook Reference: 1.6 Environments

Learning Objective: 1.6.2 Compose a quantitative essay on the importance of microenvironments in the lives of animals.

Bloom's Level: 2. Understanding

45. Choose the best example of an animal changing its environment at the global scale.

- a. a squirrel using a hole in a tree as a burrow
- b. locusts decimating an agricultural crop in the Midwest U.S.
- c. the invasive species altering Florida's community structure
- d. the use of fossil fuels

Answer: d

Textbook Reference: 1.6 Environments

Learning Objective: 1.6.3 Exemplify how the presence of animals can change the properties of the animals' environment at both local and global scales.

Bloom's Level: 2. Understanding

46. The shift in gene frequencies in smaller populations because of random deaths is referred to as

- a. evolution.
- b. nonadaptive evolution.
- c. genetic drift.
- d. pleiotropy.

Answer: c

Textbook Reference: 1.7 Evolutionary Processes

Learning Objective: 1.7.1 Explain how genetic drift and pleiotropy can cause a trait to evolve in nonadaptive directions, being certain to define "nonadaptive."

Bloom's Level: 1. Remembering

47. Because of _____, populations of the mosquito *Culex pipiens* are experiencing increased resistance to organophosphates and _____ in areas where organophosphates are sprayed.

- a. pleiotropy; reduced cold tolerance
- b. maladaptation; all other insecticides
- c. nonadaptive evolution; accelerated larval developmental stages
- d. natural selection; altered sex ratios

Answer: a

Textbook Reference: 1.7 Evolutionary Processes

Learning Objective: 1.7.1 Explain how genetic drift and pleiotropy can cause a trait to evolve in nonadaptive directions, being certain to define "nonadaptive."

Bloom's Level: 1. Remembering

48. Which process most likely leads to adaptive evolution?

- a. Natural selection
- b. Genetic drift
- c. Bottlenecks
- d. Pleiotropy

Answer: a

Textbook Reference: 1.7 Evolutionary Processes

Learning Objective: 1.7.2 Distinguish the process of *evolution* and the process of *adaptation*.

Bloom's Level: 2. Understanding

49. Which observation best demonstrates the process of evolution?

- a. The increased presence of a trait favored by natural selection
- b. A change of gene frequencies over time
- c. The shifting of gene frequencies in a population because of random events
- d. The change in an animal's phenotype in response to environmental change

Answer: b

Textbook Reference: 1.7 Evolutionary Processes

Learning Objective: 1.7.2 Distinguish the process of *evolution* and the process of *adaptation*.

Bloom's Level: 5. Evaluating

50. Which conclusion was *not* made from the seminal 1979 paper by Gould and Lewontin?

- a. Natural selection in the present environment is just one of several processes by which a species may come to exhibit a trait.
- b. When physiologists refer to a trait as an adaptation, they are making a hypothesis that natural selection has occurred.
- c. Data must be gathered in order to assess whether adaptation is likely to have occurred.
- d. Indirect evidence cannot be used to support the hypothesis of adaptation.

Answer: d

Textbook Reference: 1.7 Evolutionary Processes

Learning Objective: 1.7.2 Distinguish the process of *evolution* and the process of *adaptation*.

Bloom's Level: 5. Evaluating

51. The raw material(s) for evolution is(are)

- a. trait variation.
- b. natural selection.
- c. clines.
- d. alleles.

Answer: d

Textbook Reference: 1.7 Evolutionary Processes

Learning Objective: 1.7.2 Distinguish the process of *evolution* and the process of *adaptation*.

Bloom's Level: 2. Understanding

52. Which method is based on the premise that although we cannot see evolution that occurred in the past, the many kinds of animals alive today provide us with many examples of outcomes of

evolution, and patterns we identify in these outcomes may provide insights into processes that occurred long ago?

- a. Studies of laboratory populations over many generations
- b. The adaptation method
- c. Phylogenetic reconstruction
- d. The comparative method

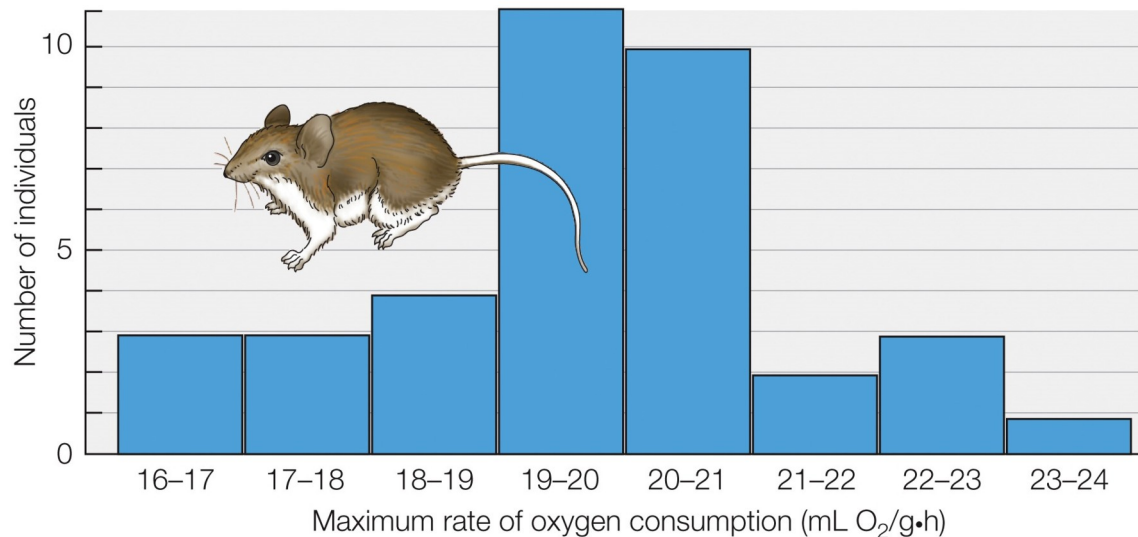
Answer: d

Textbook Reference: 1.7 Evolutionary Processes

Learning Objective: 1.7.3 Explain why the comparative method can be a useful tool for determining if a trait is an adaptation.

Bloom's Level: 2. Understanding

53. Refer to the figure shown.



Which technique for the study of adaptation was used to generate the data shown in the figure?

- a. Studies of laboratory populations over many generations
- b. Single-generation studies of individual variation
- c. Creation of variation for study
- d. Studies of genetic structures of natural populations

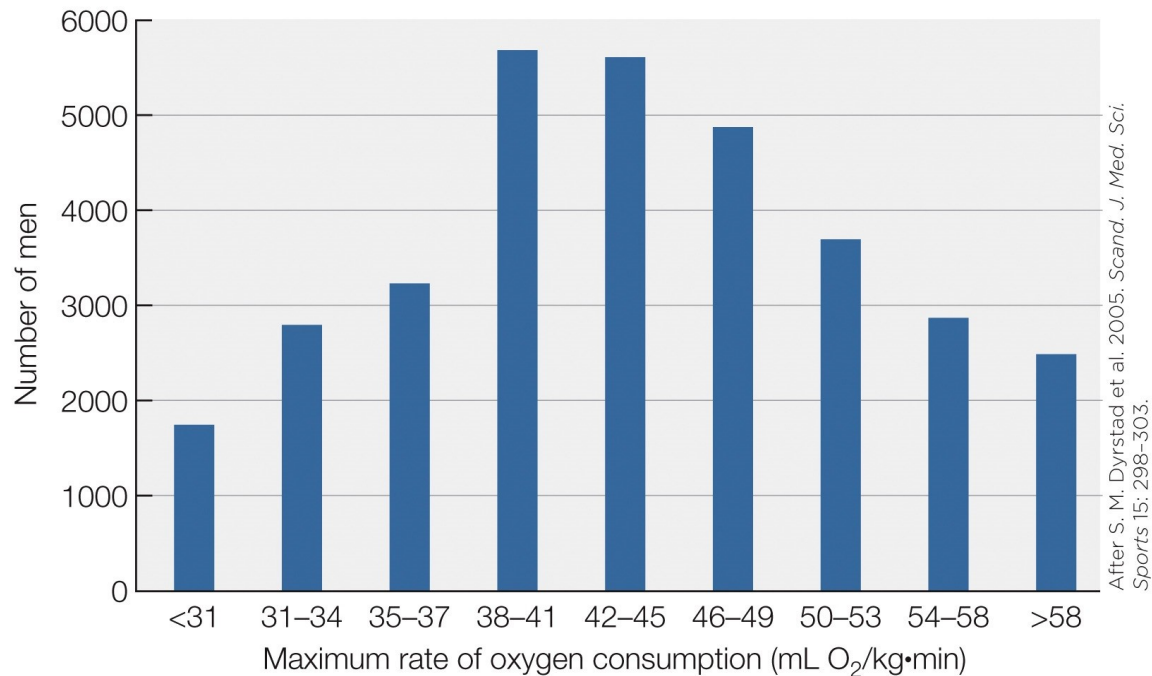
Answer: b

Textbook Reference: 1.7 Evolutionary Processes

Learning Objective: 1.7.3 Explain why the comparative method can be a useful tool for determining if a trait is an adaptation.

Bloom's Level: 3. Applying

54. Refer to the figure shown.



What is the best caption for this figure?

- Variation in O₂ consumption.
- Individual variation in maximum rate of O₂ consumption.
- Mean maximum rate of O₂ consumption.
- Range of maximum rate of O₂ consumption.

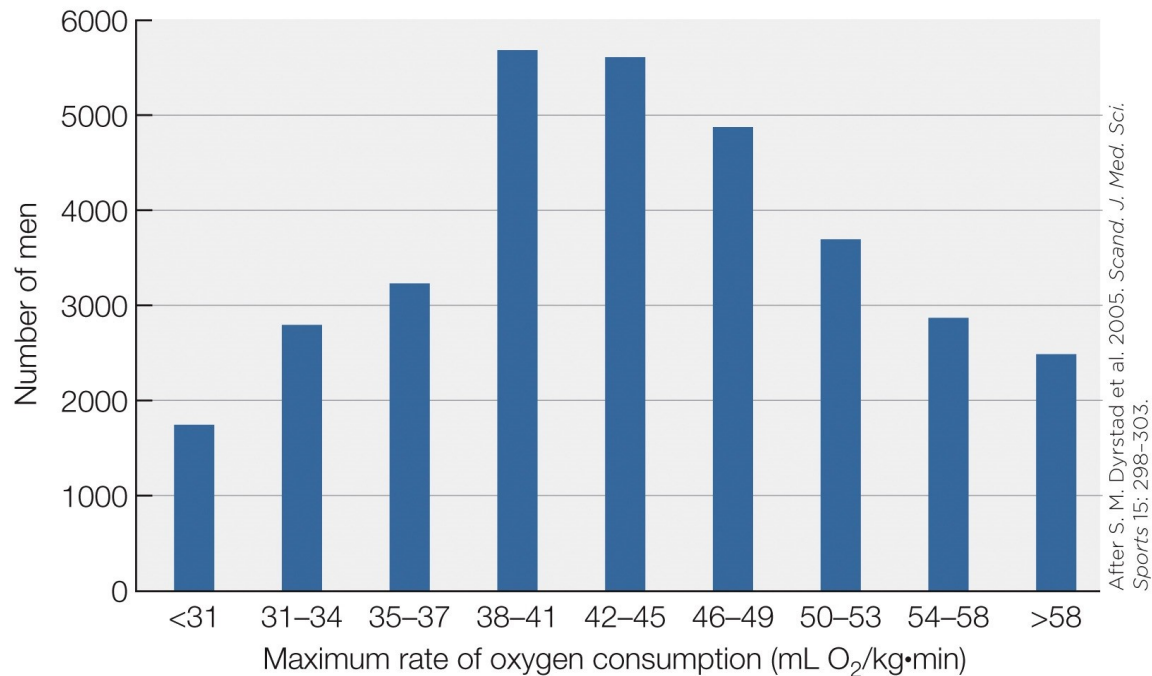
Answer: b

Textbook Reference: 1.8 Individual Variation and the Question of “Personalities” within a Population

Learning Objective: 1.8.1 Sketch a graph of quantitative data that illustrate individual variation in a physiological trait.

Bloom’s Level: 3. Applying

55. Refer to the figure shown.



Assuming the trait measured in this figure is heritable,

- there can be no basis for natural selection to act on this trait.
- there is no variation from which natural selection can act on this trait.
- natural selection acts on the individuals with extreme trait measurements.
- the variation provides the raw material for natural selection.

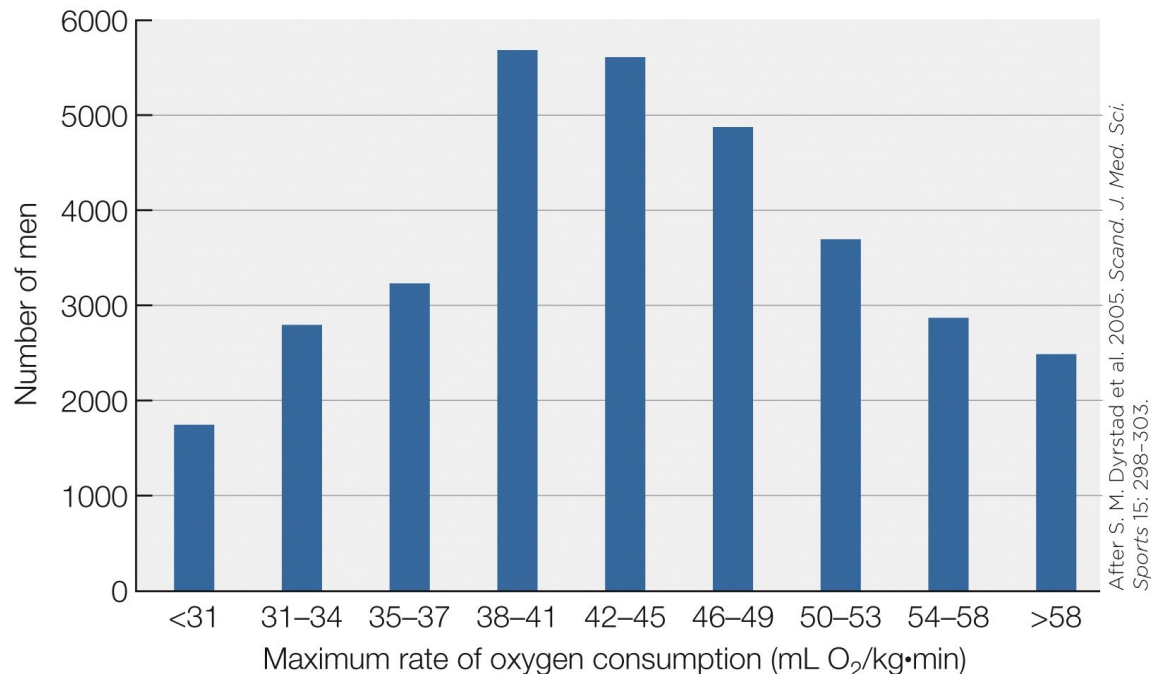
Answer: d

Textbook Reference: 1.8 Individual Variation and the Question of “Personalities” within a Population

Learning Objective: 1.8.1 Sketch a graph of quantitative data that illustrate individual variation in a physiological trait.

Bloom’s Level: 3. Applying

56. Refer to the figure shown.



Statistically speaking, an elite weight lifter would be likely to have a maximum rate of O₂ consumption

- mostly at the extreme low end of the distribution.
- mostly at the extreme high end of the distribution.
- in the average range to the lower end of the distribution.
- in the average range to the higher end of the distribution.

Answer: c

Textbook Reference: 1.8 Individual Variation and the Question of “Personalities” within a Population

Learning Objective: 1.8.2 Explain how individual variation in a physiological trait could cause different individuals to respond in different ways to a single stress.

Bloom’s Level: 3. Applying

Short Answer/Essay

57. Using the firefly as an example, explain physiology’s two central questions—mechanism and origin.

Answer: The firefly emits a flash of light from its abdomen. The process inside the animal that results in this event is the mechanism. That is, the brain sends nerve impulses that cause the light cells to become bathed with nitric oxide, resulting in the production of excited electrons through the reaction of O₂ with luciferyl-AMP. However, this explanation of the mechanism does not explain the evolutionary origin of the trait. In this case, evidence suggests that the firefly produces light for mate attraction.

Textbook Reference: 1.3 Mechanism and Origin: Physiology’s Two Central Questions

Learning Objective: 1.3.1 Specify the two major questions that are addressed in the modern study of animal physiology.

Bloom's Level: 3. Applying

58. Compare and contrast adaptation and natural selection.

Answer: Adaptation and natural selection are both concepts of evolution. Natural selection is a main process by which evolution occurs. It is the increase of gene frequencies that produce phenotypes that raises the likelihood that animals will survive and reproduce. An adaptation refers to the mechanism or trait that is the product of evolution by natural selection.

Textbook Reference: 1.3 Mechanism and Origin: Physiology's Two Central Questions

Learning Objective: 1.3.1 Specify the two major questions that are addressed in the modern study of animal physiology.

Bloom's Level: 3. Applying

59. Describe three of the subdisciplines of animal physiology.

Answer: Mechanistic physiology emphasizes the study of mechanism. Evolutionary physiology emphasizes the study of evolutionary origins. Comparative physiology is the synthetic study of the function of all animals. Environmental physiology studies how animals respond physiologically to environmental conditions and challenges. Integrative physiology is a synthetic investigation of all levels of biological organization.

Textbook Reference: 1.4 This Book's Approach to Physiology

Learning Objective: Not aligned

Bloom's Level: 1. Remembering

60. Compare and contrast conformity and regulation, including the advantages and disadvantages of each.

Answer: Conformity and regulation are responses of animals to changing environmental conditions. An animal that permits its internal conditions to be equal to those of the external environment is exhibiting conformity. Conformity has some energy-saving advantages, although the cells of the animal can be exposed to potentially widely varying conditions. An animal that maintains its internal conditions while external conditions change is exhibiting regulation. The advantage of regulation is internal consistency, although there is a trade-off in terms of increased energy expenditure.

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 4. Analyzing

61. Which of the five timeframes in which physiology changes is represented by phenotypic plasticity? Give an example.

Answer: Phenotypic plasticity refers to the chronic, reversible physiologic changes of acclimation and acclimatization. For example, as temperatures become colder in the winter, the fur on arctic hares becomes thicker and whiter.

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.1 Distinguish an animal's acute and chronic responses to changes in its external environment.

Bloom's Level: 2. Understanding

62. What is the importance of body size in the study of animal physiology?

Answer: Body size is important in the study of animal physiology because many physiological measurements are affected by body size. Gestation period in mammals, for example, increases in a predictable manner with body size. Metabolic rate and other factors related to metabolic rate also correlate with body size. If body size is not taken into account for certain measurements, this factor may produce most of the variation in the data collected and mask other factors.

Textbook Reference: 1.5 Animals

Learning Objective: 1.5.3 Analyze a trait of an animal (e.g., stomach size or longevity) to determine whether the trait is merely what is to be expected in view of the animal's body size.

Bloom's Level: 2. Understanding

63. A water temperature of 6°C can be lethal for both tropical fish and Antarctic fish—explain.

Answer: Not all fish species are able to survive at all water temperatures, even if given years to acclimate. Most tropical fish will die if cooled (even slowly) to 6°C. In contrast, Antarctic fish species have evolved for millions of years at -1.9°C, and even slowly warming them to 6°C will kill them.

Textbook Reference: 1.6 Environments

Learning Objective: Not aligned

Bloom's Level: 2. Understanding

64. Describe how the density layering of water can create anoxic zones.

Answer: Warmer water is less dense than colder water. During summer months, the water on the surface of lakes and ponds gets warmed and stays on the top for the duration of the summer, with little mixing. This leaves a colder, stagnant, bottom layer of water that will slowly lose oxygen because the microbes deplete the dissolved oxygen.

Textbook Reference: 1.6 Environments

Learning Objective: 1.6.1 Explain why animals require O₂ (oxygen).

Bloom's Level: 2. Understanding

65. Explain how adaptive and nonadaptive processes can contribute to evolution.

Answer: Adaptive processes are the processes of natural selection that result in traits that provide advantages in a population. Nonadaptive evolution includes processes by which less-adaptable alleles may persist in a population. A trait may persist because of chance (genetic drift), or because it is related to another favored trait (pleiotropy), or because it was once advantageous and has not been selected against.

Textbook Reference: 1.7 Evolutionary Processes

Learning Objective: 1.7.1 Explain how genetic drift and pleiotropy can cause a trait to evolve in nonadaptive directions, being certain to define “nonadaptive.”

Bloom's Level: 2. Understanding

66. Explain the statement: “A trait is not an adaptation merely because it exists.”

Answer: Not all traits are evolutionary adaptations that confer an advantage. Traits can exist because of evolutionary drift and other forms of nonadaptive evolution. Even a trait that appears to be beneficial is not necessarily an evolutionary adaptation. As Gould and Lewontin point out, in order to call a trait adaptive, one must provide empirical evidence that the trait is an adaptation.

Textbook Reference: 1.7 Evolutionary Processes

Learning Objective: 1.7.2 Distinguish the process of *evolution* and the process of *adaptation*.

Bloom's Level: 2. Understanding