

What type of signal is long-lasting and works at night?

- A) olfactory
- B) visual
- C) auditory
- D) electrical

**A) olfactory**

What type of signal is brief and can work among obstructions at night?

- A) olfactory
- B) visual
- C) auditory
- D) magnetic

**C) auditory**

What type of signal is fast and requires daylight with no obstructions?

- A) olfactory
- B) visual
- C) auditory
- D) tactile

**B) visual**

Circannual rhythms in birds are influenced by \_\_\_\_\_.

- A) periods of food availability
- B) periods of daylight and darkness
- C) magnetic fields
- D) lunar cycles

**B) periods of daylight and darkness**

Upon returning to its hive, a European honeybee communicates to other worker bees the presence of a nearby food source it has discovered by \_\_\_\_\_.

- A) vibrating its wings at varying frequencies
- B) performing a round dance
- C) performing a waggle dance
- D) visual cues

**B) performing a round dance**

Displays of nocturnal mammals are usually \_\_\_\_\_.

- A) visual and auditory
- B) tactile and visual

- C) olfactory and auditory
- D) visual and olfactory

**C) olfactory and auditory**

A cage containing male mosquitoes has a small earphone placed on top, through which the sound of a female mosquito is played. All the males immediately fly to the earphone and go through all of the steps of copulation. What is the best explanation for this behavior?

- A) Copulation is a fixed action pattern, and the female flight sound is a sign stimulus that initiates it.
- B) The sound from the earphone irritates the male mosquitoes, causing them to attempt to sting it.
- C) The reproductive drive is so strong that when males are deprived of females, they will attempt to mate with anything that has even the slightest female characteristic.
- D) Through classical conditioning, the male mosquitoes have associated the inappropriate stimulus from the earphone with the normal response of copulation.

**A) Copulation is a fixed action pattern, and the female flight sound is a sign stimulus that initiates it.**

A stickleback fish will attack a fish model as long as the model has red coloring. What animal behavior idea is manifested by this observation?

- A) sign stimulus
- B) cognition
- C) imprinting
- D) classical conditioning

**A) sign stimulus**

Which of the following experiments best addresses the hypothesis that moths stop flying in response to high-intensity bat sounds?

- A) Isolate and characterize the neurons that control flight muscle.
- B) Play prerecorded high-intensity bat sounds to flying moths.
- C) Observe responses of moths to bats in nature.
- D) Put bats and moths in an enclosure and make detailed observations of predator-prey interactions.

**B) Play prerecorded high-intensity bat sounds to flying moths.**

A lizard's bobbing dewlap (a colorful flap of skin hanging from an Anolis lizard's throat) is an example of a(n) \_\_\_\_\_.

- A) stimulus
- B) reflex
- C) signal
- D) innate releasing mechanism

**C) signal**

What was the main reason the honeybees switched from the "round dance" to the "waggle dance"?

- A) The waggle dance communicates the presence of nectar.
- B) The preferred food source was farther away.
- C) The round dance uses too much energy.
- D) The round dance did not communicate the quality of the food.

**B) The preferred food source was farther away.**

From the figure above, what can we determine about the location of the food source?

- A) The waggle dance in the top figure indicates that the food is directly under the hive.
- B) The waggle dance in the bottom figure indicates that the food is to the west of the hive.
- C) The waggle dance in the top figure indicates that the food is close to the hive.
- D) The waggle dance in the bottom figure indicates that the food is 90 degrees to the right of the Sun.

**D) The waggle dance in the bottom figure indicates that the food is 90 degrees to the right of the Sun.**

If the figure above shows the dances of bees in a hive at twelve noon on March 21 in the northern hemisphere, which dance is communicating that the food is to the south of the hive?

- A) dance A
- B) dance B
- C) dance C
- D) It is not possible to tell if any of the dances indicate the food is to the south of the hive.

**D) It is not possible to tell if any of the dances indicate the food is to the south of the hive.**

Scientists believe that the direction birds go when migrating is guided in part by \_\_\_\_\_.

- I) the stars in the night sky
- II) the Sun during the day
- III) the magnetic field of the Earth
- A) only I
- B) only II
- C) only III
- D) I, II, and III

**D) I, II, and III**

Which of the following examples describes a behavioral pattern that results from a proximate cause?

- A) A cat kills a mouse to obtain nutrition.
- B) A male sheep fights with another male because it helps to improve its social position.
- C) A female bird lays its eggs because the amount of daylight is decreasing slightly each day.
- D) A goose squats and freezes motionless to escape a predator.

**C) A female bird lays its eggs because the amount of daylight is decreasing slightly each day.**

The proximate causes of behavior are interactions with the environment, but behavior is ultimately shaped by \_\_\_\_\_.

- A) hormones
- B) evolution
- C) pheromones
- D) the nervous system

**B) evolution**

During a field trip, an instructor touched a moth resting on a tree trunk. The moth raised its forewings to reveal large eyespots on its hind wings. The instructor asked why the moth lifted its wings. One student answered that sensory receptors had fired and triggered a neuronal reflex culminating in the contraction of certain muscles. A second student responded that the behavior might frighten predators. Which statement best describes these explanations?

- A) The first explanation is correct, but the second is incorrect.
- B) The first explanation refers to proximate causation, whereas the second refers to ultimate causation.
- C) The first explanation is testable as a scientific hypothesis, whereas the second is not.

D) Both explanations are reasonable and simply represent a difference of opinion.

**B) The first explanation refers to proximate causation, whereas the second refers to ultimate causation.**

Which of the following is required for a behavioral trait to evolve by natural selection?

A) The behavior is determined entirely by genes.

B) The behavior is the same in all individuals in the population.

C) An individual's reproductive success depends in part on how the behavior is performed.

D) The behavior is not genetically inherited.

**C) An individual's reproductive success depends in part on how the behavior is performed.**

) In testing a hypothesis that "territorial defense in European robins is a fixed action pattern that is released by the sight of orange feathers," researchers found that robins defended their territory by attacking anything that was of similar size and had an orange patch. What experiment would you perform next to determine that the color initiated the defense response?

A) Repeat the experiment using a blue patch instead of an orange patch.

B) Repeat the experiment by removing the patch completely.

C) Repeat the experiment by using a model of a robin that was twice the size of a normal robin but with a small orange patch.

D) Repeat the experiment by using a model of a robin that had an orange patch that was twice the size of a normal patch.

**A) Repeat the experiment using a blue patch instead of an orange patch.**

Listed below are several examples of types of animal behavior. Choose the letter of the correct term (A-E) that matches each example in the following question(s).

**A. operant conditioning**

B. agonistic behavior

C. innate behavior

D. imprinting

E. altruistic behavior

Through trial and error, a rat learns to run a maze without mistakes to receive a food reward.

- A) A
- B) B
- C) C
- D) D

**A) A**

Listed below are several examples of types of animal behavior. Choose the letter of the correct term (A-E) that matches each example in the following question(s).

- A. operant conditioning
- B. agonistic behavior
- C. innate behavior**
- D. imprinting
- E. altruistic behavior

A human baby performs a sucking behavior perfectly when it is put in the presence of the nipple of its mother's breast.

- A) A
- B) B
- C) C
- D) D

**C) C**

Listed below are several examples of types of animal behavior. Choose the letter of the correct term (A-E) that matches each example in the following question(s).

- A. operant conditioning
- B. agonistic behavior
- C. innate behavior
- D. imprinting**
- E. altruistic behavior

A mother goat can recognize its own kid by smell.

- A) A
- B) B
- C) C
- D) D

**D) D**

Every morning at the same time, John went into the den to feed his new tropical fish. After a few weeks, he noticed that the fish swam to the top of the tank when he entered the room. This is an example of \_\_\_\_\_.

- A) cognition
- B) imprinting
- C) classical conditioning
- D) operant conditioning

**C) classical conditioning**

Some dogs love attention, and Frodo the beagle learns that if he barks, he gets attention. Which of the following might you use to describe this behavior?

- A) The dog is displaying an instinctive fixed action pattern.
- B) The dog is trying to protect its territory.
- C) The dog has been classically conditioned.
- D) The dog's behavior is a result of operant conditioning.

**D) The dog's behavior is a result of operant conditioning.**

Scientists have tried raising endangered whooping cranes in captivity by using sandhill cranes as foster parents. This strategy is no longer used because \_\_\_\_\_.

- A) the fostered whooping cranes' critical period was variable such that different chicks imprinted on different "mothers"
- B) sandhill crane parents rejected their fostered whooping crane chicks soon after incubation
- C) none of the fostered whooping cranes formed a mating pair-bond with another whooping crane
- D) sandhill crane parents did not properly incubate whooping crane eggs

**C) none of the fostered whooping cranes formed a mating pair-bond with another whooping crane**

White-crowned sparrows can only learn the "crystallized" song for their species by \_\_\_\_\_.

- A) listening to adult sparrow songs during a sensitive period as a fledgling, followed by a practice period until the juvenile matches its melody to its memorized fledgling song
- B) listening to the song of its own species during a critical period so that it will imprint to its own species song and not the songs of other songbird species
- C) performing the crystallized song as adults when they become sexually mature, as the song is programmed into the innate behavior for the species

D) observing and practicing after receiving social confirmation from other adults at a critical period during their first episode of courtship behavior

**A) listening to adult sparrow songs during a sensitive period as a fledgling, followed by a practice period until the juvenile matches its melody to its memorized fledgling song**

One way to understand how early environment influences behaviors in similar species is through the "cross-fostering" experimental technique. Suppose that the curly-whiskered mud rat differs from the bald mud rat in several ways, including being much more aggressive. How would you set up a cross-fostering experiment to determine if environment plays a role in the curly-whiskered mud rat's aggression?

A) You would cross curly-whiskered mud rats and bald mud rats and hand-rear the offspring to see if any grew up to be aggressive.

B) You would place newborn curly-whiskered mud rats with bald mud rat parents and place newborn bald mud rats with curly-whiskered mud rat parents. Finally, let some mud rats of both species be raised by their own species. Then you would compare the outcomes.

C) You would remove the offspring of curly-whiskered mud rats and bald mud rats from their parents, raise them in the same environment but without parents, and then compare the outcomes.

D) You would replace normal newborn mud rats with deformed newborn mud rats to see if it triggered an altruistic response.

**B) You would place newborn curly-whiskered mud rats with bald mud rat parents and place newborn bald mud rats with curly-whiskered mud rat parents. Finally, let some mud rats of both species be raised by their own species. Then you would compare the outcomes.**

Which of the following is true of innate behaviors? Innate behaviors \_\_\_\_\_.

A) are only weakly influenced by genes

B) occur in invertebrates and some vertebrates but not mammals

C) are limited to invertebrate animals

D) are expressed in most individuals in a population

**D) are expressed in most individuals in a population**

A region of the canary forebrain shrinks during the nonbreeding season and enlarges when breeding season begins. This change is probably associated with the annual \_\_\_\_\_.

A) addition of new syllables to a canary's song repertoire

B) crystallization of subsong into adult songs



- C) renewal of mating and nest-building behaviors
- D) elimination of the memorized template for songs sung the previous year

**A) addition of new syllables to a canary's song repertoire**

Although many chimpanzees live in environments containing oil palm nuts, members of only a few populations use stones to crack open the nuts. The likely explanation is that \_\_\_\_\_.

- A) the behavioral difference is caused by genetic differences between populations
- B) members of different populations have different nutritional requirements
- C) the cultural tradition of using stones to crack nuts has arisen in only some populations
- D) members of different populations differ in learning ability

**C) the cultural tradition of using stones to crack nuts has arisen in only some populations**

You observe a species of bird that, upon hatching, has contact with its parents only while being fed. You also never hear the parents sing during the feeding process. What would you propose about song learning in this species of bird?

- A) Song learning in this species is most likely learned.
- B) The period of imprinting is likely later in the bird's life.
- C) The males will learn song when they congregate with other males of their species during the winter.
- D) Song learning in this species is most likely innate.

**D) Song learning in this species is most likely innate.**

Learning has the most influence on behavior when \_\_\_\_\_.

- A) making mistakes does not result in death
- B) animals reproduce asexually
- C) animals have enormous cognitive ability
- D) making mistakes result in death

**A) making mistakes does not result in death**

You have captured a number of rats from a wild population and quickly surmise with tests that they are very good at avoiding food with poisons. What would best explain this observation?

- A) Rats are probably just intelligent enough to avoid poison.
- B) Rats may experience a large variety of toxins in their environment and learn to avoid them.
- C) Rats are taught by their parents to test small bits of food first and then return

later if the food seems safe.

D) Rats may be able to tolerate large amounts of poison.

**B) Rats may experience a large variety of toxins in their environment and learn to avoid them.**

You observe scrub jays hiding food and notice that one particular individual only pretends to hide food. What kind of experiment could you perform to test whether this behavior was random or in response to another signal?

A) Observe more of these behaviors in the wild and try to determine if the behavior is random.

B) Hypothesize a set of signals that could produce this behavior and try to match the behaviors with the signals.

C) Attempt to reproduce the behavior in captivity by using bird models and a computer simulation.

**B) Hypothesize a set of signals that could produce this behavior and try to match the behaviors with the signals.**

You observe scrub jays hiding food and notice that one particular individual only pretends to hide food. Your experiments associate the presence of other individuals with the frequency of pretending to cache food. A colleague shows you animals of the same species that do not perform this pretend caching. How does this information affect your conclusions about this behavior?

A) It suggests that this behavior might be learned.

B) It prevents you from making conclusions.

C) It suggests that your experimental design is flawed.

D) It does not change your initial conclusions.

**A) It suggests that this behavior might be learned.**

You discover a rare new bird species, but you are unable to observe its mating behavior. You see that the male is large and ornamental compared with the female. On this basis, you can probably conclude that the species is \_\_\_\_\_.

A) polygamous

B) monogamous

C) polyandrous

D) agonistic

**A) polygamous**

Fred and Joe, two unrelated, mature male gorillas, encounter one another. Fred is courting a female. Fred grunts as Joe comes near. As Joe continues to advance, Fred begins drumming (pounding his chest) and bares his teeth. Joe

then rolls on the ground on his back, gets up, and quickly leaves. This behavioral pattern is repeated several times during the mating season. Choose the most specific behavior described by this example.

- A) agonistic behavior
- B) territorial behavior
- C) learned behavior
- D) fixed action pattern

**A) agonistic behavior**

Female spotted sandpipers aggressively court males and, after mating and egg laying, leave the clutch of young for the male to incubate. This sequence may be repeated several times with different males until no available males remain, forcing the female to incubate her last clutch. Which of the following terms best describes this behavior?

- A) monogamy
- B) polygyny
- C) polyandry
- D) promiscuity

**C) polyandry**

Feeding behavior with a high energy intake-to-expenditure ratio is called \_\_\_\_\_.

- A) autotrophy
- B) heterotrophy
- C) search scavenging
- D) optimal foraging

**D) optimal foraging**

Which of the following might affect the foraging behavior of an animal in the context of optimal foraging?

- I) risk of predation
- II) prey size
- III) prey defenses
- IV) prey density
- A) only I and III
- B) only II and IV
- C) only I, II, and III
- D) I, II, III, and IV

**D) I, II, III, and IV**

Which of the following is most likely associated with the evolution of mating systems?

- A) population density
- B) territoriality
- C) certainty of paternity
- D) sexual dimorphism

**D) sexual dimorphism**

Females are typically larger and more ornamented than males where \_\_\_\_\_ occurs.

- A) monogamy
- B) polyandry
- C) polygamy
- D) polygyny

**B) polyandry**

Which of the following statements is true about certainty of paternity?

- A) Certainty of paternity is high in most species with internal fertilization because the acts of mating and birth are separated by time.
- B) Certainty of paternity is low when males guard females they have mated.
- C) Certainty of paternity is low when egg laying and mating occur together, as in external fertilization.
- D) Paternal behavior exists because it has been reinforced over generations by natural selection

**D) Paternal behavior exists because it has been reinforced over generations by natural selection**

Which of the following best describes "game theory" as it applies to animal behavior?

- A) The fitness of a particular behavior is influenced by other behavioral phenotypes in a population.
- B) The total of all of the behavioral displays, both male and female, is related to courtship.
- C) The play behavior performed by juveniles allows them to perfect adult behaviors that are needed for survival, such as hunting, courtship, and so on.
- D) The evolutionary "game" is played between predator and prey. The prey evolve a behavior in response to the nature of the predatory behavior.

**A) The fitness of a particular behavior is influenced by other behavioral phenotypes in a population.**

The color of throats of males in a population of side-blotched lizards is determined by \_\_\_\_\_.

- A) ambient temperature: blue = cold; orange = normal; yellow = hot
- B) stage of development/maturity
- C) their receptiveness to mate
- D) the success of the mating behavior of each of the throat color phenotypes

**D) the success of the mating behavior of each of the throat color phenotypes**

In the figure above, which of the following conclusions is most logical based on the data?

- A) Females produce more eggs more quickly when exposed to breeding males.
- B) Females produce eggs more quickly when exposed to many males than females paired with a male.
- C) All non-isolated females do just as well as isolated females.
- D) After four weeks together, females with males produce mature follicles to the same extent as females without males.

**A) Females produce more eggs more quickly when exposed to breeding males.**

Listed below are several examples of types of animal behavior. Choose the letter of the correct term (A-E) that matches each example in the following question(s).

- A. operant conditioning
- B. agonistic behavior
- C. innate behavior
- D. imprinting

**E. altruistic behavior**

) Upon observing a golden eagle flying overhead, a sentry prairie dog gives a warning call to other foraging members of the prairie dog community.

- A) B
- B) C
- C) D
- D) E
- D) E

The fru gene in fruit flies \_\_\_\_\_.

- I) controls sex-specific development in the fruit fly
  - II) is a master regulatory gene that directs expression of many other genes
  - III) can be genetically manipulated in females so that they will perform male sex behaviors
  - IV) programs males for appropriate courtship behaviors
- A) only I and III
  - B) only II and IV
  - C) only II, III, and IV
  - D) I, II, III, and IV

**D) I, II, III, and IV**

Pair-bonding in a population of prairie voles can be prevented by \_\_\_\_\_.

- A) the ensuing confusion caused by introducing meadow voles
- B) administering a drug that inhibits the brain receptor for vasopressin in the central nervous system (CNS) of males
- C) dying the coat color from brown to blond in either male or female prairie voles
- D) allowing the population size to reach critically low levels

**B) administering a drug that inhibits the brain receptor for vasopressin in the central nervous system (CNS) of males**

Which of the following statements about evolution of behavior is correct?

- A) Natural selection will favor behavior that enhances survival and reproduction.
- B) An animal may show behavior that minimizes reproductive fitness.
- C) If a behavior is less than optimal, it will eventually become optimal through natural selection.
- D) Innate behaviors cannot be altered by natural selection.

**A) Natural selection will favor behavior that enhances survival and reproduction.**

How do altruistic behaviors arise through natural selection?

- A) By his/her actions, the altruist increases the likelihood that some of its genes will be passed on to the next generation.
- B) The altruist is appreciated by other members of the population because its survivability has been enhanced by virtue of its risky behavior.
- C) Animals that perform altruistic acts are allowed by their population to breed more, thereby passing on their behavior genes to future generations.

D) Altruistic behaviors lower stress in populations, which increases the survivability of all the members of the population.

**A) By his/her actions, the altruist increases the likelihood that some of its genes will be passed on to the next generation.**

Which of the following has a coefficient of relatedness of 0.25?

- A) a father to his daughter
- B) an uncle to his nephew
- C) a brother to his brother
- D) a sister to her brother

**B) an uncle to his nephew**

Animals that help other animals of the same species \_\_\_\_\_.

- A) have excess energy reserves
- B) are bigger and stronger than the other animals
- C) are usually related to the other animals helped
- D) are always male

**C) are usually related to the other animals helped**

The presence of altruistic behavior is most likely due to kin selection, a theory maintaining that \_\_\_\_\_.

- A) genes enhance survival of copies of themselves by directing organisms to assist others who share those genes
- B) companionship is advantageous to animals because in the future they can help each other
- C) critical thinking abilities are normal traits for animals and they have arisen, like other traits, through natural selection
- D) natural selection has generally favored the evolution of exaggerated aggressive and submissive behaviors to resolve conflict without grave harm to participants

**A) genes enhance survival of copies of themselves by directing organisms to assist others who share those genes**

If a prairie dog had the opportunity to perform an altruistic act (that is, give an alarm call) to help its relatives, which combination of the following relatives would the prairie dog be most likely to help (base your answer solely on the genetic relationships)?

- A) two nieces, two cousins, and one half-brother
- B) two half-sisters and two nieces
- C) one son, one niece, and one half-sister

D) The prairie dog would be equally likely to act altruistically to each of the combinations described.

**D) The prairie dog would be equally likely to act altruistically to each of the combinations described.**

How would you classify the genetic basis for most behavioral traits in the animal kingdom?

- A) One gene typically codes for one behavior.
- B) One gene typically codes for many behaviors.
- C) Many genes typically code for one behavior.
- D) Behaviors are learned, not coded by genes.

**C) Many genes typically code for one behavior.**

Look at the evolutionary relationship of protein kinases in the figure above. Knowing that there is evidence that this particular protein kinase is linked to food-related behaviors in the animals studied, what conclusions can you draw?

- A) There is enormous variation in amino acid sequences between taxa.
- B) There is likely a conserved evolutionary relationship between these genes and their behavioral phenotype.
- C) PKG influences food-related behaviors in a wide variety of animals, and there is enormous variation in amino acid sequences between taxa.
- D) PKG influences food-related behaviors in a wide variety of animals, and there is likely a conserved evolutionary relationship between these genes and their behavioral phenotype.

**D) PKG influences food-related behaviors in a wide variety of animals, and there is likely a conserved evolutionary relationship between these genes and their behavioral phenotype.**

Using the figure above and the accompanying paragraph, and knowing that the PKG encoded by the foraging gene has recently been associated with the maturation of out-of-nest behavior in honeybees, what would be a logical explanation for this relationship? As animals mature, they \_\_\_\_\_.

- A) require more food; therefore, PKG levels must increase.
- B) are more likely to forage; therefore, PKG levels must increase.
- C) respond to pheromones from the queen, which increases PKG levels.
- D) are able to fly, an activity that is connected to the increase in PKG levels.

**B) are more likely to forage; therefore, PKG levels must increase.**

What probably explains why coastal and inland garter snakes react differently to banana slug prey?



- A) Ancestors of coastal snakes that could eat the abundant banana slugs had increased fitness. No such selection occurred inland, where banana slugs were absent.
- B) Banana slugs are camouflaged, and inland snakes, which have poorer vision than coastal snakes, are less able to see them.
- C) Garter snakes learn about prey from other garter snakes. Inland garter snakes have fewer types of prey because they are less social.
- D) Inland banana slugs are distasteful, so inland snakes learn to avoid them. Coastal banana slugs are palatable to garter snakes.

**A) Ancestors of coastal snakes that could eat the abundant banana slugs had increased fitness. No such selection occurred inland, where banana slugs were absent.**

Behaviors are diverse and important for survival and reproduction. Some behaviors are learned, such as the species-specific song of a yellow warbler which is different from the song of a blue-winged warbler. Other behaviors are innate, such as a female cat in heat urinating more often and in many places to attract a mate or honeybees do a "dance" that indicates the distance and direction of a food source when they return to their hive. Which of the following statements supports the idea that behaviors are important in survival and therefore affect natural selection?

- A) Learned behaviors may not necessarily increase fitness. Baby warblers can learn the song of another species.
- B) Innate behaviors are the result of selection for individual survival and reproductive success.
- C) All behaviors are survival mechanisms that increase reproductive fitness by increasing mutation rates.
- D) Both innate and learned behaviors are entirely based on genes inherited from parents.

**B) Innate behaviors are the result of selection for individual survival and reproductive success.**

The graph indicates that males leave the area where they were born while females stay in the area. What is the most likely reason for the evolution of this behavior?

- A) Movement of males out of the territory reduces competition for food among the males.
- B) The females are not as strong as the male ground squirrels and therefore stay closer to their birthplace.
- C) Females reproduce by parthenogenesis, which means they produce offspring

from unfertilized eggs so the males are not needed.

D) Within the ground squirrel population, males leave the area of their birth and are replaced by new males, thus maintaining genetic diversity in the population.

**D) Within the ground squirrel population, males leave the area of their birth and are replaced by new males, thus maintaining genetic diversity in the population.**

A male stickleback fish will attack other male sticklebacks that invade its nesting territory. It will only attack male fish, which display the red belly characteristic of the species. Why has natural selection favored this behavior?

A) The behavior reduces interspecific competition, which gives the male stickleback access to more food.

B) The behavior allows the male stickleback to attract females with its aggressive display.

C) The behavior allows the male to establish a defined space for breeding with female sticklebacks.

D) The behavior is a mechanism to reduce predation and resource competition.

**C) The behavior allows the male to establish a defined space for breeding with female sticklebacks.**