Arizona State University (ASU) BIO345 Evolution Exam 1 Practice (Sample)

Study Guide

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Questions

1. What is an evolutionary arms race?

   A. A process where species become extinct

   B. A cycle of coevolution between competing species

   C. A single species evolving without external pressures

   D. A method for creating new species

2. What evolutionary concept does the expression "survival of the fittest" primarily refer to?

   A. Physical strength among individuals.

   B. Ability to find resources.

   C. Reproductive success in the given environment.

   D. Intelligence of organisms.

3. What is one major outcome of natural selection?

   A. Increased genetic uniformity

   B. Increased biodiversity

   C. Decreased population health

   D. Reduced competition

4. To evaluate if beetle color is subject to natural selection, which experiment would best assess survival rates?

   A. Testing the heritability of color

   B. Measuring the overall population size

   C. Assessing reproductive advantages of color

   D. Testing which colors survive to maturity

5. What primarily affects a population after a significant founder event?

   A. Natural selection

   B. Genetic drift

   C. Disruptive selection

   D. A and B

6. What is adaptive radiation?

A. The gradual evolution of a single species over time

B. The rapid evolution of diversely adapted species from a common ancestor

C. The extinction of species due to environmental changes

D. The adaptation of a species to a specific habitat only

7. A beneficial allele is introduced into a bird subpopulation but fails to increase in frequency. What is likely preventing this increase?

A. Local selection outweighs gene flow

B. Local selection and gene flow are equally influential

C. Gene flow from migration prevents local adaptation

D. Random chance enhances local adaptation

8. Based on evolutionary traits, which species is identified as a hairless mammal with eyesight?

A. Bakis

B. Uppsas

C. Yelps

D. Flops

9. What does a frameshift mutation result from?

A. Substitutions of nucleotides

B. Insertions or deletions of nucleotides

C. Point mutations exclusively

D. Replications errors

10. Which of the following is NOT considered an example of adaptation?

A. The current utility of bird feathers.

B. Giraffes with longer necks.

C. Africanized honey bees exhibiting aggressive behavior.

D. The red color of mammalian blood.

Answers

1. B
2. C
3. B
4. D
5. B
6. B
7. C
8. D
9. B
10. D

Explanations

1. What is an evolutionary arms race?

A. A process where species become extinct

B. A cycle of coevolution between competing species

C. A single species evolving without external pressures

D. A method for creating new species

An evolutionary arms race refers to a cycle of coevolution between competing species, where adaptations in one species lead to counter-adaptations in another. This dynamic often occurs between predators and their prey, parasites and hosts, or two competing organisms in the same ecological niche. In this context, as one species develops a new trait, such as a more effective means of catching prey or avoiding predation, the other species is driven to evolve its own adaptations in response. This results in a continual cycle of adaptation and counter-adaptation, which can escalate over time, much like an arms race in a military context where each side seeks to outdo the other with advancements. Such evolutionary interactions can lead to significant changes in the traits of both species involved and can have profound impacts on their survival and reproductive success. This concept is central to understanding how species influence each other's evolution through their ecological relationships.

2. What evolutionary concept does the expression "survival of the fittest" primarily refer to?

A. Physical strength among individuals.

B. Ability to find resources.

C. Reproductive success in the given environment.

D. Intelligence of organisms.

The expression "survival of the fittest" primarily refers to the concept of reproductive success in the given environment. This phrase, popularized by Herbert Spencer in relation to Charles Darwin's theory of natural selection, emphasizes that "fittest" does not necessarily mean the strongest or the most intelligent. Instead, it refers to those individuals who are best adapted to their environment in terms of reproducing and passing on their genes to the next generation. In an evolutionary context, fitness is measured by the number of offspring that an organism can produce and successfully raise to a reproductive age. Different environments favor different traits, and those individuals that possess advantageous adaptations are more likely to survive and reproduce. This means that resources, intelligence, and physical strength can all play a role, but ultimately, it is reproductive success that drives evolutionary change. As a result, the concept captures the essence of how natural selection shapes populations over time, reinforcing the importance of adaptation in the reproductive context.

3. What is one major outcome of natural selection?

A. Increased genetic uniformity

B. Increased biodiversity

C. Decreased population health

D. Reduced competition

Natural selection plays a pivotal role in shaping the biodiversity of species within an ecosystem. One of the major outcomes of natural selection is the enhancement of variation within populations. This process occurs as individuals within a species exhibit different traits, and those traits that confer a survival or reproductive advantage are more likely to be passed on to future generations. Over time, as these advantageous traits accumulate and are selected for, populations can diverge and adapt to varying environmental conditions, leading to the emergence of new species and ultimately increasing biodiversity. By favoring traits that enhance survival and reproductive success, natural selection promotes a wider range of adaptations among organisms, which can lead to the formation of new niches and further evolutionary opportunities. This dynamic contributes to the complexity and richness of life on Earth, fostering diverse biological communities.

4. To evaluate if beetle color is subject to natural selection, which experiment would best assess survival rates?

A. Testing the heritability of color

B. Measuring the overall population size

C. Assessing reproductive advantages of color

D. Testing which colors survive to maturity

The chosen option effectively addresses the goal of evaluating whether beetle color is under the influence of natural selection by directly measuring survival rates based on color variation. In this context, the critical factor is understanding how different colors of beetles fare in their environment, particularly regarding their ability to survive to maturity. By testing and observing which color morphs reach maturity, researchers can infer whether certain colors confer a survival advantage or disadvantage. This approach aligns with the foundational principles of natural selection, which emphasize differential survival and reproduction based on specific traits. A successful demonstration of color-related survival would suggest that the trait is influenced by natural selection, as those beetles with colors that enhance their survival will be more likely to reach reproductive age and pass on their genes. The other choices do not directly measure survival rates: - Assessing heritability of color informs about genetic transmission but does not directly link to survival outcomes in the environment. - Measuring overall population size does not provide insight into the survival of specific color variants; it merely captures the total number of beetles, irrespective of how color impacts their success in survival. - Assessing reproductive advantages focuses on mating success rather than directly examining how color affects the chance of surviving in the wild. Thus, the selected experiment, by

5. What primarily affects a population after a significant founder event?

A. Natural selection

B. Genetic drift

C. Disruptive selection

D. A and B

A founder event occurs when a small number of individuals from a larger population establish a new population in a different location. This event can lead to a significant reduction in genetic variation because the new population is started by only a few individuals. As a result, the genetic makeup of the new population may not represent the full diversity of the original population. Genetic drift becomes particularly influential in this context. Since the new population is derived from a limited number of founders, random fluctuations in allele frequencies can have a large impact. Over time, certain alleles may become more or less common purely by chance rather than through selective pressures. This drift can lead to increased differences between the new population and the original population. Natural selection can also act on a population, but its effects depend on the variation already present in the population and the selective pressures in the new environment. In the immediate aftermath of a founder event, genetic drift tends to have a more pronounced effect because the population is small and may have low genetic variability. Disruptive selection refers to a specific type of natural selection that favors individuals at both extremes of a trait distribution, which is a more nuanced process that typically requires a relatively stable population structure and is not as directly associated with the immediate aftermath of a founder event

6. What is adaptive radiation?

A. The gradual evolution of a single species over time

B. The rapid evolution of diversely adapted species from a common ancestor

C. The extinction of species due to environmental changes

D. The adaptation of a species to a specific habitat only

Adaptive radiation refers to a process in which a single ancestral species rapidly diversifies into a range of forms that adapt to different environments or ecological niches. This phenomenon often occurs when populations of a species spread to new habitats that present different challenges and opportunities, thereby exerting selective pressures that promote a variety of adaptations. The key aspect of adaptive radiation is its speed and the fact that it results from a common ancestor branching out into multiple species, each uniquely adapted to thrive in specific conditions. This can be observed in examples such as the finches of the Galápagos Islands, which evolved from a common ancestor into several species, each with differing beak shapes tailored to their specific dietary needs. The other options do not capture the essence of adaptive radiation. The gradual evolution of a single species over time describes a more linear process of change rather than the rapid diversification seen in adaptive radiation. Extinction due to environmental changes does not relate to the creation of new species. Lastly, adaptation to a specific habitat indicates a singular focus rather than the broader diversification characteristic of adaptive radiation.

7. A beneficial allele is introduced into a bird subpopulation but fails to increase in frequency. What is likely preventing this increase?

A. Local selection outweighs gene flow

B. Local selection and gene flow are equally influential

C. Gene flow from migration prevents local adaptation

D. Random chance enhances local adaptation

The scenario describes a situation where a beneficial allele is introduced but does not increase in frequency within the bird subpopulation. Gene flow, which is the transfer of genetic material between populations, can play a critical role in the evolutionary dynamics of subpopulations. When gene flow from other populations brings in alleles that are not beneficial in the specific local context, it can dilute the effect of beneficial alleles that have been introduced. In this case, if migrants from another population possess alleles that are more advantageous in the new environment, the advantageous allele may struggle to increase in frequency because the genetic contributions from these migrants can overwhelm the local adaptive potential of the beneficial allele. Thus, it is the gene flow from migration that is likely preventing the beneficial allele from increasing in the subpopulation, as new individuals may carry alleles that are either neutral or disadvantageous, obstructing the local adaptation process. This highlights the importance of understanding the balance between local selection pressures and the effects of gene flow in shaping population genetics and evolutionary trajectories.

8. Based on evolutionary traits, which species is identified as a hairless mammal with eyesight?

A. Bakis

B. Uppsas

C. Yelps

D. Flops

The identification of a hairless mammal with eyesight as a significant evolutionary trait aligns with several fascinating adaptations observed in the animal kingdom. Notably, some species, such as certain rodents and specific breeds of domestic animals, have evolved hairless traits, which can be attributed to genetic mutations that confer advantages in particular environments. In the context of mammalian evolution, hairlessness can serve various functions, including thermoregulation in warmer climates or reduced external parasites. Furthermore, maintaining eyesight is crucial for survival, as it enhances an organism's ability to navigate its environment, find food, and avoid predators. Hence, a species characterized as hairless with functioning eyesight exemplifies an adaptation that may benefit it in its specific ecological niche. Given these considerations, highlighting a species like "Flops" as the correct answer reinforces the idea that evolutionary traits such as hairlessness and well-developed eyesight can emerge under selective pressures and adaptive strategies prevalent in nature.

9. What does a frameshift mutation result from?

A. Substitutions of nucleotides

B. Insertions or deletions of nucleotides

C. Point mutations exclusively

D. Replications errors

A frameshift mutation occurs when the reading frame of the genetic code is altered, which directly results from the insertion or deletion of nucleotides within a DNA sequence. This type of mutation shifts the entire downstream sequence, meaning that all subsequent codons are misread during translation. For example, if a single nucleotide is added or removed, the ribosome will read the mRNA differently from that point forward, often leading to completely different and typically nonfunctional protein products. In contrast, substitutions of nucleotides, as mentioned in one of the options, change just one nucleotide to another without altering the overall reading frame, and are classified as point mutations. Point mutations can lead to silent mutations, missense mutations, or nonsense mutations, but they do not cause frameshifts. Replication errors can lead to various types of mutations, but they are not specifically responsible for frameshifts unless they result in insertions or deletions. Therefore, while replication errors may indirectly contribute to frameshift mutations, they are not the mechanism that defines them. Thus, the focus on insertions or deletions in the correct answer highlights the critical role these alterations play in creating frameshift mutations, making it the accurate choice in this context.

10. Which of the following is NOT considered an example of adaptation?

A. The current utility of bird feathers.

B. Giraffes with longer necks.

C. Africanized honey bees exhibiting aggressive behavior.

D. The red color of mammalian blood.

The red color of mammalian blood is not considered an example of adaptation in the same context as the other options. Adaptations are traits that have evolved over time in response to environmental pressures, enhancing an organism's chances of survival and reproduction. Bird feathers serve important functions such as insulation, protection, and aiding in flight, making them adaptations to various ecological niches. Likewise, the longer necks of giraffes are thought to be adaptations that facilitate feeding from tall trees and possibly engaging in necking behavior during mating contests, thereby improving their chances of survival and reproductive success. Africanized honey bees displaying aggressive behavior is also an adaptation; their heightened defensiveness is a trait that has evolved to protect their hives from predators, thus increasing survival rates for the colony. In contrast, the red color of mammalian blood primarily arises from the presence of hemoglobin, which is essential for transporting oxygen. This characteristic is a biochemical necessity rather than a trait that evolved specifically due to environmental pressures to improve fitness. The red color itself does not enhance survival or reproductive success in a direct adaptive sense.