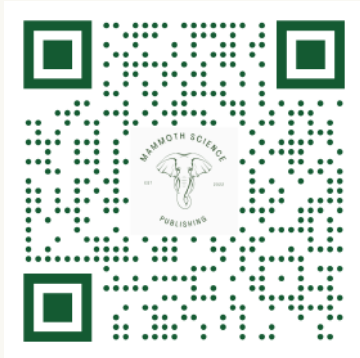


# Biodiversity & Evolution

Task Cards

front



# Question 1



FuseSchool (2016, January 1). *What Is Biodiversity? | Ecology & Environment | Biology* | FuseSchool. Youtube. Retrieved January 16, 2024, from [https://youtu.be/\\_bk2nnDI68g](https://youtu.be/_bk2nnDI68g)

## Define Biodiversity and its Role in Nature

Explain what biodiversity is and why it is important for the balance of nature.

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## Question 2



### Explore Connections in Nature

Examine how different types of diversity, like the variety of species, their genetics, and the ecosystems they live in, are all connected.

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## Question 3



### Why Diversity Matters in Nature

Investigate specific cases where having many different species, diverse genetics, and various ecosystems is crucial for the health of the environment.

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## Question 4



YourekaScience (2022, January 1). *Evolution: Explaining the diversity of life on earth*. Youtube. Retrieved January 16, 2024, from <https://youtu.be/GieZAaH8-mg>

### Understanding Evolution

Take a close look at the theory of evolution and discuss how it shapes the variety of life on Earth.

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## Question 5

### Gene Flow and Genetic Drift Exploration

Dive into the mechanisms of gene flow and genetic drift, understanding their impact on population genetics and evolution.

- Define gene flow and genetic drift, providing concise explanations for each concept.
- Research real-world examples illustrating instances of gene flow and genetic drift in different populations.
- Evaluate how gene flow and genetic drift contribute to genetic variation and evolutionary changes within populations.

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## Question 6

### Evaluating Evidence for Evolution

Examine different types of evidence that support the theory of evolution, considering their strengths and weaknesses.

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## Question 7

### How New Species Emerge

Study the process of speciation, explaining the factors that lead to the emergence of new and distinct species.

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## Question 8



Atomi (2019, January 1). WACE Biology: Defining Microevolution and Macroevolution. Youtube. Retrieved January 16, 2024, from <https://youtu.be/O8DzMNEp2TM>

### Small Changes vs. Big Changes in Evolution

Differentiate between small changes within a species (microevolution) and larger changes leading to new species (macroevolution), using specific examples.

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## Question 9



### Mechanisms Behind Survival

Critically assess how natural selection works, exploring how it helps species develop new traits and even become entirely new species.

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## Question 10



### The Power of Genetic Variation

Examine why having a variety of genetic traits is crucial for species survival, especially when environments change.

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## Question 11



### Biodiversity in Rainforests

Explore the rich variety of life in rainforests and explain why it's essential for the global balance of nature.

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## Question 12

### The Role of Poison Dart Frogs

Investigate the specific job that poison dart frogs have in rainforest ecosystems and how they contribute to overall biodiversity.

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## Question 13



### Impact of Habitat Loss on Poison Dart Frogs

Analyze how losing their homes and fragmented habitats affect poison dart frog populations, considering the ecological consequences.

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## Question 14

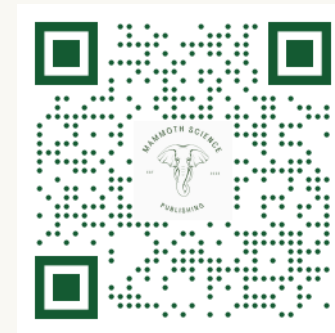
### Investigating Adaptation and Natural Selection

Explore the concepts of adaptation and natural selection, focusing on real-world examples and their implications for species survival.

- Select a specific species (plant or animal) and investigate its adaptations to its environment.
- Explore the role of natural selection in shaping these adaptations over time.
- Analyze how these adaptations contribute to the species' survival and reproductive success.



Khan Academy (2022, January 1). *Natural selection and adaptation* | High school biology | Khan Academy. Youtube. Retrieved January 16, 2024, from <https://youtu.be/giw2ELZr-bE>



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## Question 15



### Climate Change and Poison Dart Frog Habitats

Dive into how climate change affects the places where poison dart frogs live and explain the long-term consequences of climate change on their populations.

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## Question 16

### Types of Selection

Predict the three types of selection concerning body size of the poison Dart Frog when a predator is introduced into the ecosystem, when deforestation occurs in the ecosystem, and when food sources are plentiful in an ecosystem. Use a graph to help explain your answer.

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## Question 17

### Evolutionary Insights into Poison Dart Frogs

Apply a deep understanding of evolution to analyze how poison dart frogs have adapted and evolved, focusing on key traits.

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## Question 18

### Genetic Variation and Frog Conservation

Evaluate the complex relationship between genetic diversity and natural selection concerning poison dart frog conservation.

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## Question 19



### Analyzing Evolutionary Mechanisms in Frogs

Critically examine specific ways in which poison dart frogs have evolved and understand their broader ecological significance.

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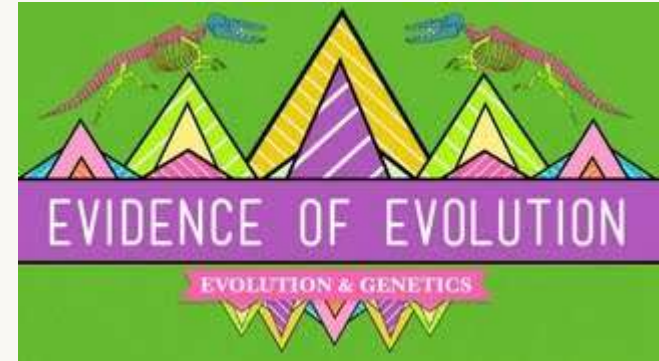
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## Question 20

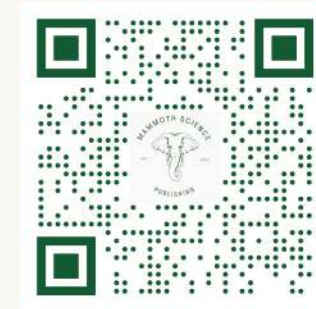
### Uncovering Evolutionary Evidence

Explore different types of evidence that support the theory of evolution, delving into their significance and implications.

- Choose one type of evidence for evolution (fossils, comparative anatomy, comparative embryology, molecular biology, or biogeography).
- Evaluate how this evidence contributes to our understanding of evolutionary processes.



Crashcourse (2013, January 1). *Evolution: It's a Thing* - Crash Course Biology #20. Youtube. Retrieved January 16, 2024, from <https://youtu.be/P3GagfbA2vo>



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## Answer 1

Biodiversity, which includes the variety of species, ecosystems, and genetic differences on Earth, is crucial for maintaining the delicate balance of nature. Its importance lies in providing stability to ecosystems, helping them cope with disturbances and adapt to changes in the environment. Diverse ecosystems offer essential services that benefit human well-being, like purifying air and water, aiding in pollination, and decomposing waste. Each species within an ecosystem plays a unique role in supporting these services. Additionally, biodiversity supports genetic diversity within species, ensuring adaptability and survival in different environments. Species with greater genetic diversity can evolve and develop traits for long-term sustainability. In essence, biodiversity is not just an ecological necessity; it's a vital element for the harmonious coexistence of all living organisms, underscoring the need for its preservation.

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## Answer 2

Species diversity, which includes different plants, animals, and microorganisms, contributes to genetic diversity within populations. This genetic diversity is crucial for species to adapt and survive. The connections extend to ecosystems, where the interactions between diverse species and their genetics collectively shape the environment. For example, the presence of certain species can influence the physical characteristics of an ecosystem, impacting its ability to support life. Changes in ecosystems, driven by factors like climate or human activities, can, in turn, affect the genetic diversity and distribution of species. Understanding these connections highlights the importance of preserving all aspects of diversity for the overall health and balance of natural systems.

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## Answer 3

Consider coral reefs as an example, where a multitude of species, including corals, fish, and microorganisms, form a complex ecosystem. The genetic diversity within coral populations enhances their ability to withstand threats like diseases and climate change, ensuring the overall health of the reef. Similarly, in the Amazon rainforest, diverse plant and animal species contribute to ecosystem stability, playing unique roles in nutrient cycling, pollination, and pest control. The genetic diversity within these species allows for adaptation to the changing conditions of the rainforest. These examples highlight the crucial role of diverse species, genetics, and ecosystems in maintaining the health and equilibrium of our environment.

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## Answer 4

Originating from Charles Darwin's insights, the theory suggests that species undergo changes over time through natural selection, where advantageous traits contribute to survival and are passed on to subsequent generations. This gradual process results in the development of new species finely adapted to their environments. The theory is exemplified in phenomena like the specialized beak shapes in Darwin's finches, demonstrating adaptation to varied food sources, and is supported by the fossil record, providing evidence of species transformations over millions of years. Beyond explaining the origin of species, the theory of evolution illuminates the interconnected and dynamic nature of life, offering a comprehensive lens to understand the rich tapestry of biodiversity on Earth.

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## Answer 5

Gene flow and genetic drift are fundamental concepts in population genetics. Gene flow involves the transfer of genes between different populations, typically through the movement of individuals. This interchange of genetic material can occur through migration, leading to increased genetic diversity within populations. On the other hand, genetic drift is the random fluctuation of gene frequencies within a population due to chance events, particularly in smaller populations. Real-world examples of gene flow include the movement of pollinators between plant populations, facilitating the exchange of genetic material. In contrast, genetic drift can be observed in small, isolated animal populations, where chance events determine the prevalence of certain traits. Both gene flow and genetic drift contribute significantly to genetic variation within populations, with gene flow promoting diversity and genetic drift leading to random changes. These processes play crucial roles in evolutionary changes, influencing the genetic makeup of populations over time.

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## Answer 6

Fossils, representing preserved remnants of ancient life, offer tangible records of evolutionary changes over time. Comparative anatomy highlights similarities and differences in anatomical structures across species, revealing evolutionary relationships. Comparative embryology studies the developmental stages of different organisms, showcasing shared ancestry. Molecular biology delves into genetic similarities, unraveling evolutionary connections at the molecular level. Finally, biogeography examines the geographical distribution of species, offering clues about historical evolutionary processes. Each type of evidence contributes unique strengths to the overall support for evolution. Fossils provide tangible historical records, while comparative anatomy and embryology offer visual similarities. Molecular biology provides precise genetic correlations, and biogeography elucidates the geographic spread of species. However, weaknesses exist, such as incomplete fossil records and potential convergent evolution affecting anatomical comparisons. Balancing these strengths and weaknesses enhances the comprehensive understanding of evolution and its evidentiary basis.

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## Answer 7

Speciation occurs when populations of a common ancestor diverge to the extent that they become reproductively isolated. This isolation can result from various factors, including geographic barriers, where populations are physically separated, limiting gene flow. Additionally, reproductive isolation can arise through mechanisms such as behavioral differences, where mating behaviors or preferences evolve differently between populations, preventing successful interbreeding. Genetic divergence, driven by mutations and natural selection, further reinforces the development of distinct species. Understanding the intricate interplay of these factors provides insight into how new species evolve, adapting to their environments and forming unique traits that contribute to their reproductive isolation and eventual differentiation from their ancestral populations.

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## Answer 8

Differentiating between microevolution, involving small changes within a species, and macroevolution, which encompasses larger changes leading to new species, sheds light on the varying scales of evolutionary processes. Microevolution often involves changes in gene frequencies within a population over time. For instance, the development of antibiotic resistance in bacteria or variations in beak sizes among finches are examples of microevolutionary changes. On the other hand, macroevolutionary processes result in the formation of new species. One notable example is the evolution of different horse species from a common ancestor over millions of years, showcasing significant morphological and genetic transformations. Understanding these distinctions helps elucidate how the accumulation of small-scale changes can lead to the divergence of species, illustrating the continuum of evolutionary processes from micro to macro scales.

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## Answer 9

Natural selection, proposed by Charles Darwin, is the process by which organisms with advantageous traits for survival and reproduction are more likely to pass those traits on to their offspring. This mechanism operates through environmental pressures, such as predation, competition for resources, or changes in climate. Beneficial traits increase an organism's chances of survival and reproduction, leading to their gradual prevalence in a population. Over generations, the accumulation of these advantageous traits can result in significant changes, ultimately contributing to the development of new species. A classic example is the peppered moth during the Industrial Revolution, where natural selection favored dark-colored moths in polluted environments, illustrating how environmental pressures can drive observable changes within a species and, in the long term, lead to the formation of new species.

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## Answer 10

Genetic diversity within a species represents the range of different traits and characteristics present in individuals. In a changing environment, having a variety of genetic traits is crucial because it increases the likelihood that at least some individuals will possess traits suited to the altered conditions. This diversity acts as a reservoir of potential adaptations, allowing a species to respond more effectively to new challenges, whether they be changes in climate, the introduction of new predators, or modifications in the availability of resources. Without genetic diversity, a population may lack the necessary traits to cope with environmental changes, making the entire species more vulnerable to extinction. Therefore, the presence of a diverse gene pool enhances a species' ability to adapt and persist in dynamic and evolving ecosystems.

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## Answer 11

Rainforests, characterized by their lush vegetation and abundant biodiversity, host an immense variety of plant and animal species. This diversity contributes to the intricate web of ecological relationships, forming a balance that sustains the health of the entire planet. The interdependence of species in rainforests is exemplified by mutualistic relationships, where certain plants and animals rely on each other for survival.

Additionally, the dense vegetation of rainforests plays a vital role in regulating the Earth's climate by absorbing and storing significant amounts of carbon dioxide. The richness of life in rainforests, from countless species of insects to unique plants and elusive mammals, creates a complex and resilient ecosystem. Preserving this biodiversity is essential for global ecological balance, as rainforests contribute to oxygen production, climate regulation, and the overall health of the Earth's ecosystems.

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## Answer 12

Poison dart frogs, found in the tropical rainforests of Central and South America, serve as bioindicators of environmental health due to their sensitivity to changes in habitat conditions. While their vibrant colors and toxic skin act as a defense mechanism against predators, these frogs also play a vital role in controlling insect populations. Their diet consists mainly of small invertebrates, contributing to the regulation of insect populations within their habitat. Additionally, the toxic compounds found in their skin have ecological implications, as some rainforest species have developed resistance to these toxins, forming intricate relationships within the ecosystem. The presence of poison dart frogs, therefore, reflects the health and diversity of rainforest ecosystems, emphasizing the interconnectedness of species and the delicate balance they maintain.

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## Answer 13

The detrimental effects of losing their homes and facing fragmented habitats significantly impact poison dart frog populations and bear ecological consequences for rainforest ecosystems. Habitat loss, primarily driven by human activities, disrupts the natural behaviors and breeding patterns of these frogs, while fragmentation increases their vulnerability. The repercussions extend beyond the frogs themselves, influencing the entire ecosystem. Poison dart frogs contribute to insect population control, and their decline can upset prey-predator dynamics, leading to imbalances. Moreover, these frogs are integral to the food web, and their disappearance can disrupt intricate ecological interactions. Preserving the habitats of poison dart frogs is crucial not only for their survival but also for maintaining the biodiversity and ecological balance of rainforests. Conservation efforts are imperative to mitigate these impacts and safeguard the interconnected web of life in these fragile ecosystems.

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## Answer 14

By delving into a specific species, such as the giraffe, one can observe remarkable adaptations to its environment. The elongated neck of the giraffe, evolved over generations, is a prime example shaped by natural selection. In environments with scarce vegetation, giraffes with longer necks had a higher chance of reaching leaves on tall trees, ensuring their survival. This adaptation contributed to the giraffe's reproductive success, as individuals with longer necks passed on this advantageous trait to their offspring. The interplay between adaptation and natural selection is evident, demonstrating how specific traits enhance a species' ability to thrive in its environment and secure its place in the evolutionary trajectory.

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## Answer 15

Rising temperatures, altered precipitation patterns, and changes in humidity directly affect the delicate balance of rainforest ecosystems where these frogs reside. The increased temperatures can disrupt the frogs' physiological processes, affecting their metabolism and behavior. Furthermore, variations in precipitation may lead to shifts in the availability of breeding sites and food sources, impacting their reproductive success and overall population health. As climate change intensifies, extreme weather events like droughts or floods may further threaten the stability of their habitats. The consequences extend beyond the frogs themselves, influencing the interconnected web of species within the ecosystem

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## Answer 16

In the presence of a new predator, selective pressure may favor intermediate body sizes as a potential adaptation for enhanced agility and evasion. This could lead to stabilizing selection, where individuals with intermediate body sizes have a survival advantage. In contrast, deforestation might drive directional selection, favoring frogs with larger body sizes adapted for increased mobility and resource acquisition in the altered environment. Lastly, when food sources are abundant, disruptive selection may occur, promoting both smaller and larger body sizes as individuals with extreme sizes could capitalize on the resource abundance. A graph illustrating these predictions would show a narrow bell curve for stabilizing selection, a shift towards larger sizes for directional selection, and peaks at both extremes for disruptive selection.

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## Answer 17

One crucial adaptation is their vibrant coloration, which serves as a warning signal to predators about their toxic nature. This trait has evolved through natural selection, as predators learn to associate bright colors with toxicity, providing a survival advantage to the frogs. Additionally, the development of toxic compounds in their skin represents an evolved defense mechanism. Over time, the frogs with more potent toxins would be less likely to be consumed, increasing their chances of survival and reproduction. The intricate webbing on their toes is another adaptive feature, aiding in climbing and traversing their rainforest habitats. Analyzing these key traits underscores the evolutionary processes that have sculpted the poison dart frog, highlighting the role of natural selection in shaping their survival strategies over time.

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## Answer 18

Genetic diversity, reflecting the variety of genetic traits within a population, is essential for the frogs' adaptation and resilience to environmental challenges. Natural selection acts on this diversity, favoring traits that enhance survival and reproduction. In the conservation context, maintaining genetic diversity is pivotal as it provides a pool of potential adaptations to environmental changes. If a population lacks diversity, it becomes more vulnerable to diseases, habitat alterations, or climate shifts. Conversely, natural selection operates within this diverse genetic pool, promoting the prevalence of traits beneficial for conservation. A comprehensive evaluation of these interwoven processes is crucial for informed conservation strategies, ensuring the long-term viability of poison dart frog populations in the face of evolving ecological pressures.

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## Answer 19

One notable adaptation is their vibrant coloration, which has evolved as a warning signal to potential predators about their toxicity. This adaptation not only enhances the frogs' chances of survival but also has broader ecological implications by influencing predator behavior and creating a learned aversion to brightly colored, toxic prey. The development of toxic compounds in their skin represents another key evolution, serving as a defense mechanism that has broader ecological significance by influencing predator-prey dynamics and contributing to the overall balance of the rainforest ecosystem. Additionally, the intricate webbing on their toes, evolved for climbing, contributes to their ecological role as arboreal species, influencing their behavior, movement patterns, and habitat interactions.

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## Answer 20

**EX: Fossils**, as a key type of evidence, provide tangible records of past life forms, enabling scientists to trace the gradual changes in species over time. The significance of fossils lies in their ability to showcase the morphological transformations of organisms and the emergence of new species. For example, the fossil record illustrates the transition of tetrapods from water to land. Evaluating this evidence contributes to our understanding of evolutionary processes by offering a historical perspective on the diversification and adaptation of life on Earth. Fossils serve as a crucial tool in unraveling the evolutionary timeline, bridging the gaps between ancient and contemporary life forms and providing insights into the interconnectedness of species across geological time scales.

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