

Evolution Post-Test

LOGIN CODE = BOOPAD2

This is a multiple-choice test on evolution ideas you will cover during the next several weeks. You may not know the answers to some questions, but that is ok. We ask you to do your best.

As you move through the test:

- Carefully read each question and circle the answer choice you think is correct.
- Work slowly and carefully. You will have the whole class period to complete the test.
- Answer as many test questions as you can. Your answers are very important to the research team and will help them further improve the teaching material.

Thank you for your help and good luck!

Please provide the following information (optional):

- What is your gender?
 - Male
 - Female
- What best describes your race/ethnicity? (Choose all that apply)
 - American Indian or Alaskan Native
 - Asian
 - Hispanic of Latin American
 - Native Hawaiian or other Pacific Islander
 - White
 - Other
- What is your age? (Write below)

- Is English your primary language?
 - Yes
 - No
- What is your current or highest level of education?
 - 7th grade
 - 8th grade
 - 9th grade
 - 10th grade
 - 11th grade
 - 12th grade
 - High School Graduate

CA40-3

1. Scientists use various methods to determine how closely two species are related. One method is to compare the physical features of the two species and another is to compare their DNA. Can scientists also use similarities in the embryos of two animal species to help determine how closely they are related?

- A. No, comparing embryos of organisms does not help in determining how closely two animal species are related. Scientists can obtain the same information by comparing features of the adult organisms.
 - B. No, comparing embryos of organisms does not help in determining how closely two animal species are related. The embryos change too much as they grow into adult organisms.
 - C. Yes, comparing embryos is a useful way of determining how closely two animal species are related. There may be important similarities in the features of the embryos, even when adults of the species look very different.
 - D. Yes, it is sometimes useful to compare embryos, but only when the adult organisms are very similar.
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EM42-4

2. Which of the following would support the claim that a particular behavioral trait found in a population of organisms is inherited?

- A. If many individual organisms in that population had the trait
 - B. If a gene was found for the trait
 - C. If the trait could be learned by offspring from their parents
 - D. If the trait was found in only one individual in that population
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CA11-2

3. If the DNA of Species X and Species Y is more similar than the DNA of Species X and Species Z, what is a reasonable conclusion about the common ancestors of these three groups?

- A. Species X and Species Y have a common ancestor, but Species X and Species Z do not.
 - B. Species X and Species Z have a more recent common ancestor than Species X and Species Y.
 - C. Species X and Species Y have a more recent common ancestor than Species X and Species Z.
 - D. Similarities in DNA do not provide information about whether two groups share a common ancestor.
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RH24-7

4. Which of the following could be affected by the information in the DNA molecules of an organism?

- A. Both an organism's physical characteristics and the function of the organism's cells
 - B. An organism's physical characteristics but not the function of the organism's cells
 - C. The function of the organism's cells but not the organism's physical characteristics
 - D. Neither an organism's physical characteristics nor the function of the organism's cells
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CA26-4

5. Assume that some type of forelimbs were present in the common ancestor of birds, crocodiles, whales, pigs, and humans, and that those ancient forelimbs evolved into the arms, wings, and fins of animals that exist today. What would be true about the genes that code for forelimbs in these different animals that evolved from the forelimbs of the common ancestor?

- A. Many of the same genes would code for forelimbs in all of these animals.
 - B. Completely different sets of genes would code for forelimbs in each of these animals.
 - C. Information about the body structures of common ancestors of different species provides no information about similarities and differences in the genes of those species.
 - D. Many of the same genes would code for arms in crocodiles and pigs, but these genes would be completely different from the genes that code for wings in birds or fins in whales.
-

SP4-2

6. If two populations of the same species are separated and stop reproducing with each other, which of the following **MUST** be true?

- A. The two populations will become different species.
 - B. The two populations will not be able to reproduce in the future.
 - C. If new alleles arise through mutation in one of the populations, those alleles will not be transferred to the other population.
 - D. Any mutations that occur in one of the populations will also occur in the other population because the two populations are from the same species.
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EN15-2

7. Which of the following do scientists use to learn about organisms that lived many years ago but are no longer alive today?

- A. Fossils of organisms that lived many years ago, and DNA from the remains of organisms that lived many years ago.
 - B. Fossils of organisms that lived many years ago, but not DNA from the remains of organisms that lived many years ago.
 - C. DNA from the remains of organisms that lived many years ago, but not fossils of organisms that lived many years ago.
 - D. Scientists have no way to learn anything about organisms that lived many years ago but are no longer alive today.
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EH6-1

8. What effect do mutations have on organisms?

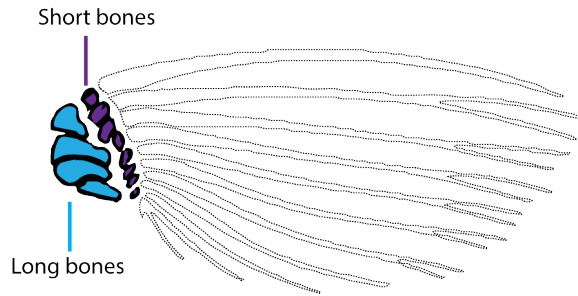
- A. All mutations are harmful to organisms because they disrupt protein function or gene regulation.
 - B. All mutations are beneficial to organisms, because they improve protein function or gene regulation.
 - C. All mutations have no effect on organisms, because they do not significantly affect protein function or gene regulation.
 - D. Some mutations are harmful, some mutations are beneficial, and some have no effect on the organism.
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9. Evolutionary biologists study the proteins that organisms make because the traits of organisms depend on the proteins they produce. Which of the following are functions of protein molecules within cells?

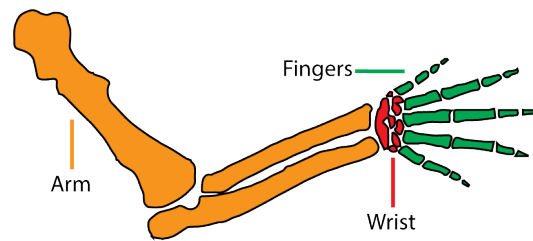
- A. Protein molecules help other molecules get in and out of cells, and they speed up chemical reactions in cells.
 - B. Protein molecules help other molecules get in and out of cells, but they do not speed up chemical reactions in cells.
 - C. Protein molecules speed up chemical reactions in cells, but they do not help other molecules get in and out of cells.
 - D. Protein molecules do not help other molecules get in and out of cells, nor do they speed up chemical reactions in cells.
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10. The evolution of hands and arms from fins is one of the most important changes to occur in the history of vertebrates. There are only two groups of bones in the fins of living fish (long bones and short bones), but there are three groups of bones in the limbs of other vertebrates such as mice (arms, wrists, and fingers).

Short and long bones in the fins of fish



Arms, wrists, and fingers in mice



Which of the following would provide evidence that both wrists and fingers of mice evolved from the **SHORT** bones of the fins of fish?

- A. If the DNA needed for wrist and finger growth in mice also exists in fish DNA.
- B. If during mouse development, both wrist and finger bones grew from a set of bones similar to the **LONG** bones in fish fins.
- C. If DNA that is needed for the development of the **LONG** bones in fish is inserted into mice that haven't been able to grow wrists and fingers results in the mice not developing normal wrists and fingers.
- D. If DNA that is needed for the development of **SHORT** bones in fish is inserted into mice that haven't been able to grow wrists and fingers results in the mice developing normal wrists and fingers.

The scenario presented here is based on an actual scientific study (Gehrke, et. al. 2015); however, it has been simplified for testing purposes.

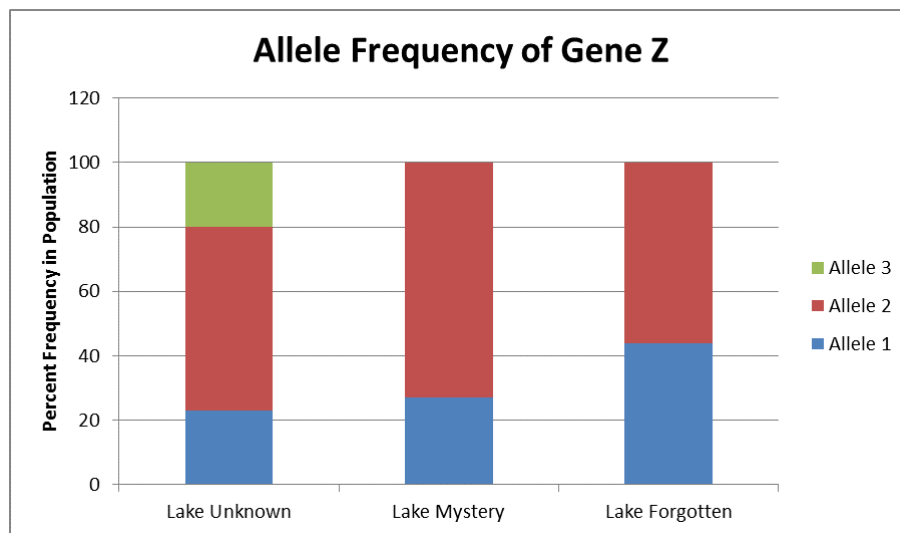
SP1-1

11. Cichlids are fish that live in freshwater lakes. There are over a thousand different species of cichlids that differ in size, color, habitat, and diet. Which piece of evidence might scientists use to determine that two populations of cichlids are from different species?

- A. The two populations have a common ancestor.
 - B. One population eats algae and the other population eats snails.
 - C. Individuals from the two populations cannot reproduce with each other.
 - D. One population lives at the bottom of the lake and the other lives near the surface.
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12. A hundred years ago, a network of streams connected three lakes: Lake Unknown, Lake Mystery, and Lake Forgotten. These streams allowed trout to travel freely between the three lakes and interbreed.

Due to environmental changes, the streams connecting the lakes dried up, so trout in each lake can no longer breed with trout from the other two lakes. Biologists are interested in how this change has affected the frequencies of different alleles of Gene Z. The chart below shows the allele frequencies of Gene Z in the three populations.



Suppose that several floods created new streams that run between the three lakes. Which of the following pieces of evidence would suggest that trout populations between the three lakes are interbreeding again?

- A. Allele 3 disappears from Lake Unknown
- B. Allele 1 disappears from all three lakes.
- C. Allele 2 disappears from all three lakes.
- D. Allele 3 appears in Lake Mystery and Lake Forgotten

RH15-2

13. What does the information in DNA molecules provide instructions for?

- A. Assembling amino acids into protein molecules
 - B. Assembling protein molecules into amino acids
 - C. Rearranging genes into protein molecules
 - D. Rearranging genes into traits
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EN46-12

14. Some organisms, such as a chimpanzee and a gorilla, have many similarities. Others, such as a zebra and a worm, have fewer similarities. What is TRUE about the ancestors of these organisms?

- A. Chimpanzees and gorillas share a common ancestor with each other, but zebras and worms do not share a common ancestor with each other.
 - B. Chimpanzees and gorillas share a common ancestor with each other, and zebras and worms share a common ancestor with each other, but chimpanzees and gorillas do not share a common ancestor with zebras and worms.
 - C. Because chimpanzees, gorillas, zebras, and worms are separate species, none of them shares a common ancestor with any other.
 - D. Chimpanzees, gorillas, zebras, and worms all share an ancient common ancestor.
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EH49-2

15. The DNA sequences of dogs and the DNA sequences of beetles differ in many ways. Which of the following mechanisms could lead to differences in the DNA sequences of dogs and beetles?

- A. Gene mutations
 - B. Recombination of genes
 - C. Gene mutations and recombination of genes
 - D. Gene mutations, recombination of genes, and natural selection
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16. A population is a group of individuals of the same species. Can the percent of individuals with certain traits in a population change because the environment changes?

- A. Yes, when the environment changes, individuals in a population can change their inherited traits to better fit the environment, and this changes the percent of individuals with certain traits in that population.
- B. Yes, when the environment changes, individuals with certain inherited traits survive and reproduce and other individuals with different inherited traits die, and this changes the percent of individuals with certain traits in a population.
- C. No, the percent of individuals with certain inherited traits in a population changes randomly from one generation to the next, never as a result of changes to the environment.
- D. No, the percent of individuals with certain inherited traits in a population cannot change because a population is all one species and so will always have the same inherited traits.

17. The table below shows the presence or absence of traits in seven different species.

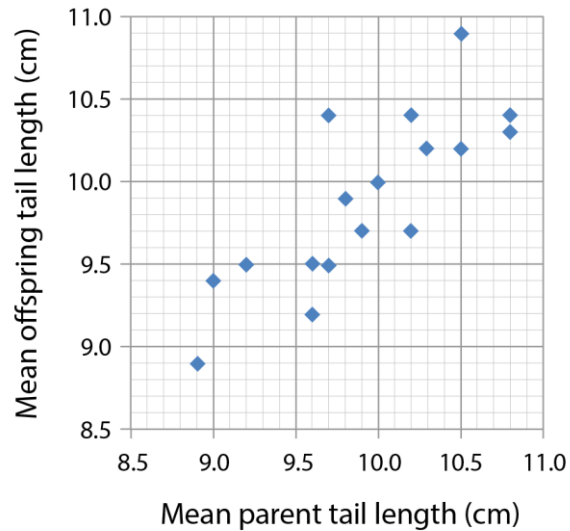
Character	Frog	Bird	Crocodile	Whale	Pig	Gorilla
Blowhole				Yes		
Body hair				Yes	Yes	Yes
Amniotic egg		Yes	Yes	Yes	Yes	Yes
Forelimbs	Yes	Yes	Yes	Yes	Yes	Yes
Backbone	Yes	Yes	Yes	Yes	Yes	Yes
Holes in Skull		Yes	Yes			

Based only on the traits presented in the table, which organism would you expect to have the most genetic similarity with crocodiles?

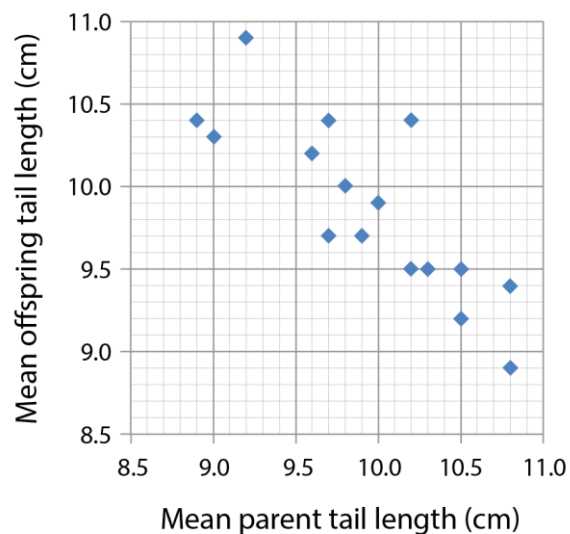
- A. Birds
- B. Gorillas
- C. Whales
- D. Not enough information is available

18. Scientists measured the tail lengths of mouse parents and the tail lengths of their adult offspring. Then they graphed the data.

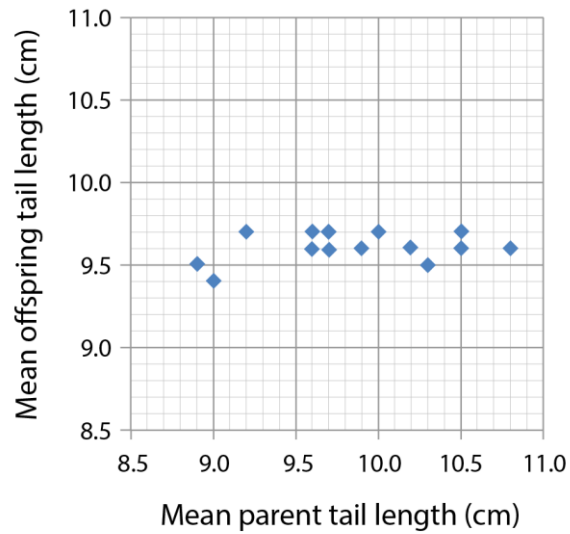
If tail length is an inherited trait, which of the following graphs and explanations shows how parent tail length would be related to offspring tail length?



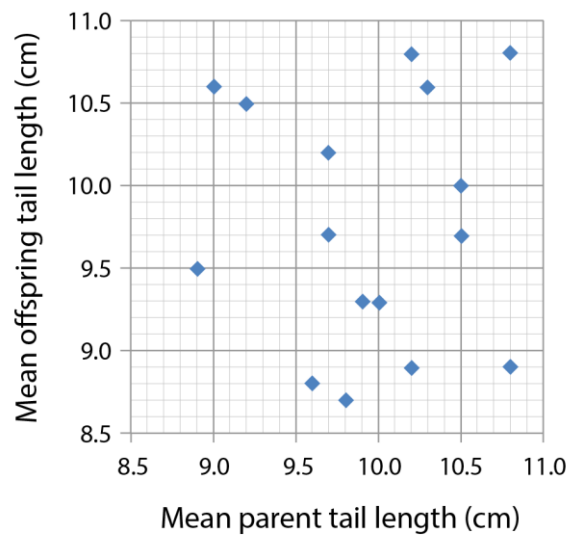
A. Because parents with long tails tend to have offspring with long tails.



B. Because parents with long tails tend to have offspring with short tails.



C. Because regardless of parent tail length, offspring tail length is dependent on the environment they are raised in.



D. Because parent tail length does not affect offspring tail length.

19. A student is reading a newspaper article and comes across the statement:

“Sharks and dolphins share a common ancestor.”

Their teacher asks them to read the article to see whether the journalist provides clear evidence and good reasons to support the claim.

Which of the following should the student look for in the article?

- A. **Evidence:** Data comparing the DNA sequence of sharks and dolphins.
Reasoning: A statement that having a similar DNA sequence suggests common ancestry.
 - B. **Evidence:** Data comparing the DNA sequence of sharks and dolphins.
Reasoning: A statement that new species can be produced when the environment favors the survival and reproduction of a population with particular traits.
 - C. **Evidence:** A statement that says that all vertebrates are related.
Reasoning: A statement that says that if all vertebrates are related, they must have similarities in their DNA sequence.
 - D. **Evidence:** A description of the similarities between the skeletons of sharks and the skeletons of dolphins.
Reasoning: A statement that both humans and fish have internal skeletons that include backbones and a skull.
-

20. How can traits vary within a species and between two different species?

- A. There can be similarities in traits within a population **but** traits are different when comparing different species.
 - B. There can be similarities in traits within a population **and** when comparing different species.
 - C. There can be similarities in traits among related species **but** traits are different when comparing a population of a single species.
 - D. All traits of organisms are different no matter whether they are the same or different species.
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21. A class of students is visiting a natural history museum. Students are looking at the skeleton of a dog, after which they walk over to an exhibit showing the skeleton of a fish.

As a homework assignment the teacher asks the students to think about the following question:

“Do dogs and fish share a common ancestor?”

Students are asked to write an argument to justify their answer. One student writes:

Common ancestors are a topic in evolution. Similar skeletal features likely indicate a common ancestor. Dogs and fish have similar anatomical features. For example, they both have a backbone, a bony skull, and their ribcages are similar. Dogs and fish may have a common ancestor.

Identify the claim, evidence, and reasoning statement in the student’s argument.

- A. **Claim:** Similar skeletal features likely indicate a common ancestor.
Evidence: For example, they both have a backbone, a bony skull, and their ribcages are similar.
Reasoning: Dogs and fish have similar anatomical features.
 - B. **Claim:** Similar skeletal features likely indicate a common ancestor.
Evidence: Dogs and fish have similar anatomical features.
Reasoning: For example, they both have a backbone, a bony skull, and their ribcages are similar.
 - C. **Claim:** Fish and dogs may have a common ancestor.
Evidence: For example, they both have a backbone, a bony skull, and their ribcages are similar.
Reasoning: Similar skeletal features likely indicate a common ancestor.
 - D. **Claim:** Fish and dogs may have a common ancestor.
Evidence: Similar skeletal features likely indicate a common ancestor.
Reasoning: For example, they both have a backbone, a bony skull, and their ribcages are similar
-

22. The table below shows the presence or absence of traits in seven different species.

Character	Frog	Bird	Crocodile	Whale	Pig	Gorilla
Blowhole				Yes		
Body hair				Yes	Yes	Yes
Amniotic egg		Yes	Yes	Yes	Yes	Yes
Forelimbs	Yes	Yes	Yes	Yes	Yes	Yes
Backbone	Yes	Yes	Yes	Yes	Yes	Yes
Holes in Skull		Yes	Yes			

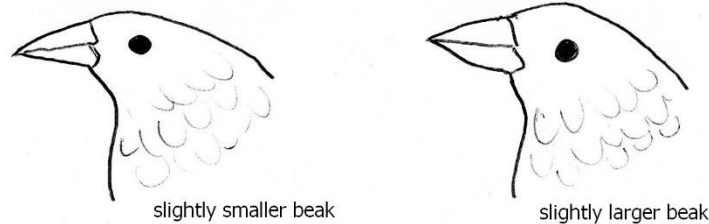
Based only on the traits presented in the table, which organism is probably most distantly related to gorillas?

- A. Bird
- B. Frog
- C. Pig
- D. Whale

23. Some animals, such as a cat and a dog, have many similarities. Others, such as a fish and a bird, have fewer similarities. What is TRUE about the ancestors of these animals?

- A. Cats and dogs share a common ancestor with each other, but fish and birds do not share a common ancestor with each other.
- B. Cats and dogs share a common ancestor with each other, and fish and birds share a common ancestor with each other, but cats and dogs do not share a common ancestor with fish and birds.
- C. Because cats, dogs, fish, and birds are separate species, none of them shares a common ancestor with any other.
- D. Cats, dogs, fish, and birds all share an ancient common ancestor.

24. A species of bird ate many types of seeds, each type coming from a different species of tree. The birds' beaks varied in size, with some individuals having slightly smaller beaks and others having slightly larger beaks.



A few years went by without much rain, and the only species of tree that survived had large seeds. Many generations later, almost all the birds had the slightly larger beaks. How is this best explained?

- A. The birds with larger beaks were better at eating the large seeds than those with smaller beaks, so only the birds with larger beaks got enough food to survive, reproduce, and pass the trait of large beaks to the next generation.
 - B. The birds with smaller beaks had to work harder than those with larger beaks to crack open the large seeds. The more they used their beaks, the larger their beaks became, so they were able to get enough food to survive, reproduce, and pass the traits of large beaks to the next generation.
 - C. The birds with smaller beaks grew their beaks so that they would be better able to eat the large seeds and get enough food to survive, reproduce, and pass the trait of larger beaks to the next generation.
 - D. It was a chance occurrence that all the individual birds' beaks in the next generation were larger. They were therefore able to eat the large seeds and get enough food to survive, reproduce, and pass the trait of large beaks to the next generation.
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25. Could individuals of a species look different today than individuals of the same species did many generations ago? Why or why not?

- A. Yes, all individuals can change a little and pass those changes on to their offspring.
 - B. Yes, some individuals can change a little and pass those changes on to their offspring.
 - C. Yes, some individuals with certain traits are more likely to survive and pass those traits on to their offspring.
 - D. No, species do not change even after many generations, so individuals of the same species would not look different.
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26. *Annosum* are a group of sexually reproducing fungi that live on and eat trees in North America, Europe, and Asia. Which of the following would provide the strongest evidence that the *Annosum* living in Europe and Asia are different species?



Photo taken by James Lindsey, distributed under a CC-BY-SA 2.5 license

- A. *Annosum* collected in Europe have genetic differences compared to *Annosum* collected in Asia.
- B. *Annosum* collected in Europe are all white in color and *Annosum* collected in Asia are all brown in color.
- C. *Annosum* collected in Europe and *Annosum* collected in Asia do not mate because they live on different continents.
- D. *Annosum* collected in Europe and *Annosum* collected in Asia cannot mate to produce viable offspring even when they are brought together.

27. Anoles are lizards that live in the southeastern United States, South America, and the Caribbean islands. Different anoles vary from each other in many ways. One trait on which anoles vary is their hind-leg length ratio. The hind-leg length ratio is the hind-leg length divided by the body length.

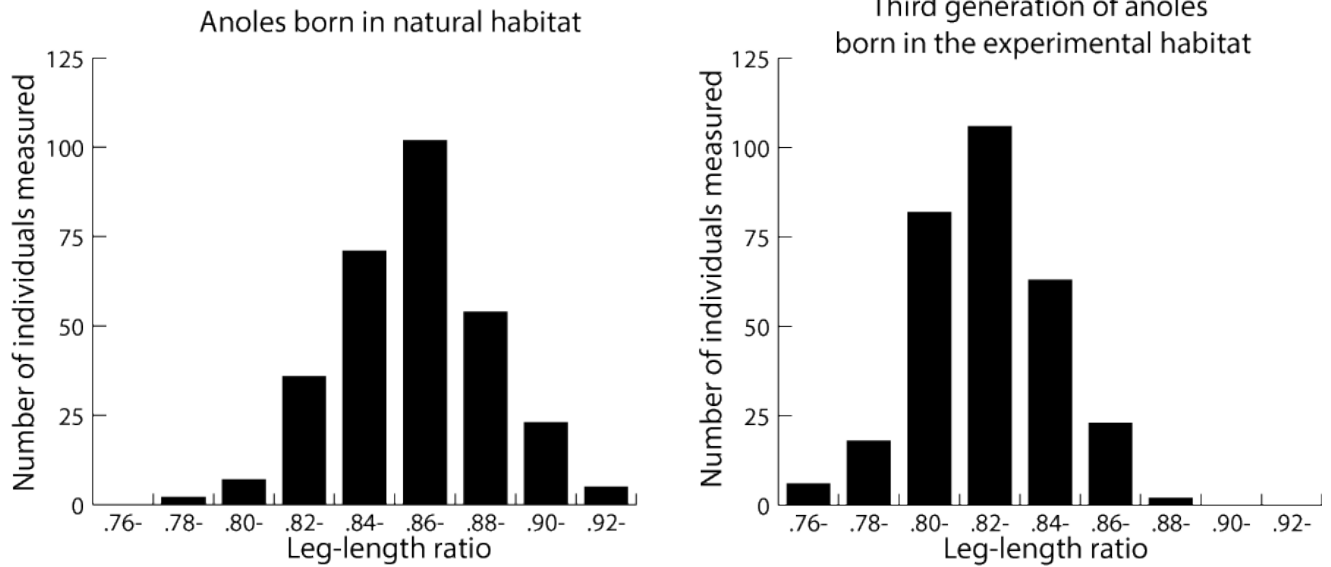
The images below show an anole and an X-ray image showing how scientists measure leg length (red line) and body length (blue line). They use these measurements to calculate the anole's leg-length ratio. Anoles that have smaller leg-length ratios are better at running on thin branches and anoles that have larger leg-length ratios are better at running on thick branches.



Left Image: Photograph of an Anole (Photo by Kristin Winchell.) Right Image: X-ray image showing how the leg-length ratio is calculated.

Adult hind-leg length ratio is a heritable trait. Scientists decided to test whether the leg-length ratio is a trait that undergoes evolution by natural selection. To do this they placed a group of anoles on small islands where there are only bushes with thin branches (no trees) and no other anoles. They called this the experimental habitat.

Each year, the scientists returned to the experimental habitat to measure the leg-length ratio of individuals from each generation of anole lizards. The graphs below show the leg-length ratios of anoles born in their natural habitat and the leg-length ratio of the third generation of anoles born in the experimental habitat.



Left Image: Distribution of Leg-length ratio in Anoles born in the natural habitat. Right Image: Distribution of Leg-length ratio in the third generation of Anoles born in the experimental habitat.

Do you think the process of natural selection caused the change in the leg-length ratio between anoles born in the natural habitat and the third generation of anoles born in the experimental habitat?

Write your answer in the form of an **argument**. Your argument should include: A **claim** that answers the question, **evidence** in the form of specific scientific data that supports your claim, and **reasoning** that uses appropriate scientific principles and justifies why the data counts as evidence for your claim.

28. Scientists studying evolution compared the DNA of chimpanzees, gorillas, and orangutans.

The scientists summarized their data in the following table:

Pair of Species Compared	Average Genetic Similarity
Chimpanzee and Gorilla	98%
Chimpanzee and Orangutan	97%
Gorilla and Orangutan	97%

When the scientists published their research, they made the following claim:

"Chimpanzees and gorillas have a more recent common ancestry than chimpanzees and orangutans."

What **evidence** and **reasoning** are the scientists using to make this **claim**?

Your answer should include **evidence** in the form of specific scientific data that supports the scientists' claim, and **reasoning** that uses scientific principles about heredity and common ancestry to justify why the data counts as evidence for their claim. If you need more space to write your argument use the back of this page.

End of Test