Supporting a Scientific Theory with Evidence

**Part 1**

The *[insert homologous structure of the two animals]* of a *[insert name of 1st animal]* and a *[insert name of 2nd animal]* are shown in the figure below. Use the figure to answer the following question.

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| *[Insert image of 1st animal.]* | *[Insert image of 2nd animal.]* |
| *[Insert label for 1st image.]* | *[Insert label for 2nd image.]* |

The scientific theory of evolution claims that **different species are related**. Explain how each animal having *[insert homologous structure]* could be used as evidence to support this claim. Provide enough detail so that someone who is unfamiliar with the scientific theory of evolution would understand your explanation. Use appropriate scientific terms in your response.

Choose two animals from the list below. Then, provide five examples of these animals’ physical structures that could be used as evidence that they are evolutionarily related.

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| *[Insert name of mammal.]* | *[Insert name of bird.]* | *[Insert name of reptile.]* |
| *[Insert name of insect.]* | *[Insert name of amphibian.]* | *[Insert name of fish.]* |

Which two animals do you choose?

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| 1st animal: |
| 2nd animal: |

Below, describe five examples of physical structures that could be used as evidence that the two animals are evolutionarily related:

1st physical structure:

2nd physical structure:

3rd physical structure:

4th physical structure:

5th physical structure:

**Part 2**

Fossil evidence exists for the three different species shown in the figure below. Use the figure to answer the questions on the following page.

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| *[Insert image of 1st species.]* | **Species A**  Fossil evidence is *[insert fossil age]* years old.  *[Insert description of species A’s variation in the homologous structure common to each of the three species]*. |
| *[Insert image of 2nd species.]* | **Species B**  Fossil evidence is *[insert fossil age]* years old.  *[Insert description of species B’s variation in the homologous structure common to each of the three species]*. |
| *[Insert image of 3rd species.]* | **Species C**  Fossil evidence is *[insert fossil age]* years old.  *[Insert description of species C’s variation in the homologous structure common to each of the three species]*. |

The scientific theory of evolution claims that **traits can change within populations over time**. Explain how the information in the figure could be used as evidence to support this claim. Provide enough detail so that someone who is unfamiliar with the scientific theory of evolution would understand your explanation. Use appropriate scientific terms in your response.

Describe the evolutionary processes that cause traits to change over time. Use the species’ *[insert homologous structure common to each of the three species]* as an example. Provide enough detail so that someone who is unfamiliar with the scientific theory of evolution would understand your explanation. Use appropriate scientific terms in your response.

Scoring Plan

**Note:** Correct answers written in the wrong section of a particular assessment, but intended for the appropriate prompt, will be graded in full. For example, observable evidence can appear under the limiting factor hypothesis prompt.

**Part 1: Homology**

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| Common Ancestry | |
| Student indicates that *[insert first animal]* and *[insert second animal]* could have evolved from a common ancestor.   * For example, “they evolved from the same animal.” * The response must contribute new information beyond what is given in the prompt. For example, “they are related” or “they are relatives” is not sufficient to receive credit. * No point is awarded for indicating that one of the presented species is ancestral to the other. | 2 pts. |
| **Note**: Credit for the following five scoring items may only be earned if the student is awarded the previous item for indicating common ancestry. |  |
| Student provides sufficient detail so that someone who is unfamiliar with the scientific theory of evolution would understand how homologous structures (not homoplasious structures, which are similar in form and function but separately evolved) support the theory of evolution.   * For example, the student describes the process by which the *[insert first animal]* and *[insert second animal]* could each have inherited *[insert homologous structure]* from a common ancestor. | 1 pt. |
| Homologous Structures | |
| Student describes a specific similarity between physical structures of *[insert first animal]* and *[insert second animal]*.   * The similarity the student describes does not have to be visible within the illustration. | 1 pt. |
| Student describes a specific variation or difference between physical structures of *[insert first animal]* and *[insert second animal]*.   * The similarity the student describes does not have to be visible within the illustration. | 1 pt. |
| Terminology | |
| Student uses the term *common ancestor* or equivalent scientific terminology (e.g., *like ancestor,* *shared ancestor*) to refer to the concept of common ancestry. | 1 pt. |
| Student uses the term *homology* or equivalent scientific terminology (e.g., *homologous structure,* *comparative anatomy*) to refer to the concept of homology. | 1 pt. |

Scoring Plan (continued)

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| Examples of Homologous Structures | |
| For the 1st physical structure, student names a homologous structure shared by the two animals indicated.  Responses that would NOT receive credit include   * Only describing a shared behavior, such as “each one breathes” or “they both make nests.” * Comparing animals’ size or coloration. * Stating a shared lack of a specific physical structure. * Describing nonspecific characteristics, such as “things,” “organs,” “skin,” or “muscles,” or characteristics common to *all* animals. | 1 pt. |
| As above, for a 2nd physical structure. | 1 pt. |
| As above, for a 3rd physical structure. | 1 pt. |
| As above, for a 4th physical structure. | 1 pt. |
| As above, for a 5th physical structure. | 1 pt. |

Scoring Plan (continued)

**Part 2: Fossil Evidence**

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| Physical Structure | |
| Student provides an example of a specific trend in a physical structure changing over time of the three fossils presented in the figure.   * Credit can still be awarded if the student incorrectly interprets the fossils’ ages in reverse chronological order. | 2 pts. |
| Student is awarded the preceding item ***and*** provides sufficient detail so that someone who is unfamiliar with the scientific theory of evolution would understand the explanation.   * Student may earn credit by providing a description of a potential cause for the trend (e.g., adaptation to a selective pressure). | 1 pt. |
| Chronology | |
| Student explains how the ages of the three fossils are consistent with a trait changing within populations over time.   * For example, credit is given for indicating a progression through time (e.g., “over the years,” “gradually”). | 2 pts. |
| Student is awarded the preceding item ***and*** provides sufficient detail so that someone who is unfamiliar with the scientific theory of evolution would understand the explanation.   * For example, credit is given for citing specific fossils’ ages or number of years between fossils’ ages. | 1 pt. |
| Terminology | |
| Student uses the term *adaptation* or equivalent scientific terminology (e.g., *increased fitness*) to refer to the concept of adaptation. | 1 pt. |

Scoring Plan (continued)

**Note**: Credit is awarded if scoring criteria are met by the response to the first prompt in part 2 (e.g., the student discusses the concept of selection in the previous explanation).

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| Variation | |
| Student describes the concept of variation (e.g., *[insert differences in a homologous structure exhibited by each of the three species],* phenotype, genotype) within populations.   * Response must indicate that variation existed within a single population at a particular point in time, not over time. Indicating that one species had different braincase sizes than the other is not sufficient, because this implies variation over time. | 2 pts. |
| **Note:** Credit for the following two scoring items may only be earned if the student is awarded the previous item for describing the concept of variation. |  |
| Student uses the term *variation* or equivalent scientific terminology (e.g., *phenotypic differences, differences in genotype*) to refer to the concept of variation. | 1 pt. |
| Student provides sufficient detail so that someone who is unfamiliar with the scientific theory of evolution would understand the concept of variation.   * For example, student provides an example of variation in a specific trait (e.g., “Some members of species A had *[insert description of a difference in a homologous structure exhibited by the three species].*”). | 1 pt. |
| Selection | |
| Student indicates that selection (e.g., natural, sexual) occurred based on variation in *[insert homologous structure exhibited by the three species]*.   * For example, student provides an example of a selective pressure that may have acted on *[insert homologous structure exhibited by the three species]*. | 2 pts. |
| **Note:** Credit for the following two scoring items may only be earned if the student is awarded the previous item for describing the concept of selection. |  |
| Student uses the term *selection* or equivalent scientific terminology (e.g., *differential reproduction*) to refer to the concept of selection. | 1 pt. |
| Student provides sufficient detail so that someone who is unfamiliar with the scientific theory of evolution would understand the concept of selection.   * For example, student describes specific differences within a population at a given time and states one of the phenotypes may have had a selective advantage (e.g., “Some members of species A had *[insert particular variation of the homologous structure exhibited by the three species]* and that helped them *[insert some survival or reproductive advantage caused by a particular variation in the homologous structure exhibited by each of the three species].*”). | 1 pt. |

Scoring Plan (continued)

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| Inheritance | |
| Student indicates that changes in *[insert homologous structure exhibited by the three species]* could have been inherited by offspring. | 2 pts. |
| **Note:** Credit for the following two scoring items may only be earned if the student is awarded the previous item for describing the concept of inheritance. |  |
| Student uses the term *inheritance* or equivalent scientific terminology (e.g., *heredity,* *genetic, genotype*) to refer to the concept of inheritance. | 1 pt. |
| Student provides sufficient detail so that someone who is unfamiliar with the scientific theory of evolution would understand the concept of inheritance.   * For example, student states that traits are inherited through genes. | 1 pt. |