**Stage 2 Biology**

**Assessment Type 2: Skills and Application Tasks**

**Evolution Supervised Task**

Student Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

SACE Registration \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Time: 75 minutes

**Assessment conditions:**

* Texts 1 and 2 provided for research and annotation two days prior to assessment.
* Unseen assessment questions provided at the beginning of the 75 minute assessment window.
* Task completed individually and supervised under test conditions.
* Approved dictionaries and annotated stimulus documents permitted. No other notes or resources to be referred to while completing the task.

This task will assess the following assessment design criteria:

 KA1 Demonstration of knowledge and understanding of biological concepts.

 KA2 Application of biological concepts in new and familiar contexts.

 KA3 Exploration and understanding of the interaction between science and society.

 KA4 Communication of knowledge and understanding of biological concepts and information, using appropriate terms, conventions, and representations.

Text 1: Extract of Science Journal Article

**Lizard blizzard survivors tell story of natural selection**

Diana yates - UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN - 03 August 2017

An unusually cold winter in the U.S. in 2014 took a toll on the green anole lizard, a tree-dwelling creature common to the southeastern United States. A new study offers a rare view of natural selection in this species, showing how the lizard survivors at the southernmost part of their range in Texas came to be more like their cold-adapted counterparts further north. The study is reported in the journal *Science*.

"We were able to track natural selection at the level of the whole organism, but also at the level of gene sequence and gene expression," said University of Illinois postdoctoral researcher Shane Campbell-Staton, who led the new research. "I think this is a really strong and clear story about biological responses to extreme weather events.”

Campbell-Staton collected DNA from several dozen anole lizards and also gathered data relating to their gene-expression profiles, information that can show which genes were being transcribed and translated into proteins and at what levels. He also tested the lizards' ability to physically function in the cold.

Then a record-breaking winter, stirred by a change in the polar vortex, altered weather patterns across the U.S. He and colleagues from Harvard and the University of Texas went back the following spring and again in August to collect the same data on the same populations he had studied before.

"One of the great things about this study is that we had three independent lines of evidence - DNA markers, gene expression levels and physiology measures - all pointing to the same biological signal, a shift toward more robustness against cold weather," said University of Illinois animal biology professor Julian Catchen, a co-author of the study.

Many lizards survived, and the survivors were likely better able to tolerate future cold-weather events. But the story is not entirely rosy, the researchers said. "It may be that the animals that did not survive this storm had the genetic variants to survive a heat wave, or a drought or some other extreme event. And now those lineages are essentially gone."

Scientists are just beginning to understand how extreme weather events - which are expected to increase as global temperatures rise [due to Climate Change] - affect natural populations.

The National Science Foundation, Harvard University and the U. of I. supported this research. Campbell-Staton began this work as a graduate student in the laboratories of Jonathan Losos and Scott Edwards at Harvard.

Text 2: Phylogenetic Tree



1. Describe how protein sequencing may have been used to determine the evolutionary relationships shown in Text 2.

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2. Describe one or more possible reproductive isolating mechanisms between Anoles and Monitor Lizards.

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3. Several types of reptiles in Text 2 do not have limbs. Explain how limblessness may have evolved, with reference to convergent or divergent evolution.

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4. Text 1 mentions ‘genetic variants’. Describe the term ‘genetic variants’ and provide two mechanisms for it arising in sexually reproducing populations, such as the Green Anole Lizard.

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5. ‘Natural selection’ and ‘genetic drift’ are both mechanisms of evolution. Justify whether natural selection or genetic drift was the likely driver of evolution in Text 1.

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6. Discuss how human activities could create new and significant selection pressures on the gene pool of Green Anole Lizards. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Discuss how Text 1 demonstrates “application and limitation”, one of the key concepts of science as a human endeavour.

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Additional writing space, if required. Please clearly label your response.

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**Stage 2 Biology Performance Standards**

| - | Investigation, Analysis, and Evaluation | Knowledge and Application |
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| A | Critically deconstructs a problem and designs a logical and coherent biological investigation with detailed justification.Obtains, records, and represents data, using appropriate conventions and formats accurately and highly effectively.Systematically analyses and interprets data and evidence to formulate logical conclusions with detailed justification.Critically and logically evaluates procedures and their effect on data. | Demonstrates deep and broad knowledge and understanding of a range of biological concepts.Applies biological concepts highly effectively in new and familiar contexts.Critically explores and understands in depth the interaction between science and society.Communicates knowledge and understanding of biology coherently, with highly effective use of appropriate terms, conventions, and representations. |
| B | Logically deconstructs a problem and designs a well-considered and clear biological investigation with reasonable justification.Obtains, records, and represents data, using appropriate conventions and formats mostly accurately and effectively.Logically analyses and interprets data and evidence to formulate suitable conclusions with reasonable justification.Logically evaluates procedures and their effect on data. | Demonstrates some depth and breadth of knowledge and understanding of a range of biological concepts.Applies biological concepts mostly effectively in new and familiar contexts.Logically explores and understands in some depth the interaction between science and society.Communicates knowledge and understanding of biology mostly coherently, with effective use of appropriate terms, conventions, and representations. |
| C | Deconstructs a problem and designs a considered and generally clear biological investigation with some justification.Obtains, records, and represents data, using generally appropriate conventions and formats, with some errors but generally accurately and effectively.Undertakes some analysis and interpretation of data and evidence to formulate generally appropriate conclusions with some justification.Evaluates procedures and some of their effect on data. | Demonstrates knowledge and understanding of a general range of biological concepts.Applies biological concepts generally effectively in new or familiar contexts.Explores and understands aspects of the interaction between science and society.Communicates knowledge and understanding of biology generally effectively, using some appropriate terms, conventions, and representations. |
| D | Prepares a basic deconstruction of a problem and an outline of a biological investigation.Obtains, records, and represents data, using conventions and formats inconsistently, with occasional accuracy and effectiveness.Describes data and undertakes some basic interpretation to formulate a basic conclusion.Attempts to evaluate procedures or suggest an effect on data. | Demonstrates some basic knowledge and partial understanding of biological concepts.Applies some biological concepts in familiar contexts.Partially explores and recognises aspects of the interaction between science and society.Communicates basic biological information, using some appropriate terms, conventions, and/or representations. |
| E | Attempts a simple deconstruction of a problem and a procedure for a biological investigation.Attempts to record and represent some data, with limited accuracy or effectiveness.Attempts to describe results and/or interpret data to formulate a basic conclusion.Acknowledges that procedures affect data. | Demonstrates limited recognition and awareness of biological concepts.Attempts to apply biological concepts in familiar contexts.Attempts to explore and identify an aspect of the interaction between science and society.Attempts to communicate information about biology. |