

PHILADELPHIA ZOO

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Survival Experts (9th-12th)

Essential Question

How do adaptations occur in wildlife? How about in humans?

Objectives

1. Discover unique adaptations in the animal kingdom
2. Understand the driving forces behind survival and extinction
3. See how humans use knowledge of other life forms in order to improve quality of living

Vocabulary

Adaptation: The change or the process of change by which an organism or species becomes better suited to its environment.

Genotype: the genetic constitution of an organism; i.e., which alleles are present on a given locus.

Phenotype: the set of observable characteristics of an individual resulting from the interaction of its genotype with the environment.

Gene frequency: the ratio of a particular allele to the total of all other alleles of the same gene in a given population.

Allele: one of two or more alternative forms of a gene that arise by mutation and are found at the same place on a chromosome

Natural selection: the process whereby organisms better adapted to their environment tend to survive and produce more offspring.

Artificial selection: the breeding of plants and animals to produce desirable traits.

Opposable thumbs: a thumb that can be used for grasping, present in apes, Old World monkeys, some marsupials, and a few other animals.

Generation time: the average time between two consecutive generations in the lineage of a population. In humans, typically 20-30 years.

Biomimicry: the design and production of materials, structures, and systems that are modeled on biological entities and processes.

Recommendations

Read:

["100 Heartbeats"](#) – Jeff Corwin

["Last Chance to See"](#) – Douglas Adams and Mark Carwadine

Research:

- Animals that have unique adaptations, not found anywhere else in the animal kingdom
- Animals that have been able to adapt to a number of different habitats and situations

Discuss:

- How quickly are animals able to adapt to significant changes in their environment?
- What are some ways that humans have adapted?

Classroom Activity

Adapting to a Novel Environment: Have students read the included paper, "Effect of repeated exposures and sociality on novel food acceptance and consumption by orangutans" by Madeleine E. Hardus, *et. al.*

Individually: Have students read the paper individually and highlight what they feel are important pieces of information.

In groups: Students should form groups to discuss in detail the key points of the paper. Students should work together to answer the included questions.

As a class: Go over the entire paper and summary questions as a class. Use the 'Questions for Discussion' to summarize learning and further understanding of the scientific process.

Standards

PA Academic: 3.1 A1, 3.1 C2, 3.1 C3, 4.4 D

Next Generation Science: HS-LS3-2, HS-LS3-3, HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5

New Jersey Core Curriculum: 5.1, 5.3B, 5.3C

Common Core: CCSS.ELA-LITERACY.RST.4, CCSS.ELA-LITERACY.RST.7, CCSS.ELA-LITERACY.W.7, CCSS.ELA-LITERACY.SL.1

Adapting to a Novel Environment

Questions for Consideration

Read the entire paper and highlight important information. Work together in a group to answer the following questions.

1. What is the survival rate after release of rehabilitated orangutans into a wild habitat?
2. What adaptations determine whether or not a reintroduced orangutan will be successful in a novel wild habitat?
3. What factor, which impacts the survival rate, are the authors concerned with here and why?
4. Name one **corrective** and three **preventative** conservation measures being taken to protect critically endangered great ape species.
5. How do orangutans primarily learn about what they can and cannot eat?
6. Describe the authors' two hypotheses.
7. The authors mention that the orangutans were "tested on a voluntary basis." What do they mean by that?
8. What were the results of the first experiment? After 8 days, what change had occurred in the acceptance, rejection, and refusal rates? What change occurred in orangutan behavior regarding these items?
9. Figure 2 shows the results for the second experiment. What impact did sociality have on orangutan acceptance and amount of foods consumed?
10. Describe the recommendation that the authors make regarding orangutan rehabilitation. How should we prepare orangutans before releasing them into a wild habitat?

Questions for Discussion

1. The authors describe, in great detail, the procedures for deploying the novel foods, examining the response and behavior, and calculating the results. Why is this information important?
2. What can we say about the way animals adapt to a novel environment, based on what was learned from this study? Think about how animals learn and what factors influence how they are able to adapt.

Answer Key

1. As low as 20% (page 1, column 1), but as high as 86% (page 2, column 1)
2. Diet choices, nesting, locomotion, and anti-predator responses.(page 2,column 1)
3. Orangutans are not able to find enough food because they are unfamiliar with many of the foods in a wild habitat. "...one of which is the capacity to obtain an adequate diet once released. Released individuals are faced with a mixture of familiar and novel foods in an unfamiliar forest;" (page 1, column 1); "In omnivore species, such as great apes, a varied and nutritional diet increases the chances of survival and constitutes the energetic bases for all other behaviours. Thus, knowledge about which food items can be eaten and those that should be avoided is crucial for survival." (page 2, column 1)
4. Corrective: rehabilitation/reintroduction. Preventative: Habitat protection, guidelines for reduced-impact logging, and awareness and law enforcement campaigns. (page 2, column 1)
5. From mothers and peers (or tutors and models) (page 2, column 2)
6. Orangutans are more likely to accept novel foods if they are exposed to these foods multiple times due to familiarization. (page 2, column 2). Orangutans are more likely to accept and consume novel foods when they see other orangutans eating those foods. (page 3, column 1)
7. They orangutans were given the opportunity to make the decision about whether or not they would spend time with the researchers. They were able to leave the experiment at any time. They were also not deprived of food leading up to the trials, and no specific order was followed for the individuals participating. (page 3, column 1)
8. Acceptance was 46.7%, trial with rejection was 42.4%, and refusal was 10.9%. There was no significant change after 8 days of trials. Orangutans spend less time exploring novel foods because they were more familiar with them. (page 4, column 1)
9. Orangutans eat more and accept more novel foods when they eat socially.
10. The authors recommend introducing novel foods that will be present in their new wild habitat, first individually, then in a social setting, to ensure acceptance and increase the likelihood of survival.

Questions for Discussion

1. For a scientific experiment to be reputable and trustworthy, it must be repeatable. That means that any other scientist should be able to read this paper and replicate the experiment to obtain the same or similar results. Experiments that are not repeatable are not considered trustworthy science.
2. Students should include comments on how adaptations can be a learned experience, rather than something predetermined in DNA.