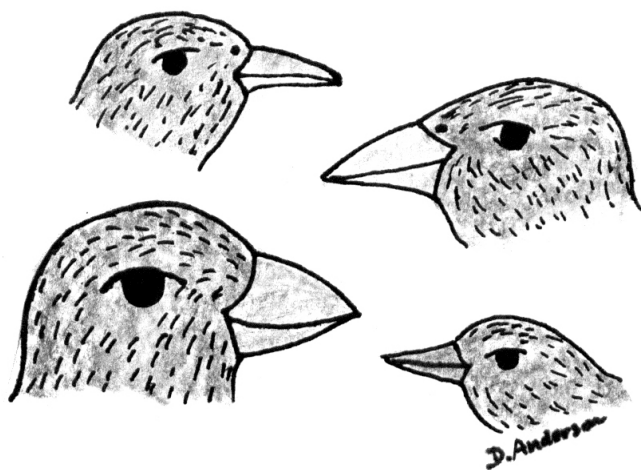


## Ερωτηματολόγια για την εμπέδωση εννοιών της Φυσικής Επιλογής (*Darwin's finches*)

Based on the article: Andersen, D. L., Fisher, K. M., and Norman, G. J. (2002), Development and Evaluation of the Conceptual Inventory of Natural Selection, *J. Res. Sci. Teaching* **39**, 952-978. <https://doi.org/10.1002/tea.10053> (supplemented and slightly modified on the basis of more recent evidence)

### Galapagos finches (*Darwin's finches*)

Scientists have long believed that the 14 species of finches on the Galapagos islands evolved from a single species of finch that migrated to the islands one to five million years ago [Lack, 1940]. Indeed, recent DNA analysis suggest that all of the Galapagos finches evolved from a single species [Sato *et al.*, 2001; Burns *et al.*, 2014]. Different species live on different islands. For example, the medium ground finch (*Geospiza fortis*) and the cactus finch (*Geospiza scandens*) live on the same island, whereas the large cactus finch (*Geospiza conirostris*) occupies another island. The most prominent differences between the different species of Galapagos finches are in their beak shapes and sizes.



In the following questions, select the one answer that best reflects how an evolutionary biologist would answer:

#### Question 1

What would happen if a breeding pair of finches was placed on an island under ideal conditions with no predators and with unlimited food so that all individuals survived? Given enough time

- [1] the finch population would stay small because birds only have enough babies to replace themselves
- [2] the finch population would double and then stay relatively stable
- [3] the finch population would increase dramatically
- [4] the finch population would grow slowly and then level off

#### Question 2

Finches on the Galapagos Islands require food to eat and water to drink.

- [1] When food and water are scarce, some birds may be unable to obtain what they need to survive.
- [2] When food and water are limited, the finches will find other food sources, so there is always enough.
- [3] When food and water are scarce, the finches will start to eat and drink less so that all birds survive.
- [4] There is always plenty of food and water on the Galapagos Islands to meet the finches' needs.

### Question 3

Once a population of finches has lived on a particular island with an unvarying environment for many years,

- [1] the population continues to grow rapidly.
- [2] the population remains relatively stable, with some fluctuations.
- [3] the population dramatically increases and decreases each year.
- [4] the population will decrease steadily.

### Question 4

In the finch population, what are the primary changes that occur gradually over time?

- [1] The traits of each finch within a population gradually change.
- [2] The proportions of finches having different traits within a population change.
- [3] Successful behaviors learned by finches are passed on to offspring.
- [4] Mutations occur to meet the needs of the finches as the environment changes.

### Question 5

Depending on their beak size and shape, some finches get nectar from flowers, some eat grubs from bark, some eat small seeds, and some eat large nuts. Which statement best describes the interactions among the finches and the food supply?

- [1] Most of the finches on an island cooperate to find food and share what they find.
- [2] Many of the finches on an island fight with one another and the physically strongest ones win.
- [3] There is more than enough food to meet all the finches' needs so they don't need to compete for food.
- [4] Finches compete primarily with closely related finches that eat the same kinds of food, and some may die from lack of food.

### Question 6

How did the different beak types **first** arise in the Galapagos finches ;

- [1] The changes in the finches' beak size and shape occurred because of their need to be able to eat different kinds of food to survive.
- [2] Changes in the finches' beaks occurred by chance, and when there was a good match between beak structure and available food, those birds had more offspring.
- [3] The changes in the finches' beaks occurred because the environment induced the desired genetic changes.
- [4] The finches' beaks changed a little bit in size and shape with each successive generation, some getting larger and some getting smaller.

### Question 7

What type of variation in finches is passed to the offspring?

- [1] Any behaviors that were learned during a finch's lifetime.
- [2] Only characteristics that were beneficial during a finch's lifetime.
- [3] All characteristics that were genetically determined.
- [4] Any characteristics that were positively influenced by the environment during a finch's lifetime.

## Question 8

What caused populations of birds having different beak shapes and sizes to become distinct species distributed on the various islands?

- [1] The finches were quite variable, and those whose features were best suited to the available food supply on each island reproduced most successfully.
- [2] All finches are essentially alike and there are **not** really fourteen different species.
- [3] Different foods are available on different islands and for that reason, individual finches on each island gradually developed the beaks they needed.
- [4] Different lines of finches developed different beak types because they needed them in order to obtain the available food.

## References:

- [1] Lack, D. (1940). Evolution of the Galapagos finches. *Nature* **146**, 324-327. <https://doi.org/10.1038%2F146324a0>
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