

Adaptations to abiotic factors

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1 Adaptations to abiotic factors

In this activity, students are encouraged to think independently and suggest an explanation for the existence of a specific adaptation of an organism. They should describe a mechanism by which a certain adaptation came into existence.

1.1 Aims

- To increase students' curiosity and encourage them to ask questions.
- To promote independent thinking.
- To "set the scene" for introducing the concept of biological evolution by natural selection.

1.2 Structure

- First, students work independently on the task (10–15 min).
- Next, the teacher leads a discussion with the whole classroom (20–30 min).

1.3 Materials

- Set of cards (see STUDENTS SHEET)

1.4 Procedure

1. Students are given the cards with pictures of different organisms. They should study the pictures, read the description of the adaptations and make sure they understand why the specific adaptation is useful for the organism in its environment.
2. Students should use their previous knowledge, logic and imagination to provide an explanation for the existence of this adaptation. They should describe a logical and believable process, preferably in several steps, by which this particular adaptation came into existence.
3. **Option one:** The activity is done towards the end of the lesson. At the end of the lesson, the teacher collects the answers and prepares a review of the student's answers for the next lesson, grouping the answers according to the similarities in the mechanisms suggested. While presenting the review, the teacher mentions historical attempts to explain the existence of adaptations, similar to those suggested by the students.

Option two: After writing their answers, students seek out fellow students suggesting a similar explanation (not necessarily describing the same adaptation). Students should be able to group themselves into three to five groups. As the students are organizing themselves, the teacher gets an idea of the explanations suggested by the students. Then, the teacher presents the key historical approaches to explaining the existence of adaptations, allowing the corresponding group of students to present their explanation.

The student's explanations generally include the following.

- The idea that the specific organisms were individually created by God to fit their environments.
- The idea that organisms were aware of their needs and were trying to adapt to their environment until they succeeded.
- The idea that certain features grew or diminished according to whether they were used or disused.
- Description of various physical, chemical or biological mechanisms acting upon the organisms, finally making them as they are.
- Mention of the survival of the fittest.
- Various vague or complex explanations of the mechanism of natural selection.

4. In conclusion, the teacher tells the students that, according to current knowledge, the mechanism of natural selection is the only mechanism by which adaptations evolve. It can be expected that most students will not be familiar with the mechanism of natural selection, or will have only a vague understanding of the process. This activity should lead to the detailed explanation of the mechanism of natural selection and its importance in evolution.

1.5 Modification

After doing some of the suggested related activities and learning the mechanism of natural selection, this activity can be modified and used again. The pictures and descriptions of the organisms remain the same. However, the task is changed to: “Use what you have learned about the mechanism of natural selection to explain the existence of this adaptation.” Students should write their explanation about the same organism they used in the first exercise. Then, the teacher can evaluate how well the mechanism of natural selection was understood.

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Cacti are well adapted to surviving the dry periods and high temperatures that characterize desert environments. They must absorb large quantities of water during the short periods of time when it is available. The water is then stored in stems or fleshy leaves in special tissues that are good at retaining moisture.

Suggest an explanation for the existence of this adaptation. Describe a process by which this particular adaptation came to be.



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The fennec fox is the smallest of all the world's foxes but has the largest ears in proportion to its body size. This animal species is native to the deserts of North Africa, to which it is adapted in various ways. Its most famous adaptation is its distinctive, bat-like ears which radiate body heat and help keep the fox cool in the hot desert environment.

Suggest an explanation for the existence of this adaptation. Describe a process by which this particular adaptation came to be.

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Moles spend their lives underground, digging tunnels in search of prey, and they are adapted to this mode of life. A mole's front legs are short, strong and end in powerful paws perfect for digging. Its legs do not bend the same way as do legs of most other animals. They bend away from its body which gives it the ability to quickly dig through tunnels using a swimming motion.

Suggest an explanation for the existence of this adaptation. Describe a process by which this particular adaptation came into existence.



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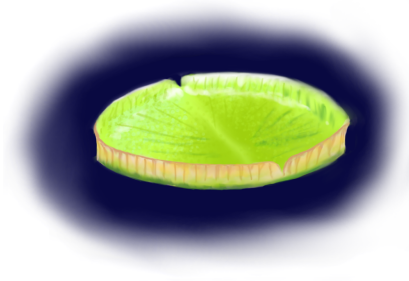
Maples and some other flowering trees produce seeds adapted to dispersal by wind. These so-called helicopter seeds have stiff wings that enable them to fly long distances. The wings are twisted and balanced so that the seed spins around as it is carried along by the wind. Depending on the wind velocity and distance above the ground, helicopter seeds can be carried considerable distances away from the parent plant.

Suggest an explanation for the existence of this adaptation. Describe a process by which this particular adaptation came into existence.

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The giant water lily lives in the shallow waters of the Amazon river basin. Waters of this area are rich in various forms of plant and animal life and the giant water lily is well adapted to its environment. It grows leaves with a huge surface area that have a rim around the edges, so other aquatic plants cannot grow over it and block the sunlight. While ensuring in this way that it gets enough sunlight, the rim also has a slit to let water drain out when it rains.

Suggest an explanation for the existence of this adaptation. Describe a process by which this particular adaptation came into existence.



Adaptations to abiotic factors



The Sunda slow loris is a nocturnal animal, typically living in the tree branches of the evergreen forests of Indonesia and Malaysia. The animal's eyes are large and forward-facing, with a light-reflecting layer called the *tapetum lucidum*. In this way the Sunda slow loris is well adapted to their nocturnal lifestyle: they have the ability to see in almost complete darkness.

Suggest an explanation for the existence of this adaptation. Describe a process by which this particular adaptation came to be.