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FREE LEARNING NOTES FOR ZAMBIA

FORM 1

Biology

Coordination and Response in Plants and Animals

Lesson notes for learners · Competence-Based Curriculum

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Living things notice changes around them and react to them. A maize plant bends towards the sun, and a chicken runs away from a dog. This topic explains how plants respond through tropisms and how animals respond through taxic responses.

AFTER THESE NOTES YOU SHOULD BE ABLE TO

- Define stimulus, response, coordination, tropism and taxis in correct terms
- Name and describe phototropism, geotropism, hydrotropism and thigmotropism in plants
- Explain the difference between positive and negative responses
- Describe taxic responses in animals such as phototaxis, chemotaxis and hydrotaxis, with examples
- Explain how plants and animals benefit from their responses

KEY WORDS

Stimulus	A change in the surroundings that a living thing can detect, such as light, water, touch or gravity
Response	The way a living thing reacts to a stimulus
Coordination	The way parts of an organism work together so that it can detect a stimulus and respond to it
Tropism	A growth movement of part of a plant in response to a stimulus from one direction
Positive response	A response towards the source of the stimulus
Negative response	A response away from the source of the stimulus
Taxis	Movement of a whole animal towards or away from a stimulus
Hormone	A chemical made in one part of an organism that controls growth or activity in another part

1 Stimulus, response and coordination

All living things are sensitive. This means they can detect changes around them. A change in the surroundings that an organism can detect is called a stimulus. Examples are light, temperature, water, touch, gravity and chemicals such as the smell of food.

The reaction of the organism to a stimulus is called a response. When you touch a hot pot and pull your hand away, the heat is the stimulus and the movement of your hand is the response.

For this to work, the parts of the organism must act together. This working together is called coordination. First the stimulus is detected. Then a message passes to the part that will act. Finally that part makes the response. Plants and animals do this in different ways. A plant responds mainly by growing. An animal can move its whole body from place to place.

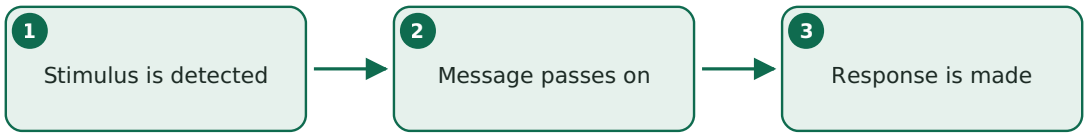


Figure 1. From stimulus to response

2 Tropisms: responses in plants

A plant is fixed in the soil and cannot walk away. It responds by growing a part of itself towards or away from a stimulus. A growth response in which the direction of growth is decided by the direction of the stimulus is called a tropism.

A tropism is positive if the part grows towards the stimulus. It is negative if the part grows away from the stimulus.

Plant tropisms are controlled by chemicals called hormones. In phototropism, for example, a hormone collects on the shaded side of the shoot and makes the cells there grow longer than the cells on the lit side. The shoot then bends towards the light.

Tropism	Stimulus	Response of the shoot	Response of the root
Phototropism	Light	Positive: grows towards light	Negative: grows away from light
Geotropism	Gravity	Negative: grows upwards	Positive: grows downwards
Hydrotropism	Water	Not usually important	Positive: grows towards water
Thigmotropism	Touch	Climbing stems and tendrils coil round a support	Not usually important

Figure 2. Tropisms in plants

3 Why tropisms help the plant, and how to show one

Each tropism helps the plant to survive. Shoots that grow towards light get more light for photosynthesis, which is how the plant makes its food. Roots that grow downwards hold the plant firmly in the soil, and roots that grow towards water can take in the water and mineral salts the plant needs. Climbing plants such as beans and pumpkin use thigmotropism: their thin stems coil round a stake or a fence, so the plant is lifted up towards the light without making a thick, strong stem of its own.

You can show phototropism with maize or bean seedlings. Grow two seedlings in small pots. Put one in a box that has a hole cut in one side, so light enters from one direction only. Put the other in an open place with light from all sides. After a few days, the seedling in the box bends towards the hole, while the other grows straight up. Keep everything else the same for both seedlings, such as the soil, the amount of water and the temperature, so that only the light direction is different. This is a fair test.

The figure shows the result. In the open place the light reaches the seedling from every side, so it grows straight. In the box the light comes only through the hole, so the shoot bends towards the hole.

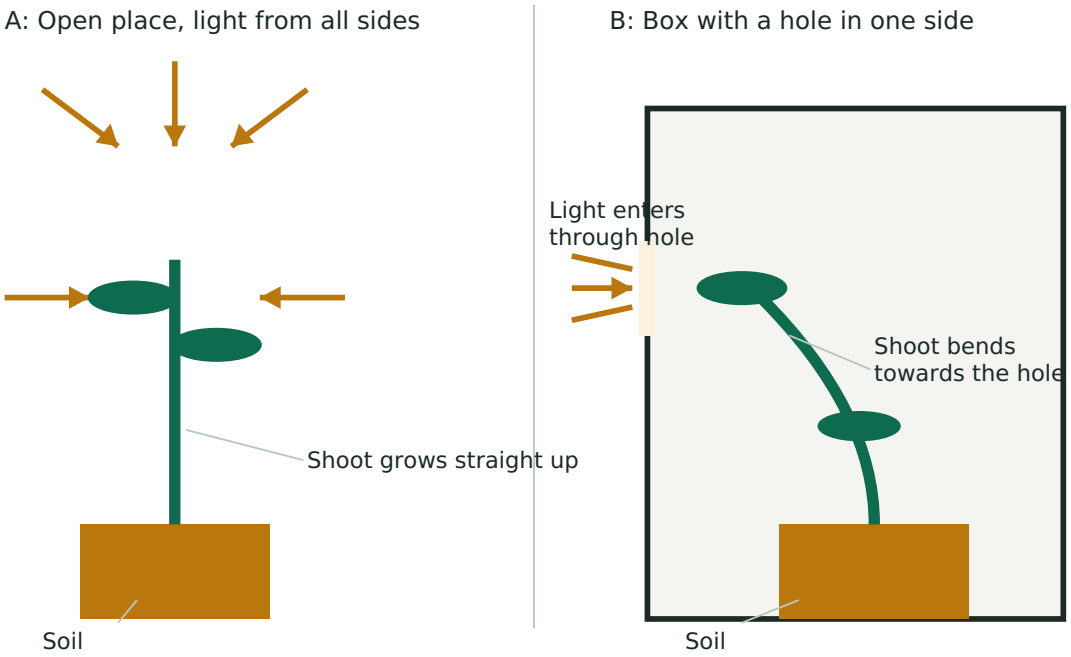


Figure 3. Phototropism: a seedling in the open grows straight; a seedling in a box with a side hole bends towards the hole

4 Taxic responses: responses in animals

An animal can move its whole body from one place to another. When a whole animal moves towards or away from a stimulus, the response is called a taxis (plural: taxes). In a taxis the direction of movement depends on the direction of the stimulus. The difference from a tropism is this: a tropism is a growth movement of part of a plant, but a taxis is a movement of the whole animal.

A taxis is named after its stimulus, and it is positive or negative in the same way as a tropism. Phototaxis is a response to light. Flying termites (ishwa) leave the ground and fly towards a lamp at night, which is positive phototaxis. Earthworms and woodlice move away from light and hide under stones or logs, which is negative phototaxis.

Chemotaxis is a response to a chemical. Houseflies move towards the smell of rotting food, which is positive chemotaxis. Hydrotaxis is a response to water or moisture. Woodlice gather in damp places under rotting logs, which is positive hydrotaxis. A woodlouse loses water from its body quickly in dry air and can dry out and die, so staying in a damp place keeps it alive.

Taxic responses help animals to find food, to find mates, to reach a good place to live and to escape danger.

Taxis	Stimulus	Example
Phototaxis (positive)	Light	Flying termites move towards a lamp
Phototaxis (negative)	Light	Earthworms move away from light
Chemotaxis (positive)	Chemical	Houseflies move towards rotting food
Hydrotaxis (positive)	Water or moisture	Woodlice gather in damp places

Figure 4. Taxic responses in animals

TRY THIS

Find a rotting log, a large stone or a heap of dead leaves outside your school or home. Lift it carefully and look for small animals such as woodlice, earthworms or millipedes. Notice whether they move towards or away from the light once their hiding place is opened. Put the log or stone back gently afterwards, and wash your hands. In your notebook, write the stimulus, the response and the name of the taxis.

REMEMBER

- A stimulus is a change in the surroundings, and a response is the reaction to it.
- Coordination is the way the parts of an organism work together to detect a stimulus and respond.
- A tropism is a growth movement of part of a plant, with direction decided by the stimulus; it is positive if towards the stimulus and negative if away.
- Shoots show positive phototropism and negative geotropism; roots show positive geotropism and positive hydrotropism.
- A taxis is the movement of a whole animal towards or away from a stimulus, for example phototaxis, chemotaxis and hydrotaxis.
- Responses help organisms to survive by getting light, water, food and safety.

? Check yourself

1. Define a stimulus and give two examples.

2. What is the difference between a tropism and a taxis?
3. A maize seedling is placed near a window and its shoot bends towards the window. Name the tropism and say whether it is positive or negative.
4. Describe how the shoot and the root of a germinating bean seed respond to gravity.
5. Why is it useful for a plant root to show positive hydrotropism?
6. A bean plant has stems that coil round a stake. Name this tropism and state the stimulus.
7. Flying termites gather round a lamp at night. Name the type of taxis and say whether it is positive or negative.
8. Woodlice are found under a damp rotting log. Name the taxis that explains this and say why it helps them.

ANSWERS

1. A stimulus is a change in the surroundings that an organism can detect. Examples: light, gravity, water, touch, temperature or a chemical.
2. A tropism is a growth movement of part of a plant in response to a stimulus. A taxis is a movement of the whole animal towards or away from a stimulus.
3. Phototropism. It is positive because the shoot grows towards the light.
4. The shoot shows negative geotropism and grows upwards. The root shows positive geotropism and grows downwards.
5. The root grows towards water, so the plant can take in the water and mineral salts it needs.
6. Thigmotropism. The stimulus is touch (contact with the stake).
7. Phototaxis. It is positive because the termites move towards the light.
8. Hydrotaxis (positive). A woodlouse loses water quickly in dry air and can dry out and die, so staying in a damp place keeps it alive.

Written by 25Schools to follow the Form 1 Biology syllabus of the Zambian competence-based curriculum. Free for learners to read, download and share. More notes and quizzes at 25schools.com.