

Biology Notes

Topic: Tropic and taxic responses

Objectives:

At the end of this topic, the students should be able to:

1. Explain what is meant by a tropic response.
2. Explain geotropism and phototropism in terms of auxins regulating differential growth.
3. Explain what is meant by a taxic response.
4. Explain simple behaviour of invertebrates in terms of taxic responses.

A response is the reaction of a living thing to an external stimulus. All living things have the ability to respond to a stimulus. Response is a general characteristic of living things. **Tropic** and **taxic** responses are two types of responses found among living things.

A **tropic response** is a growth response by plants in a particular direction. Plants do not respond to stimuli by moving from one place to another. Instead they respond by growing in a particular direction. Such growth responses are called **tropisms** and they are slow and much longer lasting than the responses given by animals.

Plants respond to three main kinds of stimuli: light (phototropism), gravity (geotropism or gravitropism) and touch.

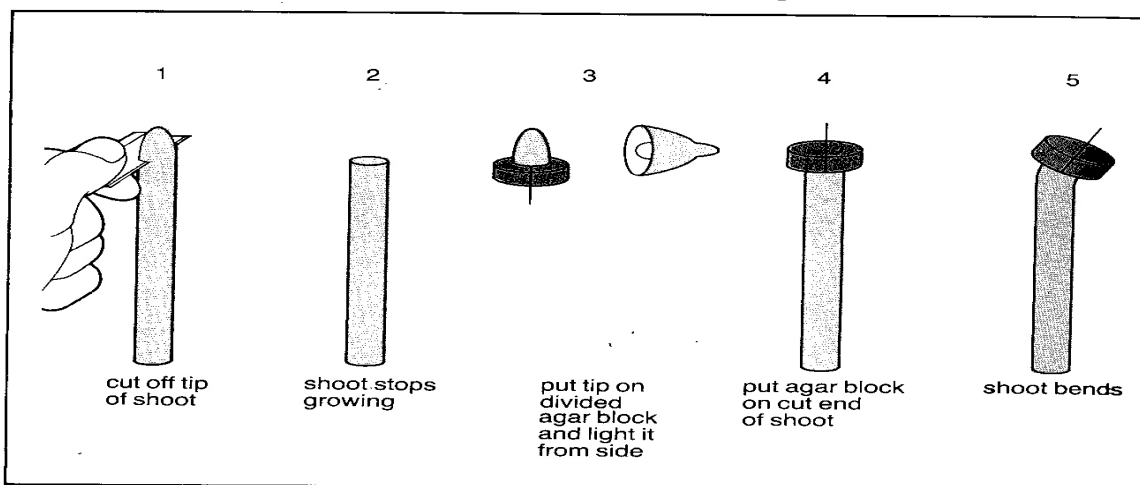
Phototropism

A growth response to light is called **phototropism**. A structure such as a shoot which grows towards light is said to be positively **phototropic**.

Scientists have investigated and found that a plant hormone called **auxin** is responsible for plant growth. Wherever this hormone is present in the plant it causes an increase in growth. This hormone is produced in the tip of a growing shoot. It then passes down the shoot, causing it to grow.

If the shoot is illuminated from one side, the shoot bends towards the light. **This is because the light causes the auxin to accumulate on the darker side of the shoot, with the result that the shoot grows faster on that side.** One of the most conclusive experiments which proved that auxin accumulates on the darker side of a shoot which is illuminated from one side is shown in the following illustration.

Illustration 1



Geotropism/Gravitropism

A growth response to gravity is called geotropism. If a structure grows toward gravity it is said to be **positively geotropic** and if it grows away from gravity it is said to be **negatively geotropic**. Whatever way a seed is, the shoot always grows upwards and the root downwards. A farmer therefore does not need to worry about the way a seedling is planted – nature will always make sure that the shoots and roots grow in the right direction.

Illustration 2

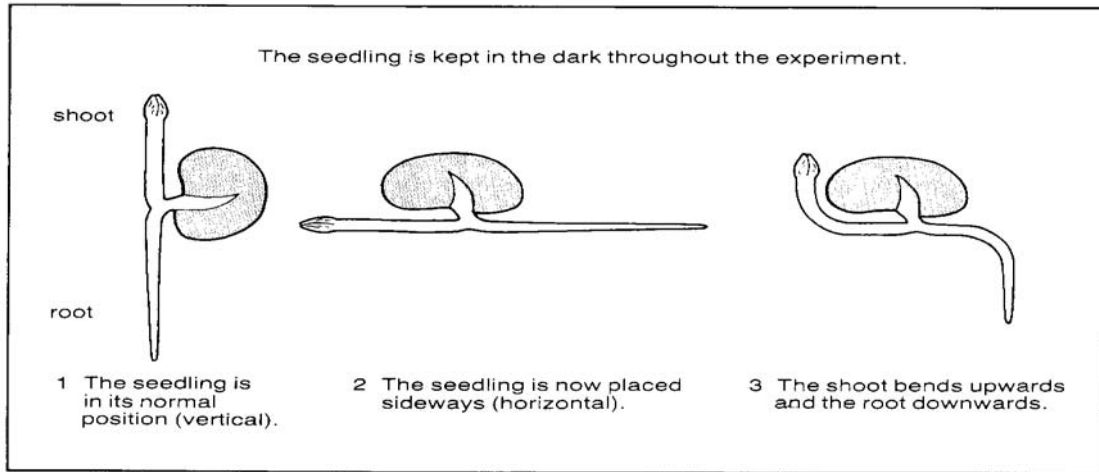


Figure 5 An experiment to show how a bean seedling responds to gravity.

Explanation:

The auxin, which is produced at the tip of the shoot moves to the lower side causing it to grow faster on that side. However **in the root, it produces the opposite effect**- causing it to grow slowly on the lower side. Consequently, the shoot grows upward and the roots grow downward. (Illustration 3)

Illustration 3

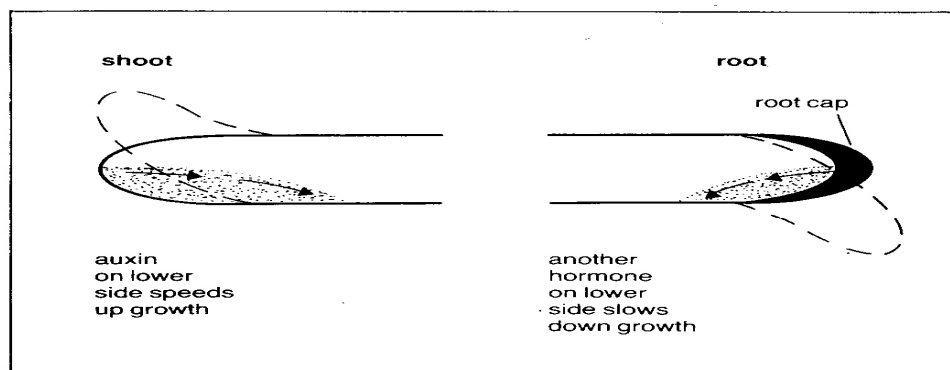


Figure 26.5 The mechanism by which the shoot and root are thought to respond to gravity.

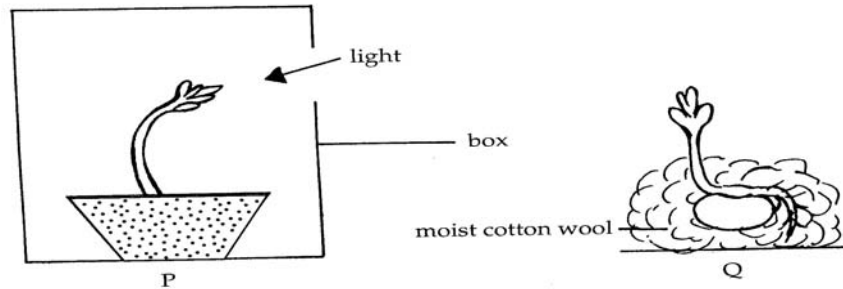
Taxic responses

Movement of a whole organism, towards, or away from, a stimulus which comes from a particular direction is called taxis or a taxic response.

This type of response is characteristic of simple invertebrates such as woodlice, earthworms, termites and blowfly larvae. These organisms avoid light altogether. The light acts as a stimulus which comes from a particular direction and the organism moves away from the light (negatively phototactic).

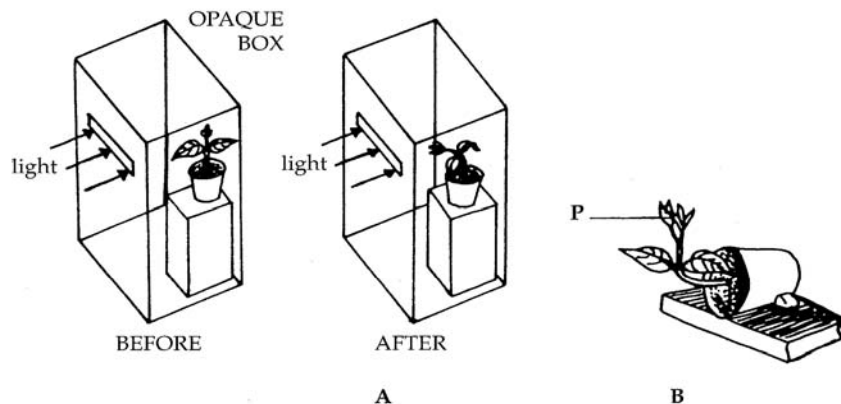
Questions

1. The diagrams P and Q are shown.



- (a) (i) What is the name given to the response shown in diagram P? (1)
- (ii) Which growth hormone causes this response? (1)
- (iii) Explain how this response to light occurs in diagram P. (2)
- (b) In diagram Q, to which positive stimuli are
- (i) the root and (ii) the shoot responding? (2)
- (c) Explain what happens to the root at Q causing it to grow towards the stimulus. (2)
- (d) Some seedlings are grown in moist soil and are completely covered by a box.
- (i) Describe the appearance of seedlings after about five days. (2)
- (ii) Explain the cause of the appearance. (2)

2. The diagrams illustrate experiments being performed to show plants responding to environmental changes.



- (a) (i) What general characteristic of living organisms is illustrated here? (1)
- (ii) Which type of response is shown in both diagrams A and B? (1)
- (b) (i) Name the response shown by the plant in A. (1)
- (ii) Name the stimulus to which the shoot is responding in experiment B. (1)
- (c) If point P was turned upside down, what would occur? (3)
- (d) (i) What is the name of the response shown by woodlice to the presence of light? (1)
- (ii) State the difference between responses to light of woodlice and the plant shown in diagram A. (1)
- (e) Name the hormone which causes the changes shown by the plant in diagrams A and B. (1)