Coordination in Plants

Gravitropism and phototropism, the role of auxin in controlling shoot growth, and investigating plant responses.

14.5 Tropic responses

Plants respond to stimuli by changing the direction in which they grow.

Gravitropism is a response in which parts of a plant grow towards or away from gravity.
Phototropism is a response in which parts of a plant grow towards or away from light.

Part	Phototropism	Gravitropism
shoot	positive: grows towards light	negative: grows away from gravity (upwards)
root	usually not responding	positive: grows towards gravity (downwards)

These responses help the plant: shoots grow towards the light for photosynthesis, and roots grow down towards water and mineral ions and to anchor the plant.

The role of auxin

Auxin is a plant hormone that controls shoot growth. It is made in the shoot tip and spreads through the plant from the tip. It stimulates cell elongation (cells grow longer).

Auxin is **unequally distributed** in response to light and gravity.

Phototropism in a shoot.

1. Light shines from one side.
2. Auxin moves to the **shaded side** of the shoot.
3. The cells on the shaded side **elongate more** than those on the lit side.
4. The shoot **bends towards the light**.

Gravitropism in a shoot. If a shoot is placed on its side, auxin collects on the **lower side**. The cells on the lower side elongate more, so the shoot bends **upwards**, away from gravity.

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(In roots, a high concentration of auxin on the lower side **inhibits** growth, so the roots bend downwards. The details are not required.)

Investigations

- **Phototropism:** grow seedlings in a box with a hole on one side (or with a light on one side). The shoots bend **towards the light**. Seedlings with the tip removed or covered with foil do not bend, which shows that the **tip** detects the light and makes the auxin. Controls: seedlings lit from above, or in the dark.
- **Gravitropism:** place germinating seeds on damp cotton wool on a vertical board, with the roots pointing in different directions, or turn the seedlings on their side. After a few days the **roots** always bend **downwards** and the **shoots** upwards. Using a clinostat (which slowly rotates the seedlings so that gravity acts evenly) as a control, there is no bending.

> **TRY IT**
>
> Explain why a seedling placed next to a window grows towards the window.

Auxin made in the tip moves to the **shaded side**. The cells on the shaded side **elongate more**, so the shoot bends **towards the light**.

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