Seedlings that find the light HL

60 minutes • C3.1.17, C3.1.18 • Chapters 1, 2

Positive phototropism as growth, the tip and the growing region, and the two ways to record a tropism in seedlings

BY THE END, STUDENTS CAN

- [ ] Record a tropism in seedlings with annotated drawings and by measuring the angle of curvature, and say what limits the precision and accuracy of the measurements C3.1.17
- [ ] Explain positive phototropism as growth towards light from one side C3.1.18

TIMING

0–5	5 min	Do now: moving or growing?	
5–20	15 min	Set up the seedlings	
20–32	12 min	The tip and the bend	
32–44	12 min	Phototropism line dance	
44–54	10 min	Recording a tropism	
54–60	6 min	Exit: back to the window	
	60 min	One lesson	

STARTER

5 min

Do now: moving or growing?

A photograph of a houseplant leaning towards a window. Is it moving or growing, and how could you tell? Pairs write one sentence. Take two answers and leave them up for the end of the lesson.

ON THE BOARD, FROM THE GUIDE

Open the guide on the projector at each chapter (the links work in this PDF). Every figure plays from its own buttons, and the lesson's slides have the same figures, step by step, in the order of this plan.

01 Watching seedlings grow

CHAPTER 01 IN THE SLIDES

Step through the figure (2 steps, the arrow keys on a projector). Stop on each caption and ask what changed before you go on.

1. A **drawing** of tray A at 0 and 24 hours, lit from the left: the light's direction, a scale bar and notes on what you see. Qualitative data.
2. A side-on **photograph** of one seedling at 24 hours: a vertical line, a line along the top 5 mm of the shoot, and the angle between them, measured with a protractor. Quantitative data.

> **Predict box:** Two students measure the same seedling's angle of curvature. One photographs it square-on from the side; the other from above and to one side. Whose angle is more accurate? Hands up or mini whiteboards first.
>
> **Answer C: The square-on one, as at a slant a bend looks smaller or larger**

02 Growing towards the light

CHAPTER 02 IN THE SLIDES

Show the figure: The growing region just below the tip bends. Cells on the shaded side grow longer than those on the lit side, so the shoot curves towards the light. The difference in cell length is exaggerated.

Play the animation, A seedling finds the light. It loops; pause it on each moment below and ask what is happening (in the lesson slides it is a video).

1. Oat seedlings lit from **above** grow straight up. The clock counts the hours.
2. Lit from one side, cells in the tip move their **auxin efflux carriers** to the shaded side: auxin flows there, then down.
3. The shaded side grew more, so each shoot curves towards the light: **positive phototropism**.
4. After 2 hours lit from the side: shoots with intact tips or foil collars bend towards the light; capped and cut ones stay straight, and cut ones barely grow.

> **Predict box:** The tip of a grass seedling is covered with a foil cap, and the seedling is lit from one side. What happens? Hands up or mini whiteboards first.
>
> **Answer B: It grows straight up: the part that senses light is in the dark**

THE LESSON

15 min

Set up the seedlings

Groups set up Seedlings in a box (below): trays lit from one side with tips intact, under foil caps, and with foil collars just below the tips, and a control tray lit from above. Each group draws its trays now, at 0 hours, with an arrow for the light and a scale bar.

12 min

The tip and the bend

Chapter 2's figure: the tip senses, the region below bends, the shaded cells grow longer. Then its predict box on the foil cap: students vote before you reveal it. Play the film through, then use its Tip control for the cap, the collar and the cut tip, asking for a prediction before each.

12 min

Phototropism line dance

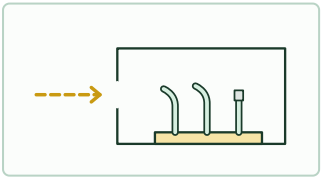
The line dance below, run twice: once with the tip watching the lamp, once with the tip's eyes covered. Ask which part of the dance stands for the tip, which for auxin and which for the growing cells, and where the dance is wrong (cells grow; they do not walk).

10 min

Recording a tropism

Chapter 1's figure, step by step: the drawing gives qualitative data, the angle gives quantitative data. Pairs list what limits the precision and what limits the accuracy of an angle, then the predict box on the two photographs. Draw the seedlings again tomorrow, and photograph them side-on for lesson 3.

ACTIVITIES



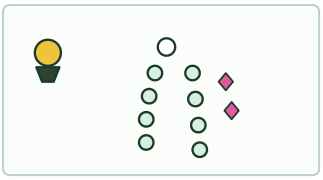
PRACTICAL

Seedlings in a box

Prepare it before lesson 1: soak oat or wheat grains overnight, then grow them on damp paper or compost in a dark cupboard until the shoots are 1 to 2 cm tall (allow several days, and look each day). Stand each tray in a shoe box with a slit cut in one side, facing a lamp or a bright window. Give some shoots a foil cap over the tip and some a foil collar just below it; leave some intact; keep one tray in a box lit from above as the control. Draw the trays at 0 hours and again a day later, with notes, then photograph them side-on with squared paper behind, and measure each angle of curvature in lesson 3. Remind groups to measure every seedling, not only the ones that bent well.

Needs: oat or wheat grains, a dark cupboard, seed trays or Petri dishes, damp paper or compost, shoe boxes, a lamp or a bright window, kitchen foil, squared paper, a phone camera, a protractor or an angle app.

Safety: a lamp gets hot, so keep it clear of foil, paper and damp compost; keep mains leads and plugs away from damp compost and water; check for allergy to cereal grains and dust; throw away any paper or compost that grows mould without opening or sniffing it; wash hands afterwards.



WHOLE CLASS

Phototropism line dance

Two lines of students, side by side and facing the front, are the lit and shaded sides of a shoot; a lamp (a torch, or a sign) stands at one side; one student at the front is the tip. The tip passes auxin cards (pink diamonds) to the line on the side away from the lamp. On each beat, everyone steps forward; anyone holding a card takes a longer step. The two lines curve round towards the lamp. Then cover the tip's eyes and run it again: no cards, no curve. Ask which part of the dance is the tip, which the auxin and which the growing cells, and where the dance is wrong: cells grow, they do not walk.

Needs: about 15 auxin cards (pink diamonds), a torch or a sign for the lamp, room to walk.

LAB

The cress maze

The site's cress maze: cress seedlings in a box find their way round its inner walls to the only gap that lets the light in. It needs a week, so start it alongside lesson 1. Keep the cap and collar experiments for the grass seedlings: the tip result is a grass result, and in thale cress, the best-studied seedling of all, light is sensed in the upper stem instead.

Needs: a shoe box, card, scissors, cress seeds, damp compost or paper, a windowsill.

Safety: the teacher cuts the card, with scissors or a craft knife; wash hands after handling compost.

PLENARY

6 min

Exit: back to the window

Back to the houseplant. In two sentences: is the lean movement or growth, and which side of the stem grew faster?

WHAT STUDENTS GET WRONG

"A tropism is movement." It is growth: one side of the shoot grows more than the other.

"The lit side shrinks." It grows too, just less than the shaded side.

"Light pushes the auxin away, or destroys it." The guide teaches redistribution: light makes cells move their efflux carriers, and the carriers send auxin to the shaded side.

"Precise means accurate." A reading can be fine and repeatable and still wrong, if a slanted camera shifts every angle the same way.

STRETCH AND SUPPORT

Support: a drawing of a bending shoot to label: tip, growing region, lit side, shaded side, longer cells, where the auxin is.

Support: use the key terms (tap the dotted words) as a glossary, and the five mnemonic tiles as a starter.

Stretch: roots grow down, towards gravity. What would a root need, to sense which way is down? (Beyond the guide.)

IN THE GUIDE

1 Watching seedlings grow

2 Growing towards the light

All The whole guide, with the figures that play

PPTX This lesson's slides, in the order of this plan

EXAM PRACTICE

Check yourself

Set it for homework: a fresh paper of exam-bank questions on C3.1 at higher level each time, marked as students go and saved to their Exam practice when they are signed in.

biologybybradford.com/exam-maker/sit?topics=C3.1&level=HL&paper=quiz&marks=15&src=ep

PRACTISE AND REVISE

BUILD FOR YOUR CLASS

- Tarsia puzzle, dominoes and picture reveal on C3.1, built from its key terms and ready to print
- A pub quiz with rounds on C3.1, to present or run with no projector
- An escape room built from the question bank on C3.1

ALREADY ON THE SITE FOR C3.1

- Lab: Tropisms
- Quiz: Integration of Body Systems
- Revision map: C3.1 Integration of body systems, to fill in
- Exam questions: C3.1 in the exam maker, a paper with its markscheme

CARD SETS ON SPLYCR

Open a set to host it as a class game, or make a copy to edit.

- C2.2–C3.2 Neural Signalling, Body Systems & Defence

How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.