

A. TROPISMS

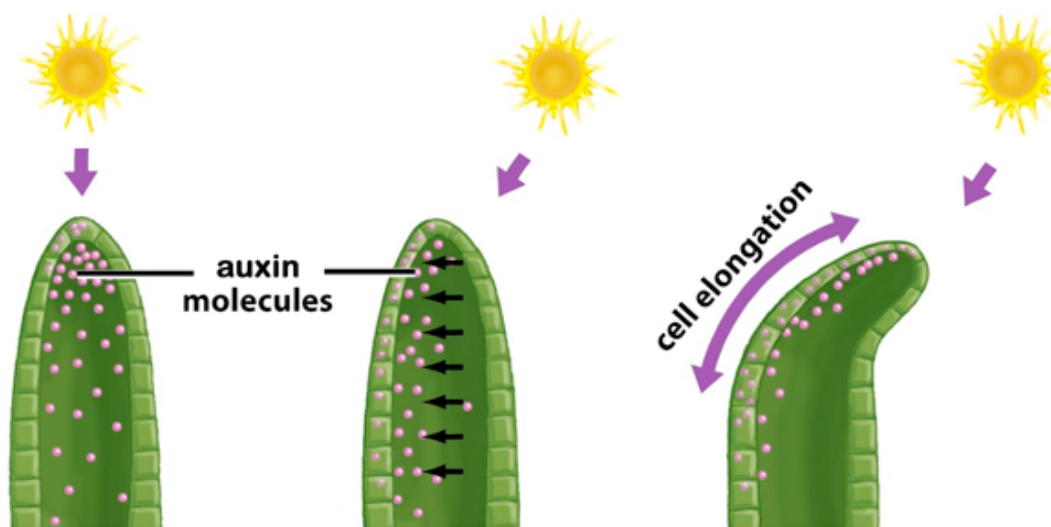
- Plants respond to **light** and **gravity**.

Phototropism is a response in which parts of a plant **grow towards** or **away** from the **direction of incoming light**

Geotropism is a response in which parts of a plant **grow towards** or **away** from the **direction of gravity**

	SHOOTS	ROOTS
PHOTOTROPISM	Positively phototropic (towards light)	Negatively phototropic (away from light)
GEOTROPISM	Negatively geotropic (opposite direction as gravity)	Positively geotropic (same direction as gravity)

B. WHAT MAKES SHOOTS GROW TOWARDS LIGHT?



- Auxin** is produced at the **shoot tip**.
- Shoot tip** detects **direction of light**.
- More auxin diffuses** down the **shaded side** than the side closer to light.
- Auxin** causes **more cell elongation** on the **shaded side**.
- (So) the shoot **bends towards** the **light**.

C. WHAT MAKES SHOOTS GROW STRAIGHT UP?

- If light is shone from directly above:

Auxin is produced at the shoot tip

Auxin diffuses equally to both sides of the shoot

Auxin causes both sides to have the same cell elongation

(So) the shoot grows upwards

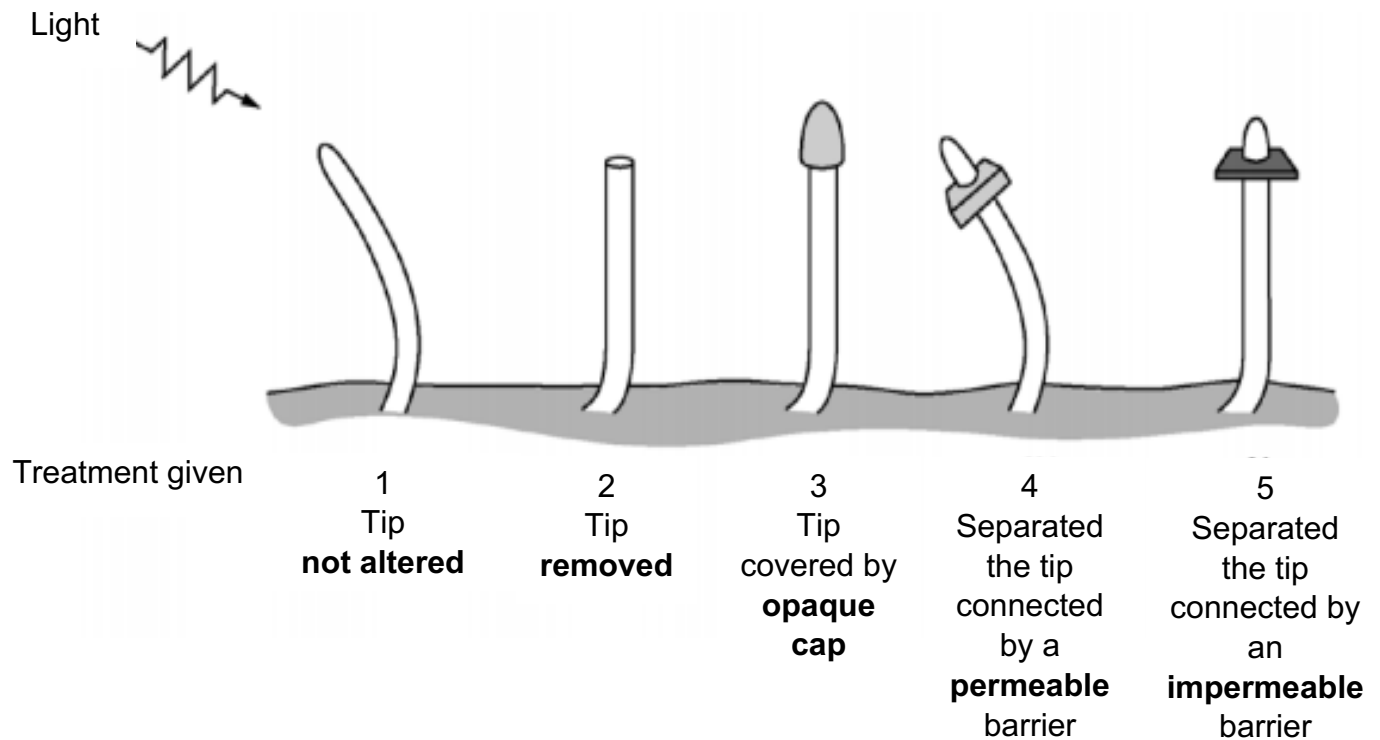


EXAM TIP!

“Always talk about **CELL ELONGATION** and **NOT CELL DIVISION**.

The shoot bends due to the cells getting **LONGER**, which is **DIFFERENT** from them **DIVIDING**.

D. HOW WE KNOW THIS – SOME CLASSIC EXPERIMENTS

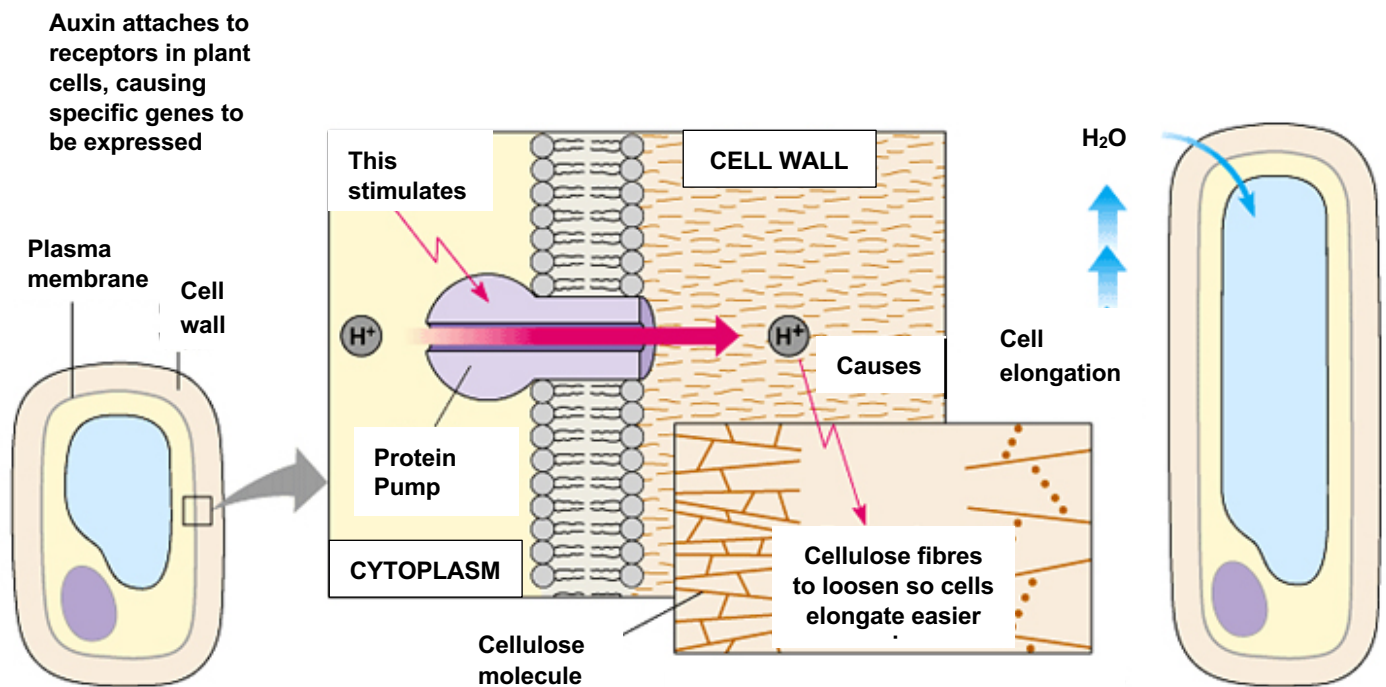


From this, it can be concluded that:

- **Light** is **detected** by **cells** at the **tip**.
- A growth substance (**auxin**) is **produced** at the **tip**.
- The **growth substance** causes the **shoot** to **bend**.
- The **growth substance** must **diffuse** from the **tip** and **down** the **shoot**.

E. HOW AUXIN CAUSES CELL ELONGATION IN SHOOTS

- Go through each point a **step at a time**, while **looking at the diagram**.
- The **cellulose** in **plant cell walls** must be **loosened** to allow the **shoot** to **bend**.



- (positive) **phototropism** is growth **towards light**
- **shoot tip** detects **direction of light**
- **shoot tip** produces **auxin**
- **auxin moves** to **shaded side** of **shoot**
- (so) auxin causes **cells** on **shaded side** to **elongate more**/grow faster
- **auxin** attaches to **receptors** in plant cells
- (to) **switch on** specific **genes**
- (that) **causes transport** of H^+ from **cytoplasm** to **cell wall** by **active transport**
- (using a) **protein pump**
- (this) **decrease** in **pH** **breaks bonds** between **cellulose fibres**
- (so) **cell walls** are **more flexible** / **softer**/ **bend easier**
- (then) **water enters** cells by **osmosis**

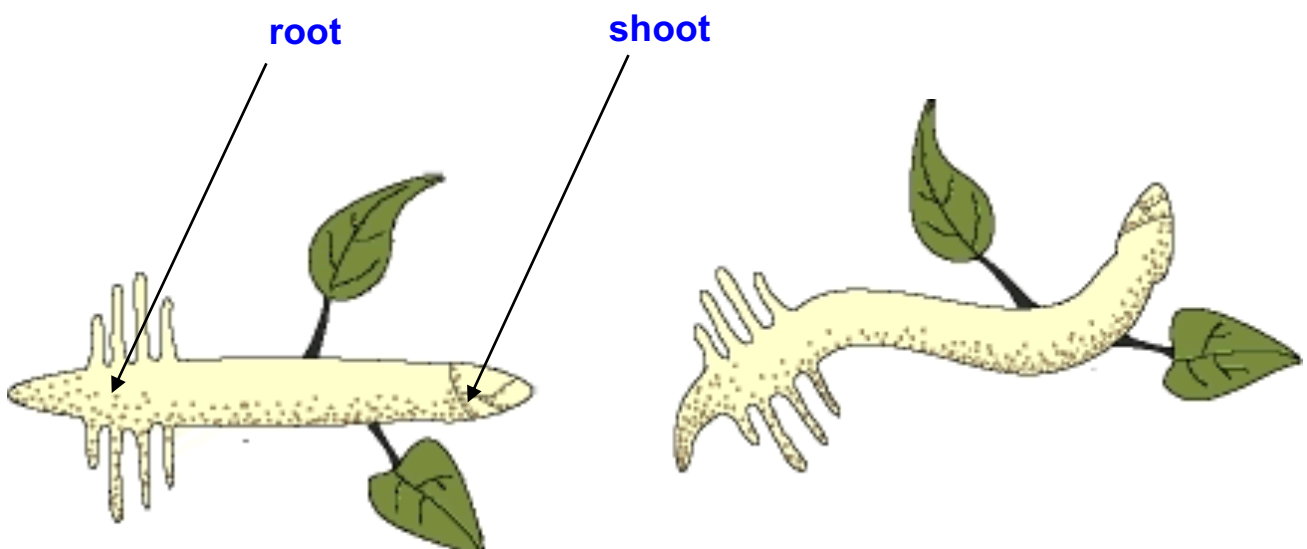
F. HOW AUXIN AFFECTS ROOTS

- This is **not** in the **syllabus**.
- However, you could be given a **data analysis question** on this.
- If so, this should **help**:

AUXIN:

PROMOTES CELL ELONGATION IN SHOOTS

INHIBITS CELL ELONGATION IN ROOTS



- **More auxin** on **lower side** (of root)
- Due to **gravity**
- **Auxin inhibits/prevents cell elongation** in roots
- (So) **less cell elongation** on the **lower side**
- (So) root **bends downwards**