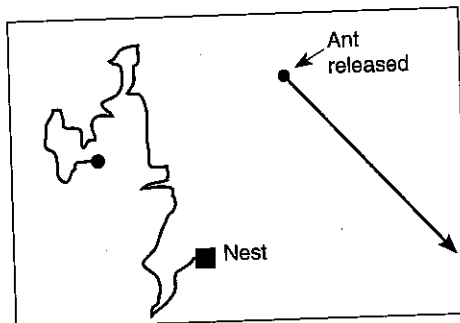


effect of the atmosphere on the Sun's light) can still detect the plane of light in the sky the even when the Sun is obscured. They can therefore still use the changing position of the Sun (via the changing angle of polarisation) to navigate accurately even when the Sun is obscured.

13. Homing Behaviour in Insects (page 20)

- Moving the pine cones shifted the environmental landmarks (the cue). The wasp oriented on the new position of the cones, which were away from the nest.

2. (a)



- (b) The ant would have returned to the nest directly (an angle of $\sim 25^\circ$). If displaced, it would have made a return journey at the same angle from the new position.

14. Homing in Salmon (page 21)

- They recognise the unique odour of the river of their birthplace.
 - The map shows that some salmon entered the wrong river systems (e.g. navigated up the wrong tributary, and strayed into the Ohinemaka drainage system).
 - The natal river has a proven record in providing an environment that is suitable for the eggs to survive to hatching so returning there to breed offers a greater chance of reproductive success.
- They have no chemical memory of the odour of their stream of origin, therefore cannot find the stream.

15. Plant Responses (page 22)

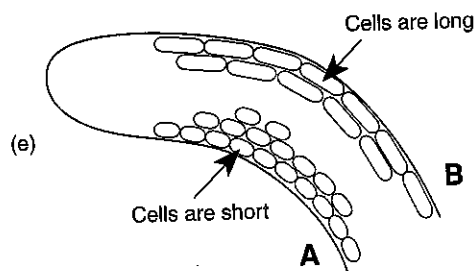
- Light (including the light/dark cycle), gravity, temperature, touch, chemicals.
- Appropriate responses enhance survival in different environments. They enable the plant to synchronise its daily cycles and seasonally important events, such as germination, with environmental cues.
- Closing of stomata
 - Leaf fall, dormancy
 - Leaf closure, leaf toxins
 - Closing of flowers.

16. Tropisms (page 23)

- Positive chemotropism
 - Negative gravitropism
 - Positive hydrotropism
 - Positive phototropism
 - Positive gravitropism
 - Positive thigmomorphogenesis (*alt.* thigmotropism)
- Enables roots to turn and grow down into the soil (where they obtain moisture and nutrients).
 - Enables coleoptiles to turn up and grow towards the sunlight (necessary for food manufacture).
 - Enables the plant to clamber upwards and grow toward the light instead of possibly becoming smothered by more upright plants.
 - Enables pollen tube to locate the micropyle of the embryo sac, and sperm nuclei to fertilise the egg.
- Tropisms show adaptive value because they help position a plant to achieve the most favourable conditions. For example, positive phototropism orientates seedlings to grow towards the sunlight, and helps them obtain enough light for photosynthesis.

17. Investigating Phototropism (page 24)

- Auxin.
 - Positive phototropism.
 - Point A:** Cells stay short.
 - Point B:** Cells elongate.
 - Side B



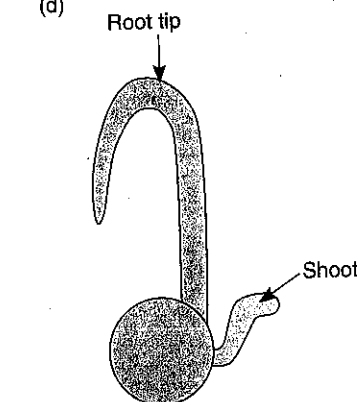
- The hormone is produced in the shoot tip. The light initiates the response.
- Plant A: The plant will exhibit phototropism and bend towards the sun.
Plant B: The plant will exhibit no phototropic behaviour and will not bend.

18. Investigating Gravitropism (page 25)

- In shoots, more auxin accumulates on the lower side of the shoot. In response to higher auxin levels here, the cells on the lower side of the stem elongate and the shoot tip turns up.
 - In roots, the accumulation of auxin on the lower side inhibits elongation (since this is the response of roots to high auxin). The cells on the upper side therefore elongate more than those on the lower side and the root tip turns down.
- Approx. 10^{-3} mgL $^{-1}$
 - Stem growth is promoted.
- A negative geotropic response ensures shoots turn up towards the light (important when light may be absent as when buried deeply in soil).
 - Positive geotropism ensures roots turn down into the soil so that they can begin obtaining the water and minerals required for continued growth.

19. Investigating Gravitropism in Seeds (page 26)

- Down (towards the ground).
 - The root began to curve towards the ground.
 - The direction of the pull of gravity relative to the root had changed and so the root curved to compensate for the change of direction and continue to grow down.
 -



- Up (away from the ground)
 - The shoot continued to grow away from the ground.
 - The shoot reorientated itself to grow away from the ground, as this is the direction in which it is most likely to find light.

