

Topic 8

Level 1

1. D
2. C
3. D
4. A
5. D
6. A
7. C

LEVEL 2

1. B
2. B
3. A
4. C
5. B
6. C
7. A
8. B
9. B
10. D

Free response question

...correct. Signal transduction pathways are often started by a hormone or other small molecule, but they can also be initiated by light. This is possible because the receptor is a protein (a phytochrome) that is activated by light, changes shape, and starts the transduction process. Not surprisingly, a number of pathways in plants are started with light as the stimulus.

- 9. (B) is correct. This is the transduction step, which enables the plant to amplify the signal received in reception.
- 10. (D) is correct. Activation of the cellular receptor protein (phytochrome) leads to the opening of the calcium ion channels and a temporary but marked increase in calcium in the cytosol. The high calcium levels activate protein kinase 2, which leads to the activation of transcription factor 2.

Question

- (a) It was originally thought that plant flowering depended on the length of the daylight, but then scientists concluded that it is actually night length that determines when a plant will flower. Plants monitor the length of the night by the molecular switching of two forms of the phytochrome pigment. Phytochromes respond to a shift in red (r) light to far-red (fr) light. This is a photoreversible response, and the threshold to trigger flowering is called the critical dark period. The accumulation of specific phytochrome isomers combined with the biological clock of plants allows for the specific monitoring of the length of the night. Long-day plants and short-day plants actually monitor the length of the night, not the day. Short-day plants must have a period of darkness longer than a specific critical period to flower, so you get chrysanthemums to flower by keeping them in a greenhouse where shades are pulled to block light to simulate a long night. The total amount of light must not exceed the critical period, and this will induce flowering.
- (b) The response described is phototropism. Early experiments determined that only the tip of the coleoptiles responds to light by producing a chemical, now known to be auxin, whose concentration increases on the dark side of the stem. Auxin causes elongation (not cell division) of the cells on the dark side, and this will bend the seedling toward the light source.
- (c) The first response is photoperiodism. Because in many plants, flowering is related to day length, this serves as an adaptation to ensure that flowering resources are not committed until growing conditions are most favorable for survival of flowers, fruits, and seeds. For example, short-day plants will not set flower buds unless they receive a critical period of darkness, and any interruption in this will keep them from flowering. These plants will, therefore, in nature, flower in the earliest days of spring, whereas long-day plants will not flower until the longer days of summer. In each case, the time of flowering will enhance reproductive success. The second response is phototropism. This response ensures that plants will maximize their exposure to light, which increases their ability to do photosynthesis.

Lab

1. D
2. D