CHAPTER 39
PLANT RESPONSES TO INTERNAL AND EXTERNAL SIGNALS

Learning objectives:

Signal Transduction and Plant Responses

1. Compare the growth of a plant in darkness (etiolation) to the characteristics of greening (de-etiolation).
2. Describe the signal pathways associated with de-etiolation.
3. Describe the role of second messengers in the process of de-etiolation.
4. Describe the two main mechanisms by which a signaling pathway can activate an enzyme.
5. Explain, with examples, what researchers have learned about the activity of plant hormones by study of mutant plants.

Plant Responses to Hormones

6. Compare plant and animal responses to hormones.
7. For the following scientists, describe their hypothesis, experiments, and conclusions about the mechanism of phototropism:
    a. Charles and Francis Darwin
    b. Peter Boysen-Jensen
    c. Frits Went
8. List six classes of plant hormones, describe their major functions, and note where they are produced in the plant.
9. Explain how a hormone may cause its effect on plant growth and development.
10. Describe a possible mechanism for the polar transport of auxin.
11. According to the acid-growth hypothesis, explain how auxin can initiate cell elongation.
12. Explain why 2,4-D is widely used as a weed killer.
13. Explain how the ratio of cytokinin to auxin affects cell division and cell differentiation.
14. Describe the evidence that suggests factors other than auxin from the terminal bud may control apical dominance.
15. Describe how auxin and gibberellins work together to stimulate stem elongation.
16. Explain the role of gibberellins in triggering seed germination.
17. Describe the functions of brassinosteroids in plants.
18. Describe the effects of ABA on seed dormancy and drought stress.
19. Describe the role of ethylene in the triple response to mechanical stress, apoptosis, leaf abscission, and fruit ripening.

Plant Responses to Light

20. Define photomorphogenesis and note which colors are most important in regulating this process.
21. Compare the roles of blue-light photoreceptors and phytochromes.
22. Describe the phenomenon of chromophore photoreversibility and explain its role in light-induced germination of lettuce seeds.

23. Define circadian rhythm and explain what happens when an organism is artificially maintained in a constant environment.
24. Explain how light entrains biological clocks.
25. Define photoperiodism.
26. Distinguish between short-day, long-day, and day-neutral plants. Explain why these names are misleading.
27. Explain what factors other than night length may control flowering.
28. Describe the evidence that the *CONSTANS* gene plays a role in signaling flowering.

Plant Defenses Against Herbivores and Pathogens

29. Explain how plants deter herbivores with physical and chemical defenses.
30. Describe how plants may recruit parasitoids to attack herbivorous caterpillars.
31. Describe how the hypersensitive response helps a plant limit the damage from pathogen attack.
32. Explain the role of salicylic acid in eliciting systemic acquired resistance to infection.