

## Transport in Vascular Plants

### An Overview of Transport Mechanisms in Plants

1. Describe how proton pumps function in transport of materials across plant membranes, using the terms *proton gradient*, *membrane potential*, *cotransport*, and *chemiosmosis*.
2. Define osmosis and *water potential*. Explain how water potential is measured.
3. Explain how solutes and pressure affect water potential.
4. Explain how the physical properties of plant cells are changed when the plant is placed into solutions that have higher, lower, or the same solute concentration.
5. Define the terms *flaccid*, *plasmolyze*, *turgor pressure*, and *turgid*.
6. Explain how aquaporins affect the rate of water transport across membranes.
7. Name the three major compartments in vacuolated plant cells.
8. Distinguish between the symplast and the apoplast.
9. Describe three routes available for lateral transport in plants.
10. Define *bulk flow* and describe the forces that generate pressure in the vascular tissue of plants.
11. Relate the structure of sieve-tube cells, vessel cells, and tracheids to their functions in bulk flow.

### Absorption of Water and Minerals by Roots

12. Explain what routes are available to water and minerals moving into the vascular cylinder of the root.
13. Explain how mycorrhizae enhance uptake of materials by roots.
14. Explain how the endodermis functions as a selective barrier between the root cortex and vascular cylinder.

### Transport of Xylem Sap

15. Describe the potential and limits of root pressure to move xylem sap.
16. Define the terms *transpiration* and *guttation*.
17. Explain how transpirational pull moves xylem sap up from the root tips to the leaves.
18. Explain how cavitation prevents the transport of water through xylem vessels.
19. Explain this statement: "The ascent of xylem sap is ultimately solar powered."

### The Control of Transpiration

20. Explain the importance and costs of the extensive inner surface area of a leaf.
21. Discuss the factors that may alter the stomatal density of a leaf.
22. Describe the role of guard cells in photosynthesis-transpiration.
23. Explain how and when stomata open and close. Describe the cues that trigger stomatal opening at dawn.
24. Explain how xerophytes reduce transpiration.
25. Describe crassulacean acid metabolism and explain why it is an important adaptation to reduce transpiration in arid environments.

### Translocation of Phloem Sap

26. Define and describe the process of translocation. Trace the path of phloem sap from a primary sugar source to a sugar sink.
27. Describe the process of sugar loading and unloading.
28. Define *pressure flow*. Explain the significance of this process in angiosperms.