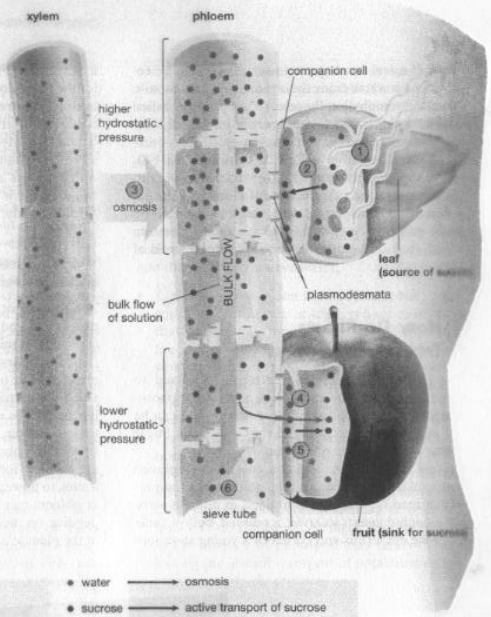
FIGURE 24-25 The pressure-flow theory
Differences in hydrostatic pressure force fluid through phloem sieve tubes. ① A photosynthesizing leaf manufactures sucrose (red dots), which ② is actively transported (red arrow) into a nearby companion cell in phloem. The sucrose diffuses into the adjacent sieve-tube element through plasmodesmata, raising the concentration of sucrose in the sieve-tube element. ③ Water (blue dots) leaves nearby xylem and moves into the "leaf end" of the sieve tube by osmosis (blue arrow), raising the hydrostatic pressure as increasing numbers of water molecules enter the fixed volume of the tube. ④ The same sieve tube connects to a developing fruit. At the "fruit end" of the tube, sucrose enters the companion cells by diffusion through plasmodesmata. Sucrose is then actively transported out of the companion cells and into the fruit cells. ⑤ Water moves out of the sieve tube by osmosis, lowering the hydrostatic pressure within the tube. ⑥ High pressure in the leaf end of the phloem and low pressure in the fruit end cause water, together with any dissolved solutes, to flow in bulk from leaf to fruit.



One Last Thing

Organisms that can make (and store) glucose in this way (plants) are essentially making (and storing) their own food. "Troph" is a suffix meaning "related to nutrition," so plants are referred to as *autotrophs* ("auto" means "self"); they are "self-feeders."

Organisms that cannot make their own food are called *heterotrophs*. Heterotrophs rely on the consumption of plants and other animals for nutrition. Humans and other animals are all heterotrophs.

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TABLE 32-2 *Plant Structures Adapted for Vegetative Reproduction*

Name	Description	Examples
Runner (stolon)	horizontal, aboveground stem that produces leaves and roots at its nodes; a new plant can grow from each node	strawberry, spider plant, Boston fern
Rhizome	horizontal, belowground stem that produces leaves and roots at its nodes; a new plant can grow from each node	ferns, horsetails, iris, ginger, sugar cane
Bulb	very short, underground monocot stem with thick, fleshy leaves adapted for storage; bulbs divide naturally to produce new plants	tulip, daffodil, onion, garlic, hyacinth
Tuber	underground, swollen, fleshy stem specialized for storage; the buds on a tuber can grow into new plants	potato, caladium, Jerusalem artichoke

TABLE 33-1 *Five Groups of Plant Hormones*

Plant hormone	Function	Features	Examples
Auxins	• promote cell growth • promote root formation on stem and leaf cuttings • promote apical dominance • increase number of fruits • prevent dropping of fruit • prevent sprouting of stored potatoes and onions	• produced in growing regions of plant (shoot tips, young leaves, developing fruit) • important role in tropisms	• indoleacetic acid, IAA (natural) • naphthalene acetic acid, NAA (synthetic) • herbicides 2,4-D and Agent Orange (synthetic)
Gibberellins (GA)	• promote elongation growth • promote germination, and seedling growth • increase size of fruit • overcome bud dormancy • substitute for long-day or vernalization requirements for flowering	• produced in all parts of plant, especially in immature seeds • more than 80 types	• GA_3 (natural)
Ethylene	• promotes ripening of fruit • promotes flowering in mangoes and pineapples • promotes abscission	• produced in fruits, flowers, leaves, and roots • colorless gas	• ethephon (synthetic) breaks down and releases ethylene (natural)
Cytokinins	• promote cell division • promote lateral bud growth in dicots	• produced in developing roots, fruits, and seeds • auxin-to-cytokinin ratio is important	• zeatin (natural) • kinetin (synthetic) • benzyladenine (synthetic)
Abscisic acid (ABA)	• promotes stomatal closure • promotes dormancy • inhibits other hormones • blocks growth	• produced in leaves • expensive to synthesize	• ABA (natural or synthetic)