

## Summary TABLE Plant Cell Components







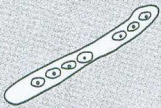
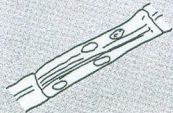
MAJOR COMPONENTS	INDIVIDUAL CONSTITUENTS	KEY DESCRIPTIVE FEATURES	FUNCTION(S)
Cell wall		Consists of cellulose microfibrils embedded in a matrix of hemicelluloses, pectins, and glycoproteins. Lignin, cutin, suberin, and waxes may also be present.	Strengthens the cell; determines cell size and shape.
	Middle lamella	Pectin-rich layer between cells.	Cements adjacent cells together.
	Primary wall	First wall layers to form. Contains primary pit-fields.	Found in actively dividing and actively metabolizing cells.
	Secondary wall	Formed after the primary wall is laid down. Located interior to the primary wall. Contains pits.	Found in cells with strengthening and/or water-conducting function. Is rigid and thus imparts added strength.
	Plasmodesmata	Cytoplasmic strands traversing the cell wall.	Interconnect protoplasts of adjacent cells, providing a pathway for the transport of substances between cells.
Nucleus		Bounded by a pair of membranes, the nuclear envelope, and containing nucleoplasm, nucleoli, and chromatin (chromosomes) consisting of DNA and histone proteins.	Controls cellular activities. Stores genetic information.
Plasma membrane		Single membrane, forming the outer boundary of the cytoplasm.	Mediates transport of substances into and out of the cell. Site of cellulose synthesis. Receives and transmits hormonal and environmental signals.
Cytoplasm	Cytosol	The least differentiated part of the cytoplasm.	Matrix in which organelles and membrane systems are suspended and biochemical events occur.
	Plastids	Surrounded by a double-membrane envelope. Semiautonomous organelles containing their own DNA and ribosomes.	Sites of food manufacture and storage.
	Chloroplasts	Contain chlorophyll and carotenoid pigments embedded in thylakoid membranes.	Sites of photosynthesis. Involved in amino acid synthesis and fatty acid synthesis. Temporary storage of starch.
	Chromoplasts	Contain carotenoid pigments.	May function in attracting insects and other animals essential for cross-pollination and fruit and seed dispersal.
	Leucoplasts	Lack pigments entirely.	Some (amyloplasts) store starch; others form oils.
	Proplastids	Undifferentiated plastids; may form prolamellar bodies.	Precursors of other plastids.
	Mitochondria	Surrounded by a double-membrane envelope. The inner membrane is folded into cristae. Semiautonomous organelles, containing their own DNA and ribosomes.	Sites of cellular respiration.
	Peroxisomes	Surrounded by a single membrane. Sometimes contain crystalline protein bodies.	Contain enzymes for a variety of processes such as photorespiration and conversion of fats to sucrose.
	Vacuoles	Surrounded by a single membrane (the tonoplast); may take up most of the cell volume.	Filled with cell sap, which is mostly water. Often contain anthocyanin pigments; store primary and secondary metabolites; break down and recycle macromolecules.
	Ribosomes	Small, electron-dense particles, consisting of RNA and protein.	Sites of protein synthesis.
	Oil bodies	Have an amorphous appearance.	Sites of lipid storage, especially triglycerides.
	Endoplasmic reticulum	Network of membrane channels.	Rough ER (mainly cisternal ER) has ribosomes and thus is involved in protein synthesis. Smooth ER (mainly tubular ER) is involved in lipid synthesis. Channels materials throughout the cell.
	Golgi complex	Collective term for the cell's Golgi bodies, stacks of flattened, membranous sacs.	Processes and packages substances for secretion and for use within the cell.
	Endomembrane system	Collective term for the endoplasmic reticulum, Golgi complex, <i>trans</i> -Golgi network, plasma membrane, nuclear envelope, tonoplast, and various vesicles.	The dynamic network in which membranes and various substances are transported throughout the cell.
	Cytoskeleton	Complex network of protein filaments.	Involved in cell division, growth, and differentiation.
Microtubules	Dynamic, cylindrical structures composed of tubulin.	Involved in many processes, such as cell plate formation, deposition of cellulose microfibrils, and directing the movement of Golgi vesicles and chromosomes.	
Actin filaments	Dynamic, filamentous structures composed of actin.	Involved in many processes, including cytoplasmic streaming and the movement of the nucleus and organelles.	

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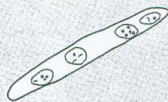









## Tissues and Cell Types

	TISSUE	CELL TYPE	CHARACTERISTICS	LOCATION	FUNCTION
<b>Dermal tissues</b>	Epidermis		Unspecialized cells; guard cells and cells forming trichomes; sclerenchyma cells	Outermost layer of cells of the primary plant body	Mechanical protection; minimizes water loss (cuticle); aeration of internal tissue via stomata
	Periderm		Cork cells; cork cambium cells; parenchyma cells of the phelloderm; sclereids	Initial periderm beneath epidermis; subsequently formed periderms deeper in bark	Replaces epidermis as protective tissue in roots and stems; aeration of internal tissue via lenticels
<b>Ground tissues</b>	Parenchyma tissue	Parenchyma	Shape: commonly polyhedral (many-sided); variable Cell wall: primary, or primary and secondary; may be lignified, suberized, or cutinized Living at maturity	Throughout the plant, as parenchyma tissue in cortex; as pith and pith rays; in xylem and phloem	Such metabolic processes as respiration, digestion, and photosynthesis; storage and conduction; wound healing and regeneration
	Collenchyma tissue	Collenchyma	Shape: elongated Cell wall: unevenly thickened, primary only—nonlignified Living at maturity	On the periphery (beneath the epidermis) in young elongating stems; often as a cylinder of tissue or only in patches; in ribs along veins in some leaves	Support in primary plant body
	Sclerenchyma tissue	Fiber	Shape: generally very long Cell wall: primary and thick secondary—often lignified Often (not always) dead at maturity	Sometimes in cortex of stems, most often associated with xylem and phloem; in leaves of monocotyledons	Support; storage
		Sclereid	Shape: variable; generally shorter than fibers Cell wall: primary and thick secondary—generally lignified May be living or dead at maturity	Throughout the plant	Mechanical; protective
<b>Vascular tissues</b>	Xylem	Tracheid	Shape: elongated and tapering Cell wall: primary and secondary; lignified; contains pits but not perforations Dead at maturity	Xylem	Chief water-conducting element in gymnosperms and seedless vascular plants; also found in angiosperms
		Vessel element	Shape: elongated, generally not as long as tracheids; several vessel elements end-on-end constitute a vessel Cell wall: primary and secondary; lignified; contains pits and perforations Dead at maturity	Xylem	Chief water-conducting element in angiosperms
	Phloem	Sieve cell	Shape: elongated and tapering Cell wall: primary in most species; with sieve areas; callose often associated with wall and pores Living at maturity; either lacks or contains remnants of a nucleus at maturity; lacks distinction between vacuole and cytoplasm; contains large amounts of tubular endoplasmic reticulum; lacks P-protein	Phloem	Food-conducting element in gymnosperms
		Albuminous cell	Shape: generally elongated Cell wall: primary Living at maturity; associated with sieve cell, but generally not derived from same mother cell as sieve cell; has numerous plasmodesmatal connections with sieve cell	Phloem	Believed to play a role in the delivery of substances to the sieve cell, including informational molecules and ATP
		Sieve-tube element	Shape: elongated Cell wall: primary, with sieve areas; sieve areas on end wall with much larger pores than those on side walls—this wall part is termed a sieve plate; callose often associated with walls and pores Living at maturity; either lacks a nucleus at maturity or contains only remnants of nucleus; in magnoliids, eudicots, and some monocots, contains a proteinaceous substance known as P-protein; several sieve-tube elements in a vertical series constitute a sieve tube	Phloem	Food-conducting element in angiosperms
		Companion cell	Shape: variable, generally elongated Cell wall: primary Living at maturity; closely associated with sieve-tube elements; derived from same mother cell as sieve-tube element; has numerous plasmodesmatal connections with sieve-tube element	Phloem	Believed to play a role in the delivery of substances to the sieve-tube element, including informational molecules and ATP

**Table 4.2 Summary of Plant Types**

Cell Type		Characteristics	Location	Function
Parenchyma		Living at maturity; usually more or less spherical or elongate in shape; usually has primary cell walls only	Cortex and pith of roots and stems; mesophyll of leaves; xylem and phloem	Site of basic metabolic cell functions
Transfer cell		Living at maturity; modified parenchyma cell containing cell wall ingrowths	Xylem, phloem, secretory structures	Involved in short-distance transport
Collenchyma		Living at maturity; elongate with plastic cell walls.	Leaf petioles, young stems	Support
Sclereid		Dead at maturity; elongate, star-shaped, or stone-shaped with thick, lignified secondary cell walls.	Cortex, pith, mesophyll	Strength
Fiber		Dead at maturity; long, thin cell with thick, lignified secondary cell walls.	Xylem, phloem, cortex	Most important strengthening and supportive cell type
Vessel member		Dead at maturity; lignified secondary cell walls that may be spiral, ringed or pitted; perforation plates in open end walls; members connect together to form vessels.	Xylem	Transport of water and dissolved minerals
Tracheid		Dead at maturity; similar to vessel member, except with narrower diameter and closed pitted ends; do not form vessels	Xylem	Transport water
Sieve-tube member		Living at maturity, but does not retain cell nucleus; elongate cell with aggregates of pores (sieve plates) on end walls and side walls; cells join end to end to form sieve tubes	Phloem	Transport of sugars

**Table 4.2 Summary of Plant Types (continued)**

Cell Type		Characteristics	Location	Function
Sieve cell		Living at maturity; similar to sieve-tube members, but does not develop sieve plates or join to form sieve tubes; found only in ferns and gymnosperms	Phloem in conifers and ferns	Transport of sugars
Companion cell		Living at maturity	Connected to sieve-tube members	Metabolic regulation of sieve-tube members
Albuminous cell		Living at maturity; counterpart to companion cells, found in gymnosperms and ferns	Phloem in conifers and ferns	Metabolic regulation of sieve cells
Guard cells		Living at maturity; occur in pairs separated by a pore to form a stoma	Leaves, young stems	Gas exchange
Epidermal cell		Living at maturity; contains no chlorophyll; outer wall impregnated with cutin	Epidermis	Inhibit evaporation of water
Subsidiary cell		Living at maturity; type of epidermal cell	Occurs in contact with guard cells in epidermis	Regulate guard cell opening
Trichome		Living at maturity; elongated epidermal structure composed of one or more cells	Epidermis	Absorption, secretion, storage, and more
Phellem cell		Dead at maturity; also called cork cell; cell walls impregnated with suberin (a wax)	Outer layers of periderm	Replacement of epidermis in old stems and roots
Phelloderm cell		Most living at maturity	Inner layers of periderm	Replacement of epidermis in old stems and roots
Secretory cell		Living at maturity; several different types; may be solitary or part of a multicellular secretory structure	Most tissues and organs	Secretion of different secretory products