**The Cell: Organelle Diagrams**

**Fig 7-4. A prokaryotic cell.** Lacking a true nucleus and the other membrane-enclosed organelles of the eukaryotic cell, the prokaryotic cell is much simpler in structure. Only organisms of the domains Bacteria and Archaea have prokaryotic cells.

**Fig 7-7. Overview of an animal cell.** This drawing of an animal cell incorporates the most common structures of animal cells (no cell actually looks just like this). The cell has a variety of organelles ("little organs"), many of which are bounded by membranes. The most prominent organelle in an animal cell is usually the nucleus. Most of the cell's metabolic activities occur in the cytoplasm, the entire region between the nucleus and the plasma membrane. The cytoplasm contains many organelles suspended in a semifluid medium, the cytosol. Pervading much of the cytoplasm is a labyrinth of membranes called the endoplasmic reticulum (ER).
**Fig 7-8. Overview of a plant cell.** This drawing of a generalized plant cell reveals the similarities and differences between an animal cell and a plant cell. In addition to most of the features seen in an animal cell, a plant cell has membrane-enclosed organelles called plastids. The most important type of plastid is the chloroplast, which carries out photosynthesis. Many plant cells have a large central vacuole. Outside a plant cell’s plasma membrane is a thick cell wall, perforated by channels called plasmodesmata.

**Fig 7-9. The nucleus and its envelope.** Within the nucleus is chromatin, consisting of DNA and proteins. When a cell prepares to divide, individual chromosomes become visible as the chromatin condenses. The nucleolus functions in ribosome synthesis. The nuclear envelope, which consists of two membranes separated by a narrow space, is perforated with pores and lined by a nuclear lamina.
hormone insulin and digestive enzymes. Bound ribosomes also make proteins destined for insertion into membranes or the interiors of other organelles. Free ribosomes mainly make proteins that remain dissolved in the cytosol. Bound and free ribosomes are identical and can alternate between these two roles. (b) This simplified diagram of a ribosome shows its two subunits.

Fig 7-12. The Golgi apparatus. The Golgi apparatus consists of stacks of flattened sacs, or cisternae, which, unlike ER cisternae, are not physically connected. (The drawing is a cutaway view.) A Golgi stack receives and dispatches transport vesicles and the products they contain. Materials received from the ER are modified and stored in the Golgi and eventually shipped to the cell surface or other destinations. Note the vesicles joining and leaving the cisternae. A Golgi stack has a structural and functional polarity, with a cis face that receives vesicles containing ER products and a trans face that dispatches vesicles (at right, TEM).
**Fig 7-11. Endoplasmic reticulum (ER).** A membranous system of interconnected tubules and flattened sacs called cisternae, the ER is also continuous with the nuclear envelope. (The drawing is a cutaway view.) The membrane of the ER encloses a compartment called the cisternal space. Rough ER, which is studded on its outer surface with ribosomes, can be distinguished from smooth ER in the electron micrograph (TEM).

**Fig 7-16. Review: relationships among organelles of the endomembrane system.** The red arrows show some of the pathways of membrane migration. The nuclear envelope is connected to the rough ER, which is also confluent with smooth ER. Membrane produced by the ER flows in the form of transport vesicles to the Golgi, which in turn pinches off vesicles that give rise to lysosomes and vacuoles. Even the plasma membrane expands by the fusion of vesicles born in the ER and Golgi. Coalescence of vesicles with the plasma membrane also releases secretory proteins and other products to the outside of the cell.
**Fig 7-14. The formation and functions of lysosomes.** The ER and Golgi apparatus generally cooperate in the production of lysosomes containing active hydrolitic enzymes. Lysosomes digest (hydrolyze) materials taken into the cell and recycle materials from intracellular refuse. This figure shows one lysosome fusing with a food vacuole and another engulfing a damaged mitochondrion.

**Fig 7-15. The plant cell vacuole.** The central vacuole is usually the largest compartment in a plant cell, comprising 80% or more of a mature cell. The rest of the cytoplasm is generally confined to a narrow zone between the vacuolar membrane (tonoplast) and the plasma membrane. Functions of the vacuole include storage, waste disposal, protection, and growth (TEM).

**Fig 7-17. The mitochondrion, site of cellular respiration.** The two membranes of the mitochondrion are evident in the drawing and micrograph (TEM). The cristae are infoldings of the inner membrane. The cutaway drawing shows the two compartments bounded by the membranes: the intermembrane
space and the mitochondrial matrix.

Fig 7-18. The chloroplast, site of photosynthesis. Chloroplasts are enclosed by two membranes separated by a narrow intermembrane space that constitutes an outer compartment. The inner membrane encloses a second compartment, containing a fluid called stroma. The stroma surrounds a third compartment, the thylakoid space, delineated by the thylakoid membrane. Thylakoid sacs (thylakoids) are stacked to form structures called grana, which are connected by thin tubules between individual thylakoids (TEM).

Fig 7-19. Peroxisomes. Peroxisomes are roughly spherical and often have a granular or crystalline core that is probably a dense collection of enzyme molecules. This peroxisome is in a leaf cell. Notice its proximity to two chloroplasts and a mitochondrion. These organelles cooperate with peroxisomes in certain metabolic functions (TEM).
**Fig 7-21. Motor molecules and the cytoskeleton.** The microtubules and microfilaments of the cytoskeleton function in motility by interacting with proteins called motor molecules. Motor molecules work by changing their shapes, moving back and forth something like microscopic legs. ATP powers these conformational changes. With each cycle of shape change, the motor molecule releases at its free end and then grips at a site farther along a microtubule or microfilament.

**Fig 7-22. Centrosome containing a pair of centrioles.** An animal cell has a pair of centrioles within its centrosome, the region near the nucleus where the cell’s microtubules are initiated. The centrioles, each about 250 nm (0.25 mm) in diameter, are arranged at right angles to each other, and each is made up of nine sets of three microtubules. The blue portions of the drawing represent nontubulin proteins that connect the microtubule triplets (TEM).
Fig 7-23. A comparison of the beating of flagella and cilia.

Fig 7-24. Ultrastructure of a eukaryotic flagellum or cilium.
Fig 7-27. **Microfilaments and motility.** In the three examples shown in this figure, cell nuclei and most other organelles have been omitted.

Fig 7-28. **Plant cell walls.** Plant cells first construct thin primary walls, often adding stronger secondary walls to the inside of the primary wall when the cell’s growth ceases. A sticky middle lamella cements adjacent cells together. Thus, the multilayered partition between these cells consists of adjoining walls individually secreted by the cells. The walls do not isolate the cells: The cytoplasm of one cell is continuous with the cytoplasm of its neighbors via plasmodesmata, channels through the walls (TEM).
Extracellular matrix (ECM) of an animal cell. The molecular composition and structure of the ECM varies from one cell type to another. In this example, three different types of glycoproteins are present: proteoglycan, collagen, and fibronectin. Collagen fibers are embedded in proteoglycan complexes, which consist of proteoglycan molecules extending like little trees from long polysaccharide molecules. Fibronectin molecules are the adhesive that attaches the ECM to the plasma membrane of the cell, by connecting to membrane proteins called integrins.