Relative volumes of intracellular organelles (hepatocyte)

Compartment	% total volume	number/cell	role in the cell
Cytosol	54%	1	metabolism, transport, protein translation
Mitochondria	22%	1700	energy generation, apoptosis
Rough ER	9%	1*	synthesis of membrane and secreted proteins
Smooth ER, Golgi	6%	1*	protein modification, sorting, catabolism
Nucleus	6%	1	cell regulation, proliferation, DNA transcription
Endosomes	1%	200	intracellular transport and export, ingestion of extracellular substances
Lysosomes	1%	300	cellular catabolism
Peroxisomes	1%	400	very long-chain fatty acid metabolism

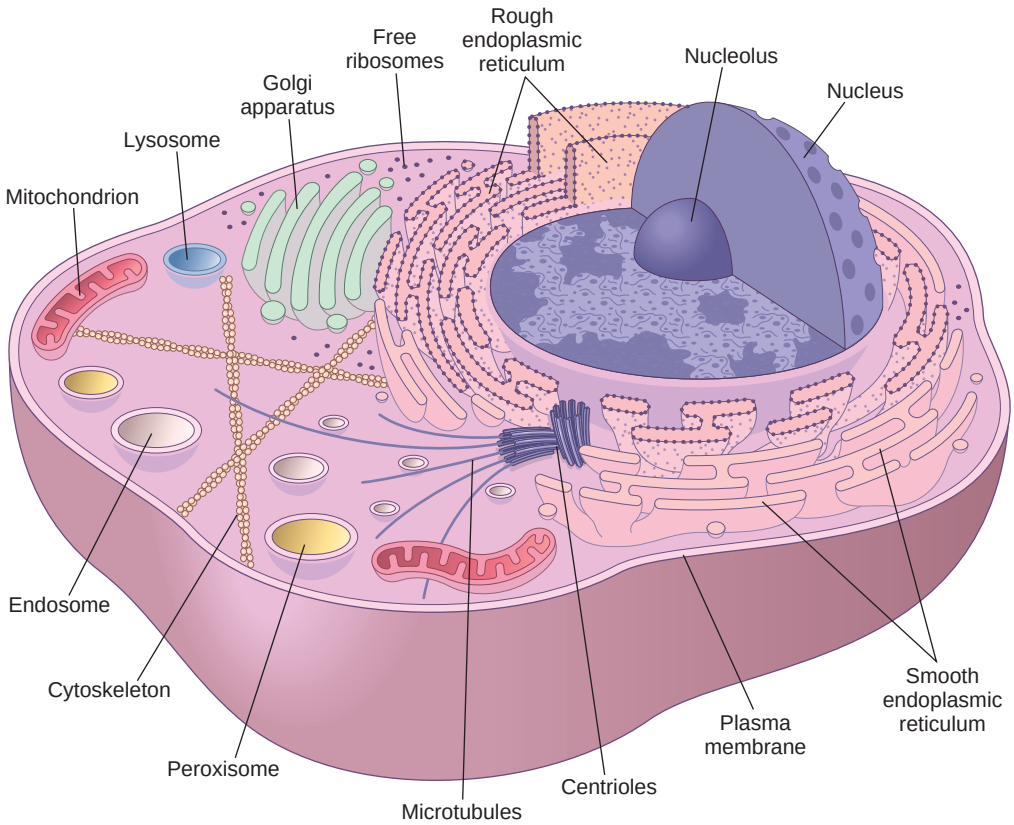

Figure 1-5 Basic subcellular constituents of cells. The table presents the number of the various organelles within a typical hepatocyte, as well as their volume within the cell. The figure shows geographic relationships but is not intended to be accurate to scale. (Adapted from Weibel ER, Stäubli W, Gnägi HR, et al: Correlated morphometric and biochemical studies on the liver cell. I. Morphometric model, stereologic methods, and normal morphometric data for rat liver. J Cell Biol 42:68, 1969.)

Plasma Membrane: Protection and Nutrient Acquisition

Plasma membranes (and all other organellar membranes) are more than just static lipid sheaths. Rather, they are fluid bilayers of amphipathic phospholipids with hydrophilic head groups that face the aqueous environment and hydrophobic lipid tails that interact with each other to form a barrier to passive diffusion of large or charged molecules (Fig. 1-6). The bilayer is composed of a heterogeneous collection of different phospholipids, which are distributed asymmetrically—for example, certain membrane lipids preferentially associate with extracellular or cytosolic faces. Proper organization of phospholipids is important for cell health, as specific phospholipids interact with particular membrane proteins, influencing their distribution and function. In addition, asymmetric partitioning of phospholipids is important in several other cellular processes, as follows:

- *Phosphatidylinositol* on the inner membrane leaflet can be phosphorylated, serving as an electrostatic scaffold for intracellular proteins; alternatively, polyphosphoinositides can be hydrolyzed by phospholipase C to generate intracellular second signals like diacylglycerol and inositol trisphosphate.
- *Phosphatidylserine* is normally restricted to the inner face where it confers a negative charge involved in electrostatic protein interactions; however, when it flips to the extracellular face, which happens in cells undergoing apoptosis (programmed cell death), it becomes an "eat me" signal for phagocytes. In the special case of platelets, it serves as a cofactor in the clotting of blood.
- *Glycolipids* and *sphingomyelin* are preferentially expressed on the extracellular face; glycolipids (and particularly gangliosides, with complex sugar linkages and terminal sialic acids that confer negative charges) are important in cell-cell and cell-matrix interactions,