

FIGURE 16-30

Carbohydrate digestion and absorption

1 The dietary polysaccharides starch and glycogen are converted into the disaccharide maltose through the action of salivary and pancreatic amylase. 2 Maltose and the dietary disaccharides lactose and sucrose are converted to their respective monosaccharides by the disaccharidases (maltase, lactase, and sucrase) located in the brush borders of the small intestine epithelial cells. 3 The monosaccharides glucose and galactose are absorbed into the interior of the cell and eventually enter the blood by means of Na⁺- and energy-dependent secondary active transport. 4 The monosaccharide fructose is absorbed into the blood by passive facilitated diffusion.

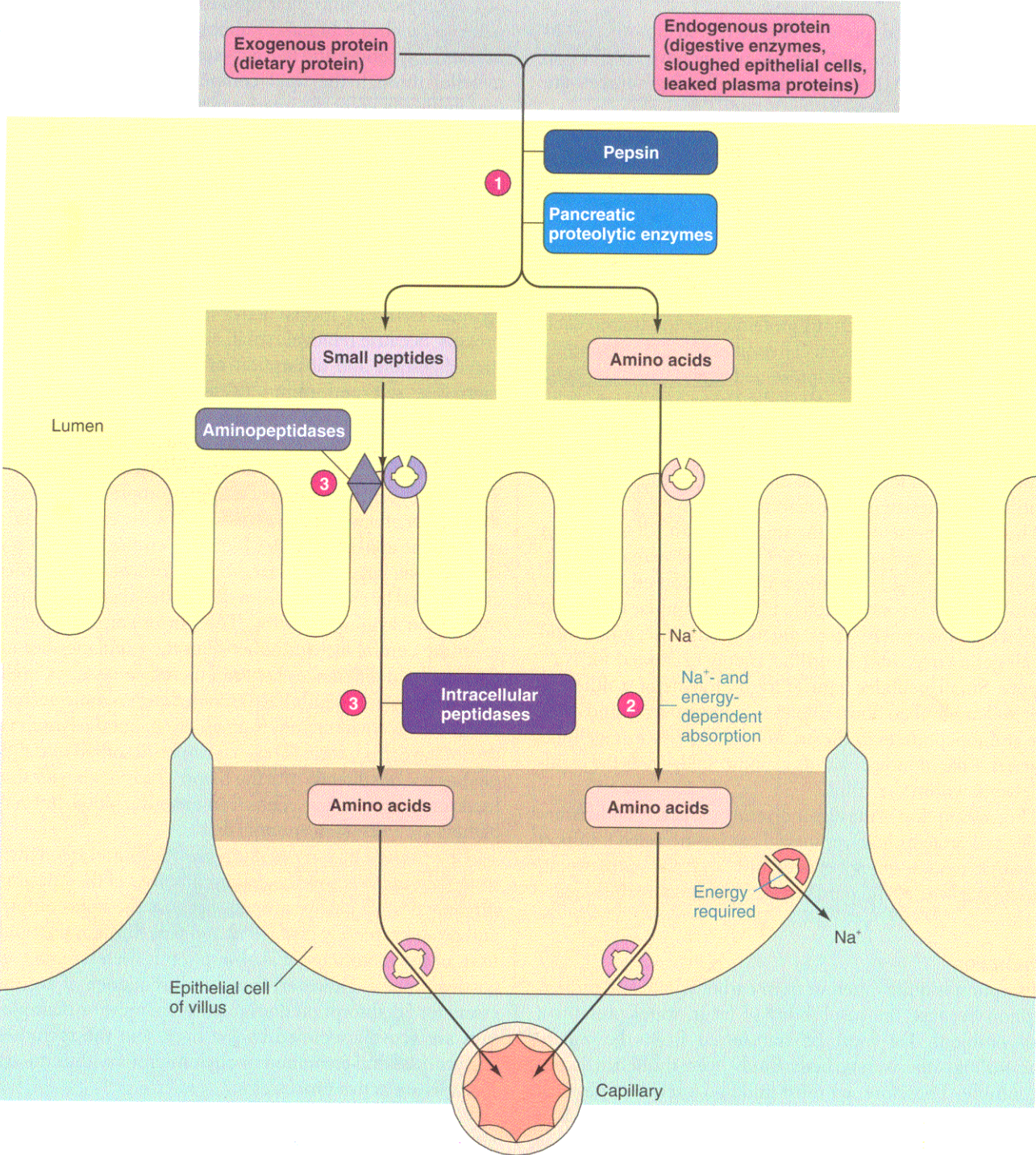


FIGURE 16-31

Protein digestion and absorption

1 Dietary and endogenous proteins are hydrolyzed to their constituent amino acids and a few small peptide fragments by gastric pepsin and the pancreatic proteolytic enzymes. 2 Amino acids are absorbed into the small intestine epithelial cells and eventually enter the blood by means of Na⁺- and energy-dependent secondary active transport. Various amino acids are transported by carriers specific for them. 3 The small peptides, which are absorbed by a different type of carrier, are broken down into their amino acids by aminopeptidases in the epithelial cells' brush borders or by intracellular peptidases.

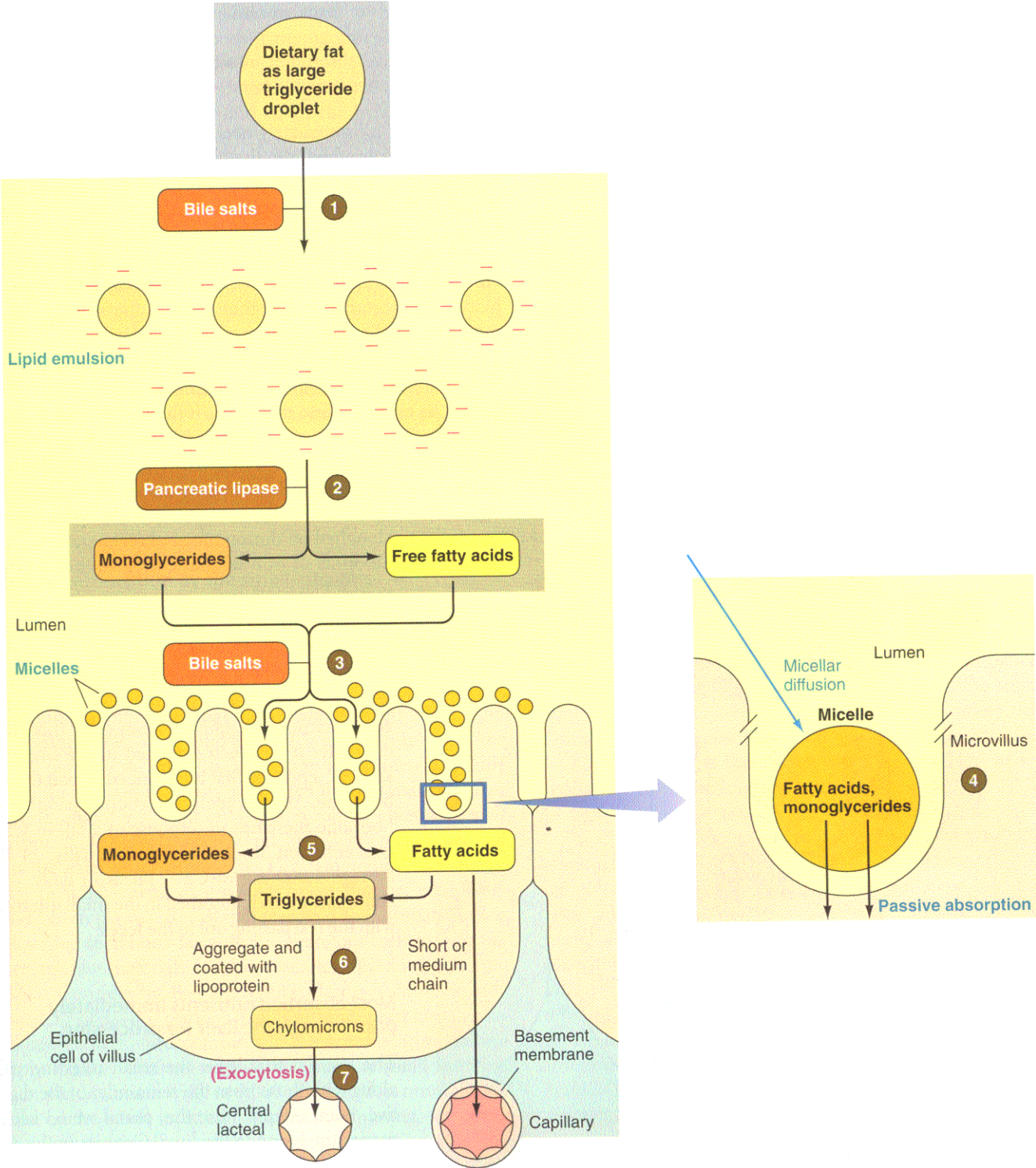


FIGURE 16-32
Fat digestion and absorption

Because fat is not soluble in water, it must undergo a series of transformations in order to be digested and absorbed. **1** Dietary fat in the form of large fat globules composed of triglycerides is emulsified by the detergent action of bile salts into a suspension of smaller fat droplets. This lipid emulsion prevents the fat droplets from coalescing and thereby increases the surface area available for attack by pancreatic lipase. **2** Lipase hydrolyzes triglycerides into monoglycerides and free fatty acids. **3** These water-insoluble products are carried in the interior of water-soluble micelles, which are formed by bile salts and other bile constituents, to the luminal surface of the small intestine epithelial cells. **4** When a micelle approaches the absorptive epithelial surface, the monoglycerides and fatty acids leave the micelle and passively diffuse through the lipid bilayer of the luminal membranes. **5** The monoglycerides and free fatty acids are resynthesized into triglycerides inside the epithelial cells. **6** These triglycerides aggregate and are coated with a layer of lipoprotein to form water-soluble chylomicrons, which are extruded through the basal membrane of the cells by exocytosis. **7** Chylomicrons are unable to cross the basement membrane of blood capillaries, so instead they enter the lymphatic vessels, the central lacteals.

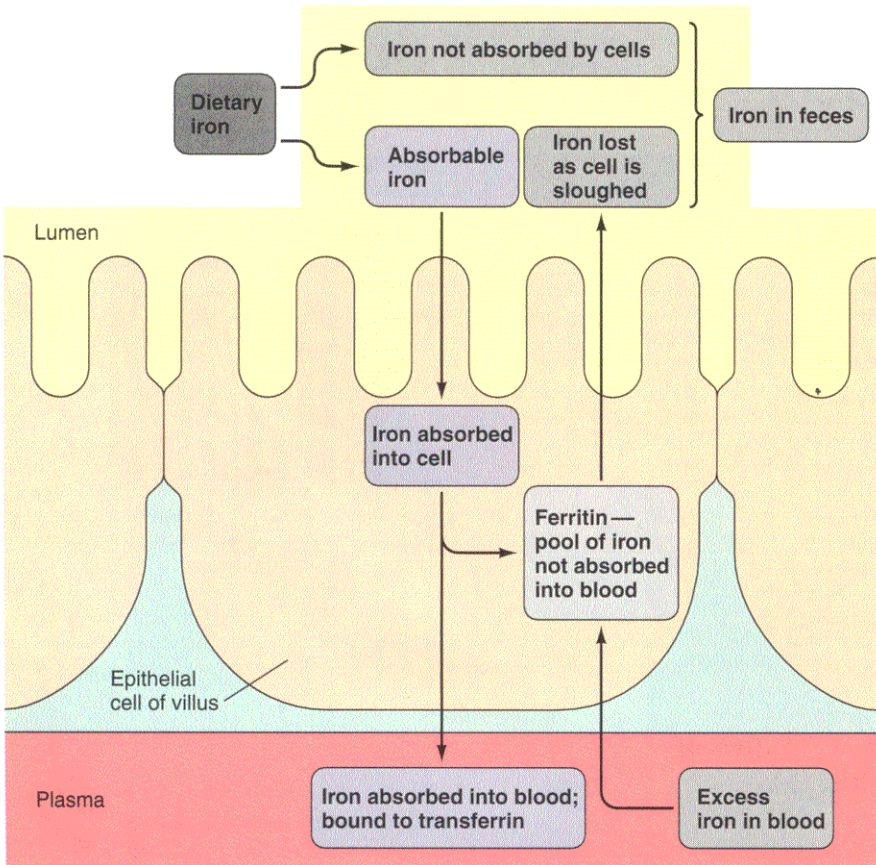


FIGURE 16-33