

24.1: Digestion of Triacylglycerols

Learning Objectives

- Describe the process of digestion of lipids and their transport into the bloodstream.

Lipid digestion begins in the upper portion of the small intestine. A hormone secreted in this region stimulates the gallbladder to discharge bile into the duodenum. The principal constituents of **bile** are the bile salts, which emulsify large, water-insoluble lipid droplets, disrupting some of the hydrophobic interactions holding the lipid molecules together and suspending the resulting smaller globules (micelles) in the aqueous digestive medium. These changes greatly increase the surface area of the lipid particles, allowing for more intimate contact with the lipases and thus rapid digestion of the fats. Another hormone promotes the secretion of pancreatic juice, which contains these enzymes.

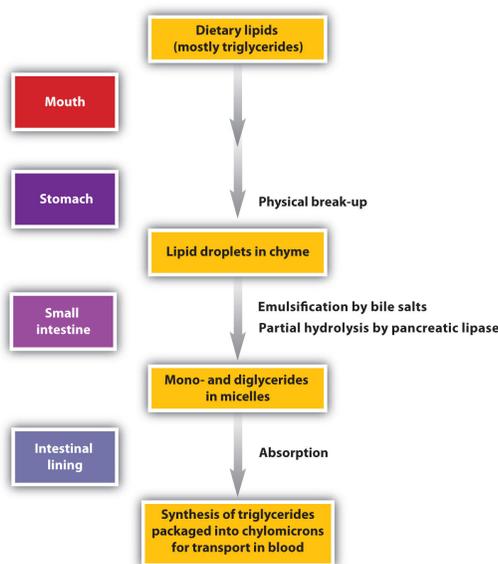


Figure 24.1.1: The Principal Events and Sites of Lipid (Primarily Triglyceride) Digestion

The lipases in pancreatic juice catalyze the digestion of triglycerides first to diglycerides and then to 2-monoglycerides and fatty acids:

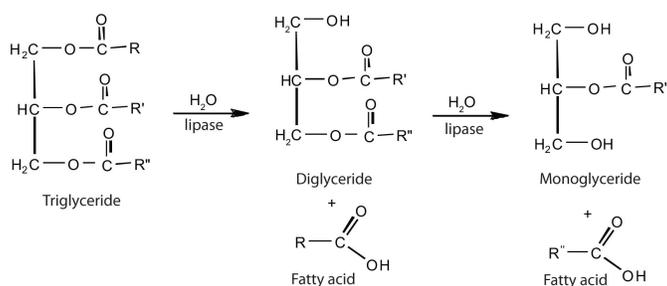


Figure 24.1.2: Digestion of triglycerides.

The large and hydrophobic long-chain fatty acids and monoacylglycerides are not so easily suspended in the watery intestinal chyme. However, bile salts and lecithin resolve this issue by enclosing them in a **micelle**, which is a tiny sphere with polar (hydrophilic) ends facing the watery environment and hydrophobic tails turned to the interior, creating a receptive environment for the long-chain fatty acids. The core also includes cholesterol and fat-soluble vitamins. Without micelles, lipids would sit on the surface of chyme and never come in contact with the absorptive surfaces of the epithelial cells. Micelles can easily squeeze between microvilli and get very near the luminal cell surface. At this point, lipid substances exit the micelle and are absorbed via simple diffusion.

The free fatty acids and monoacylglycerides that enter the epithelial cells are reincorporated into triglycerides. The triglycerides are mixed with phospholipids and cholesterol, and surrounded with a protein coat. This new complex, called a **chylomicron**, (see Figure 24.1.3), is a water-soluble lipoprotein.

 File:2512 Chylomicrons Contain Triglycerides Cholesterol Molecules and Other Lipids.jpg

Figure 24.1.3: Lipoproteins (chylomicrons) package triacylglycerols and cholesterol for transport to cells.

After being processed by the Golgi apparatus, chylomicrons are released from the cell. Too big to pass through the basement membranes of blood capillaries, chylomicrons instead enter the large pores of lacteals. The lacteals come together to form the lymphatic vessels. The chylomicrons are transported in the lymphatic vessels and empty through the thoracic duct into the circulatory system (Figure 24.1.4).

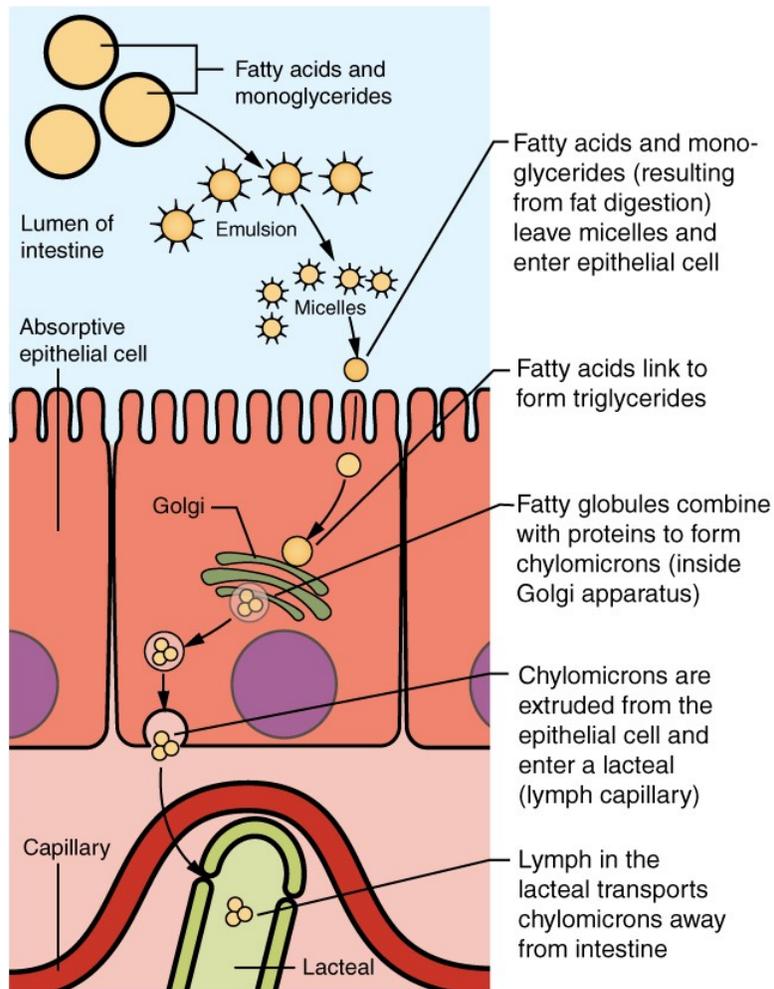


Figure 24.1.4: Pathways of Lipids

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