



CHAPTER 16

LIPIDS

Along with proteins, carbohydrates, and nucleic acids, lipids form one of the major classes of organic compounds in biochemistry. Lipids play important roles in living systems, from their presence in cell membranes to their action as sex hormones. This chapter will describe various types of lipids, as well as examine how simple starting materials are converted by living organisms into complex terpenes.

16.1 CLASSIFICATION OF LIPIDS

Lipids are naturally occurring substances that are soluble in nonpolar solvents. This is an operational, rather than a structural, distinction. Samples of material from a natural source are shaken with a polar solvent (water or an alcohol–water mixture) and a relatively nonpolar one (diethyl ether, hexane, or dichloromethane). Carbohydrates, proteins, nucleic acids, and related compounds are polar and do not dissolve in the nonpolar solvent—they either dissolve in the polar aqueous phase or remain behind undissolved. The portion of the natural material that dissolves in the nonpolar solvent is the **lipid fraction**.

The various classes of compounds that make up the lipid fraction will be discussed in the sections which follow. One class of lipids, the prostaglandins, was the subject of the boxed essay in Chapter 12 (Section 12.3).

16.2 FATS, OILS, AND FATTY ACIDS

Fats are one type of lipid. They have a number of functions in living systems, including that of energy storage. Although carbohydrates serve as a source of readily available energy, an equal weight of fat delivers over twice the amount of energy. It is more

CHAPTER OUTLINE

- 16.1 Classification of Lipids
- 16.2 Fats, Oils, and Fatty Acids
- 16.3 Phospholipids
- 16.4 Waxes
- 16.5 Steroids: Cholesterol
- 16.6 Vitamin D
 - “Good” Cholesterol?
 - “Bad” Cholesterol? What’s the Difference?
- 16.7 Bile Acids
- 16.8 Corticosteroids
- 16.9 Sex Hormones
- 16.10 Carotenoids
 - Anabolic Steroids
- 16.11 Biosynthesis: Acetyl Coenzyme A
- 16.12 Terpene Biosynthesis: The Isoprene Rule
- 16.13 Isopentenyl Pyrophosphate: The Biological Isoprene Unit
- 16.14 Carbon–Carbon Bond Formation in Terpene Biosynthesis
 - Learning Objectives
- 16.15 Summary
 - Additional Problems