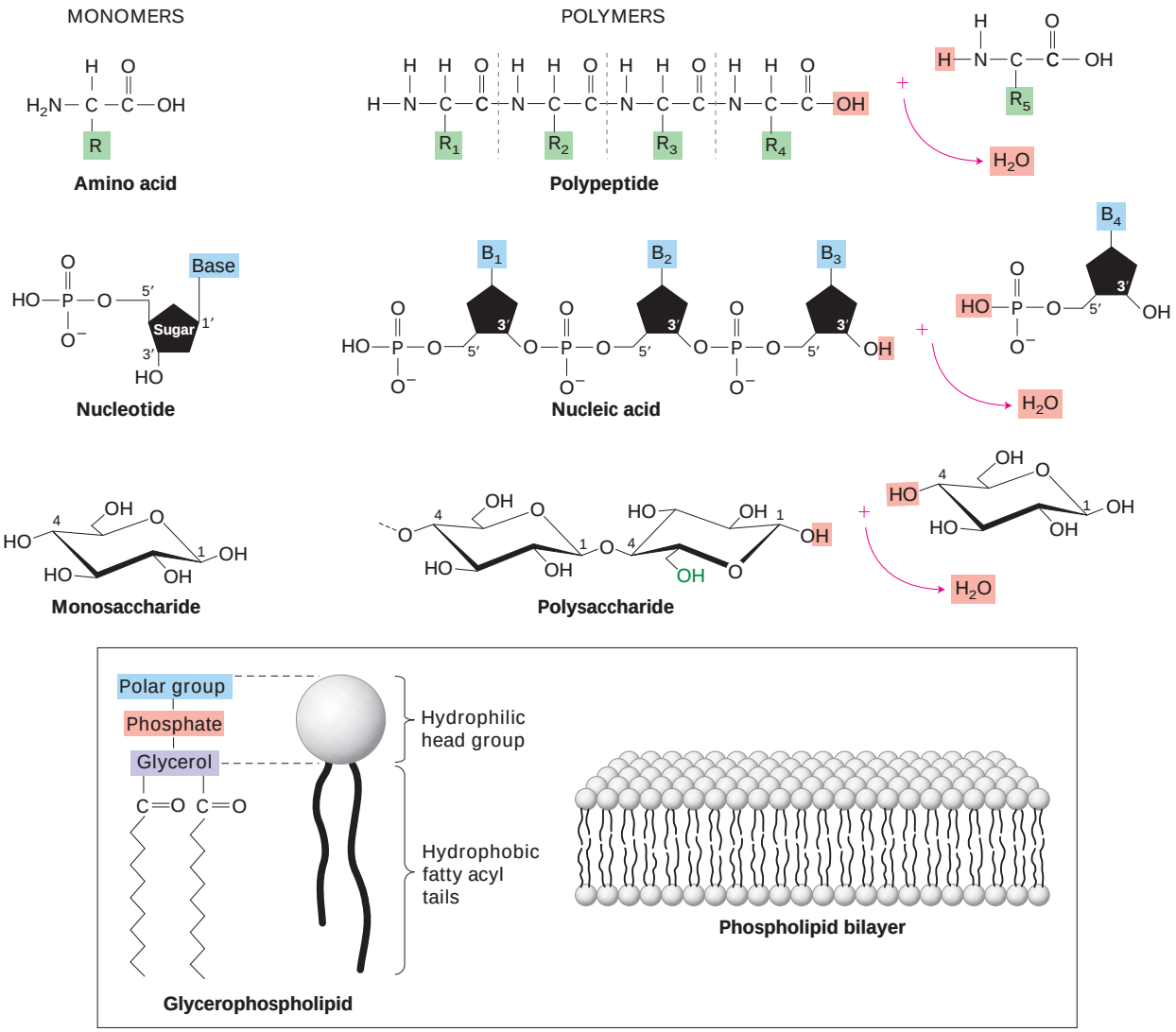
- In an aqueous environment, nonpolar molecules or nonpolar portions of larger molecules are driven together by the hydrophobic effect, thereby reducing the extent of their direct contact with water molecules (see Figure 2-9).
- Molecular complementarity is the lock-and-key fit between molecules whose shapes, charges, and other physical properties are complementary. Multiple noncovalent interactions can form between complementary molecules, causing them to bind tightly (see Figure 2-10), but not between molecules that are not complementary.
- The high degree of binding specificity that results from molecular complementarity is one of the features that distinguish biochemistry from typical solution chemistry.

2.2 Chemical Building Blocks of Cells

The three most abundant biological macromolecules—**proteins, nucleic acids,** and **polysaccharides**—are all **polymers** composed of multiple covalently linked identical or nearly identical small molecules, or **monomers** (Figure 2-11). The covalent bonds between monomer molecules usually are formed by **dehydration reactions** in which a water molecule is lost:

$$H{-}X_1{-}OH + H{-}X_2{-}OH \rightarrow H{-}X_1{-}X_2{-}OH + H_2O$$

Proteins are linear polymers containing ten to several thousand amino acids linked by **peptide bonds.** Nucleic acids



▲ FIGURE 2-11 **Covalent and noncovalent linkage of monomers to form biopolymers and membranes.** Overview of the cell's chemical building blocks and the macrostructures formed from them. (*Top*) The three major types of biological macromolecules are each assembled by the polymerization of multiple small molecules (monomers) of a particular type: proteins from amino acids (Chapter 3), nucleic acids from nucleotides (Chapter 4), and polysaccharides from monosaccharides (sugars). The monomers are covalently linked into polymers by coupled reactions whose net result is condensation through the dehydration reaction shown. (*Bottom*) In contrast, phospholipid monomers noncovalently assemble into bilayer structure, which forms the basis of all cellular membranes (Chapter 5).