Further processing of PGH_2 then leads to other eicosanoids. PGE_2, for instance, arises by an isomerization of PGH_2 catalyzed by PGE synthase (PGES). The coenzyme glutathione is needed for enzyme activity, although it is not chemically changed during the isomerization and its role is not fully understood. One possibility is that the glutathione thiolate anion breaks the O–O bond in PGH_2 by an S_N2-like attack on one of the oxygen atoms, giving a thioperoxy intermediate (R—S—O—R′) that eliminates glutathione to give the ketone (Figure 27.5).

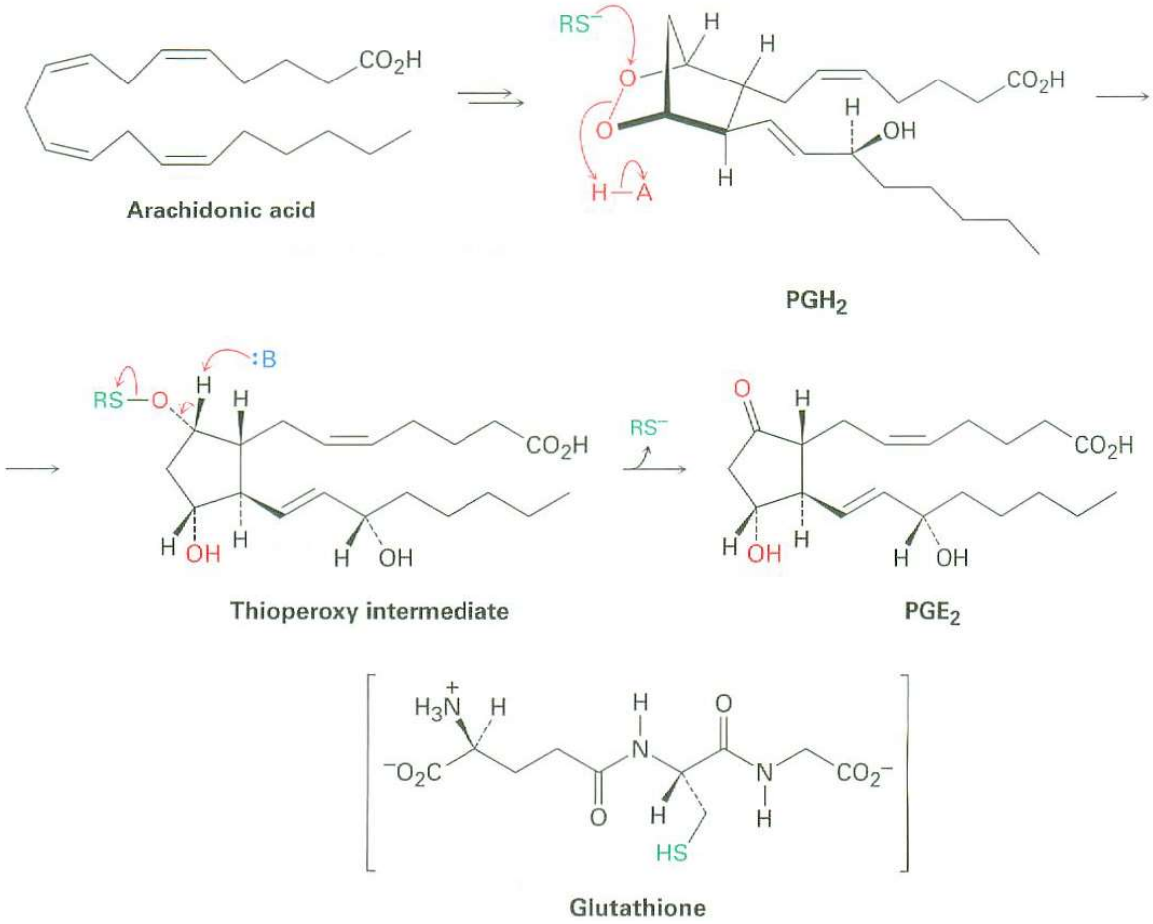


Figure 27.5 Mechanism of the conversion of PGH_2 into PGE_2.

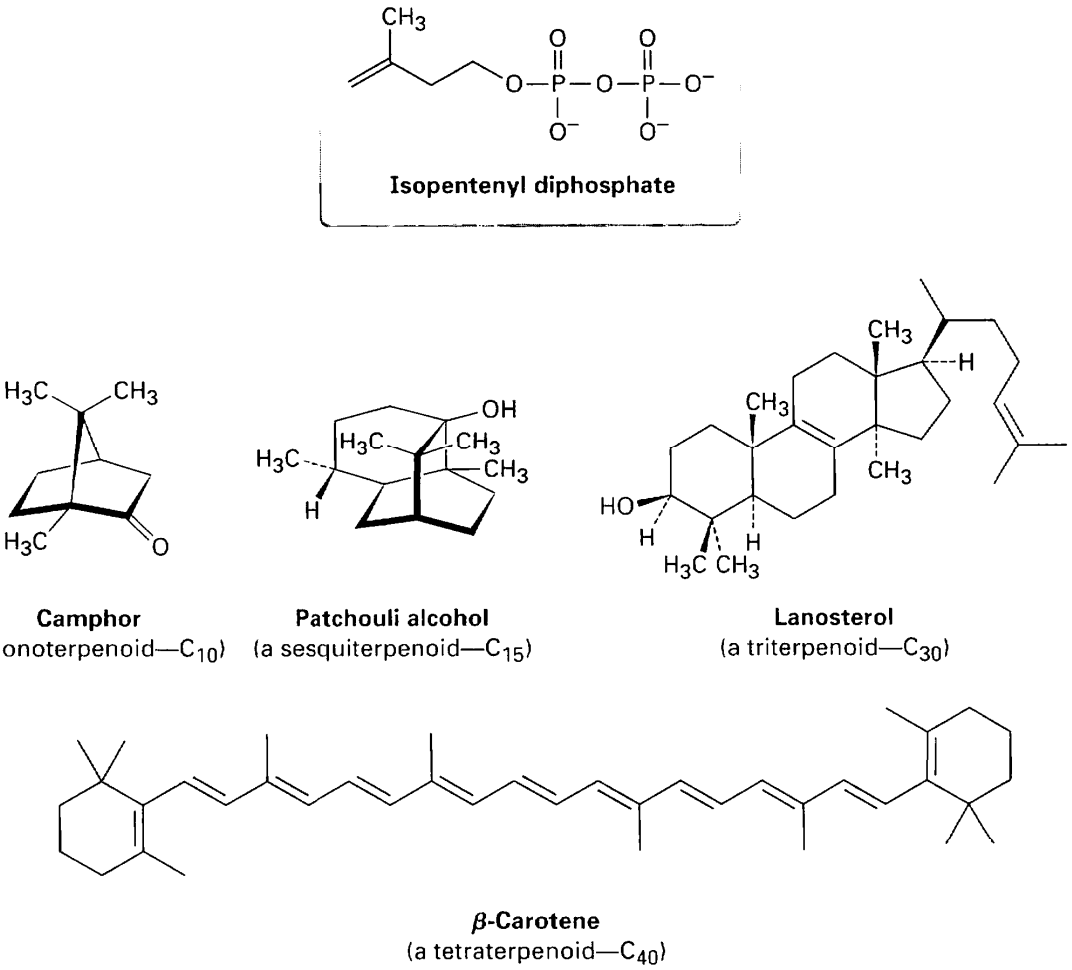
Problem 27.5 Assign *R* or *S* configuration to each chirality center in prostaglandin E_2 (Figure 27.5), the most abundant and biologically potent of mammalian prostaglandins.

27.5 Terpenoids

In the Chapter 6 *Focus On*, "Terpenes: Naturally Occurring Alkenes," we looked briefly at **terpenoids**, a vast and diverse group of lipids found in all living organisms. Despite their apparent structural differences, all terpenoids are related. All contain a multiple of five carbons and are derived biosynthetically from the five-carbon precursor isopentenyl diphosphate (Figure 27.6). Note that formally, a

terpenoid contains oxygen, while a *terpene* is a hydrocarbon. For simplicity, we'll use the term *terpenoid* to refer to both.

Figure 27.6 Structures of some representative terpenoids.



Terpenoids are classified according to the number of five-carbon multiples they contain. *Monoterpenoids* contain 10 carbons and are derived from two isopentenyl diphosphates, *sesquiterpenoids* contain 15 carbons and are derived from three isopentenyl diphosphates, *diterpenoids* contain 20 carbons and are derived from four isopentenyl diphosphates, and so on, up to triterpenoids (C_{30}) and tetraterpenoids (C_{40}). Monoterpenoids and sesquiterpenoids are found primarily in plants, bacteria, and fungi, but the higher terpenoids occur in both plants and animals. The triterpenoid lanosterol, for example, is the precursor from which steroid hormones are made, and the tetraterpenoid β-carotene is a dietary source of vitamin A (Figure 27.6).

The terpenoid precursor isopentenyl diphosphate, formerly called isopentenyl pyrophosphate and abbreviated IPP, is biosynthesized by two different pathways depending on the organism and the structure of the final product. In animals and higher plants, sesquiterpenoids and triterpenoids arise primarily from the *mevalonate* pathway, whereas monoterpenoids, diterpenoids, and tetraterpenoids are biosynthesized by the *1-deoxyxylulose 5-phosphate (DXP)* pathway. In bacteria,