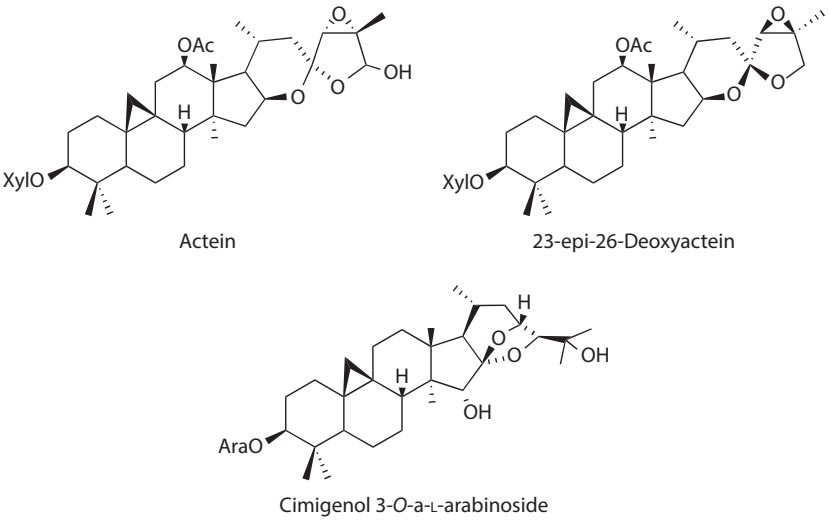

FIGURE 7.2 Some common triterpenoid constituents of black cohosh.

antimalarial activity. Owing to the development of resistance to synthetic antimalarial drugs, artemisinin has become an effective alternative therapy. The yield of artemisinin in *A. annua* is relatively low making its commercial production an expensive process. Considering that the majority of people suffering from malaria live in underdeveloped regions of the world, a practical and cost-effective method for the production of artemisinin is highly desirable. This situation is a prime example of what has become known as the "supply issue" for the practical production of natural products. The issue is focused on the difficulty of producing commercial quantities of complex natural products.

Herbal remedies continue to play a significant role in human medicine. Chemical investigations have identified many of the active principles in many commonly used products. These products are often sold as dietary supplements rather than ethical pharmaceutical products. Because these products are complex mixtures of many natural products, there is a need to establish criteria for their standardization. This situation is complicated by the natural variation in secondary metabolites produced by closely related species of medicinal plants. Owing to the possibility that variations in the composition of the products will result in unpredictable potency, the herbal products industry has been developing quality control standards. Black cohosh, for example, which is taken for the relief of menopausal symptoms, has a number of signature triterpenoid constituents, including actein, 23-*epi*-26-deoxyactein, and cimigenol-3-*O*-arabinoside (Figure 7.2). These compounds can be identified by coupled high-performance liquid chromatography—mass spectrometry (LC/MS), in comparison with authentic reference compounds. Our ability to quantify the amount of the key constituents in these herbal products will facilitate a better understanding of their efficacy and permit greater confidence in their use in medicine.

7.3 ANTIBIOTICS

The development of antibiotics for the treatment of bacterial infections, which was critical during the war years of the early 1940s, changed the course of drug discovery efforts in the pharmaceutical industry. Following the pioneering experiments of Selman Waksman at Rutgers University on soil actinomycetes, pharmaceutical companies began the systematic evaluation of antibiotics produced by bacteria isolated from the soil. During the succeeding quarter century, often referred to as the "Golden Age" of antibiotic discovery, all of the major classes of life-saving antibiotics were found.