



FIGURE 7.3 Additional examples of antibiotics found during the “Golden Age of Antibiotics Discovery.”

The previously illustrated penicillin, vancomycin, tetracycline, and erythromycin represent the progenitors of the most important classes of antibacterial agents still in use today. Other examples of these wonderfully complex compounds are illustrated in Figure 7.3. Streptomycin, isolated by Waksman from *Streptomyces griseus*, was the first of the class of aminoglycoside antibiotics to be introduced into therapy. Chloramphenicol, rifamycin, and amphotericin were also discovered during this time and each has a valuable niche in modern chemotherapy.

In addition to antibiotics used for the treatment of microbial diseases, microbial products have been explored for a number of other therapeutic uses. Owing to the relative ease with which new organisms could be isolated from the environment and grown in culture, these provided versatile sources of new chemistry. Beginning in the 1960s these sources were employed for screening against other diseases, such as parasitic and fungal infections, as well as for the ability to differentially kill cancer cells. Notable among the antiparasitic compounds discovered in this way are the milbemycins. These polyketide-derived macrolides, produced by *Streptomyces* species, are exceptionally effective against several types of parasites that infect livestock. Compounds in the milbemycin class, e.g., ivermectin and moxidectin (Figure 7.4) have also found utility against the devastating human disease of river blindness caused by filarial worms, which is endemic to sub-Saharan Africa, and other tropical areas of the world.

Actinomycete-derived antibiotics with efficacy as anticancer agents have also been a major focus of screening programs (see Figure 7.5). Waksman once again discovered the first of these, actinomycin D, from *Streptomyces parvullus*. Today, actinomycin has quite a limited use, but it served as a prototype for the discovery of other antitumor antibiotics. Doxorubicin, which interacts similarly with DNA, was isolated in the 1960s and remains an important component of typical chemotherapy regimes. Another early discovery from the Golden Age that remains in use today for chemotherapy is bleomycin. Bleomycin is a complex glycopeptide antibiotic produced by *S. verticillus* that induces DNA damage through oxidative reactions.