Additional challenges also exist in areas once thought to have been conquered by modern science. In the 1960s and 1970s, for example, it was widely believed that modern medicine had all but conquered infectious disease and that the major classes of antibacterial agents, β-lactams, quinolone, tetracyclines, and macrolide antibiotics (Figure 1.4) would provide all

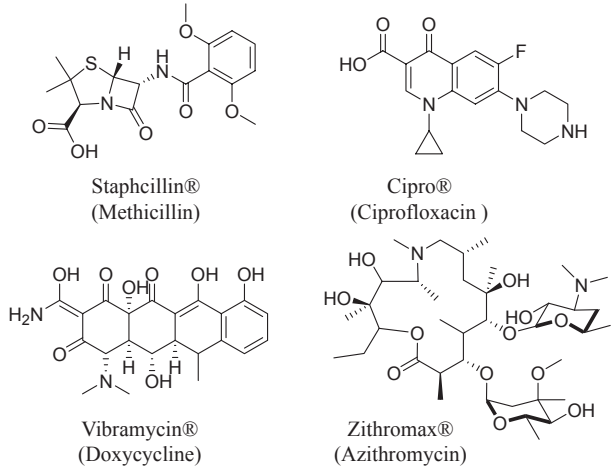

FIGURE 1.4 Staphcillin® (Methicillin), Cipro® (Ciprofloxacin), Vibramycin® (Doxycycline), and Zithromax® (Azithromycin) are representative examples of β-lactam, quinolone, tetracycline, and macrolide antibiotics respectively.

of the tools necessary to protect humanity. The rise of methicillin-resistant *Staphylococcus aureus* (MRSA) in the 1980s and 1990s, however, has made it clear that additional tools will be required in order to maintain the upper hand in the war against bacterial infection. Methicillin (Staphcillin®) was introduced in 1959 as a means of treating penicillin-resistant infections, but less than two years later, resistant strains were identified in European hospitals. By the 1980s, MRSA had spread throughout the globe, and as of 2009, MRSA infections cost the US health system $3 billion to $4 billion annually.[33]

There is no doubt that the discovery of new therapeutic agents has a positive impact on society, but to the casual observer, it is not clear how this goal is achieved. On the surface, providing a drug necessary to solve a medical problem would seem to be a relatively simple task; identify the cause of the disease or malady and design a drug that will fix or eliminate the problem. In the case of infectious disease, eliminate the infectious agent, whether bacterial or viral, and the health problem is solved. This is, of course, a very simplistic view, as there are many factors to consider beyond killing the offending organism. There are millions of compounds that will kill an infectious organism, but how many of these compounds can do so without negatively impacting the host? How many of the remaining compounds