discuss in this chapter "nontraditional approaches" to antimicrobial therapies. These therapies such as antibodies, immunomodulators, phages, essential oils, and microbiome-based therapy are less susceptible to generate resistance than traditional antibiotics treatment.

19.2 Antibodies

In spite of a considerable number of antibiotics available to treat bacterial infections, antibodies have been shown as ineffective in the fight against resistant microorganisms, especially in immunocompromised patients. With the increased microbial resistance, the pharmaceutical industry has reduced investments in development of new antibiotics. One of the alternatives to the use of antibiotics is antibodies, which regulate or induce a humoral immune response, which are promising in the fight against bacterial infections in immunocompromised subjects or in cases where there are no effective drugs. The use of passive immunotherapy, which utilizes monoclonal antibodies (mAbs), has been proposed as an alternative to the use of antibiotics against multidrug-resistant strains. mAbs may bind directly to the target antigen, acting as an opsonizing agent or neutralizing toxins and virulence factors.

19.2.1 Raxibacumab Versus *Bacillus anthracis*

Bacillus anthracis is an endospore-forming bacterium, being deemed a highly lethal bioterrorism threat. Although antibiotics can be used to effectively treat bacteremia, mortality of inhalational anthrax ranges from 45 to 80%, mainly due to pathogenesis caused by exotoxin. The anthrax toxin is a tripartite toxin containing enzyme and binding portions called (i) lethal factor (LF) and (ii) edema factor (EF). The protective antigen (PA) is the gatekeeper portion that binds to cell receptors and, therefore, binds and translocates LF and EF within the cell.

In December 2012, the Food and Drug Administration (FDA) approved raxibacumab to treat infections caused by *B. anthracis*, which is a human IgG1γ MAb produced by recombinant DNA technology in a murine cell expression system that has the ability to bind to the PA component of *B. anthracis* toxin. Raxibacumab has a molecular weight of about 146 kDa, with an equilibrium dissociation constant (Kd) of 2.78 ± 0.9 nM. For the treatment of inhalation anthrax, the antibody should be used in combination with appropriate antibacterial drugs and it is indicated for anthrax prophylaxis when alternative therapies are not available or are not appropriate.

19.2.1.1 Treatment and Mechanism of Action

Raxibacumab inhibits PA binding to its cell receptors, preventing intracellular entry of anthrax LF and EF, the enzyme toxin components responsible for pathogenic effects of anthrax toxin. This mechanism of action has no direct