

**CHAPTER 19**  
**ANTIBIOTICS AND**  
**ANTIMICROBIAL DRUGS**

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**SOURCE OF ANITBIOTICS**

- ◆ Penicillin was discovered accidentally
- ◆ There have been few major discoveries of new natural antibiotics since 2000
- ◆ Many microorganisms produce toxic substances as part of their survival mechanisms and have developed methods to protect themselves from the antibiotics they produce

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**ANTIBIOTIC SPECTRA**

- ◆ Antibiotics are classified by their spectra of reactivity, either broad or narrow and their effect, cidal or static
- ◆ Penicillin is composed of a core ring structure known as the  $\beta$ -lactam ring

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### ANTIBIOTIC SPECTRA

- ◆ Natural penicillin is found in two forms, G and V, which both have a narrow spectrum of activity
- ◆ Modification or addition of side chains to the core structure of naturally occurring antibiotics can increase their effect and their spectrum of activity

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### ANTIBIOTIC TARGETS

- ◆ Antibiotics must satisfy the criterion of selective toxicity: they must react against bacteria but not against the host
- ◆ Most antibiotics have dose dependant activity and toxicities
- ◆ There are five targets for antibiotics: the bacterial cell wall, the bacterial plasma membrane, protein synthesis, metabolic inhibition, and nucleic acids

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### ANTIBIOTIC TARGETS

- ◆ The bacterial cell wall is the most easily selectively toxic because human cells do not have a cell wall
- ◆ Nucleic acids and the plasma membrane are the least selectively toxic targets because they are very similar in bacteria and in host cells

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### ANTIVIRAL DRUGS

- ◆ Viruses present problems for therapy because they are obligate intracellular microbes and once inside the host cell, selective toxicity is hard to achieve
- ◆ Potential targets for antiviral drugs are specific viral proteins, which are selected based on knowledge of viral life cycles

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### ANTIVIRAL DRUGS

- ◆ Many currently available antiviral drugs target viral DNA polymerases, including reverse transcriptase, and viral proteases
- ◆ Viral entry and uncoating are also potential targets

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### ANTIFUNGAL DRUGS

- ◆ Fungal infections have become more prevalent since the appearance of immunocompromised individuals, especially caused by HIV infection
- ◆ Because fungi and host cells are eukaryotes, selective toxicity is hard to achieve and side effects of antifungal drugs can be serious
- ◆ Targets for antifungals are ergosterol in the fungal cell membrane, and the fungal cell wall, neither of which are present in animal cells

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### DRUGS FOR PARASITIC INFECTIONS

- ◆ Drugs that are useful against parasitic protozoans and helminths have been slow to be developed because diseases caused by these organisms do not often occur in developed countries
- ◆ Selective toxicity is hard to achieve because parasites are eukaryotes, like humans; many antiparasitic drugs have serious side effects

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### DRUGS FOR PARASITIC INFECTIONS

- ◆ There are several antimalarial drugs based on quinine, but they have similar resistance issues to antibiotics
- ◆ Metronidazole is one of the most widely used anti-protozoan drugs and is also used as an antibiotic; it has good selective toxicity
- ◆ Ivermectin is used to treat several types of intestinal worm infection

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