A scientist discovers that a soil bacterium he has been studying produces an antimicrobial that kills gram-negative bacteria. She isolates and purifies the antimicrobial compound, then chemically converts a chemical side chain to a hydroxyl group. When she tests the antimicrobial properties of this new version, she finds that this antimicrobial drug can now also kill gram-positive bacteria. The new antimicrobial drug with broad-spectrum activity is considered to be which of the following?

A. resistant  
B. semisynthetic  
C. synthetic  
D. natural

Which of the following antimicrobial drugs is synthetic?

A. sulfanilamide  
B. penicillin
Fill in the Blank

The group of soil bacteria known for their ability to produce a wide variety of antimicrobials is called the ________.

actinomycetes

Short Answer

Where do antimicrobials come from naturally? Why?

Why was Salvarsan considered to be a “magic bullet” for the treatment of syphilis?

Critical Thinking

In nature, why do antimicrobial-producing microbes commonly also have antimicrobial resistance genes?

14.2: Antibacterial Drugs

Multiple Choice

Which of the following combinations would most likely contribute to the development of a superinfection?

A. long-term use of narrow-spectrum antimicrobials
B. long-term use of broad-spectrum antimicrobials
C. short-term use of narrow-spectrum antimicrobials
D. short-term use of broad-spectrum antimicrobials

B

Which of the following routes of administration would be appropriate and convenient for home administration of an antimicrobial to treat a systemic infection?

A. oral
B. intravenous
C. topical
Which clinical situation would be appropriate for treatment with a narrow-spectrum antimicrobial drug?

A. treatment of a polymicrobial mixed infection in the intestine  
B. prophylaxis against infection after a surgical procedure  
C. treatment of strep throat caused by culture identified *Streptococcus pyogenes*  
D. empiric therapy of pneumonia while waiting for culture results

---

**Fill in the Blank**

The bacterium known for causing pseudomembranous colitis, a potentially deadly superinfection, is ________.

*Clostridium difficile*

---

**True/False**

Narrow-spectrum antimicrobials are commonly used for prophylaxis following surgery.

False

---

**Short Answer**

When prescribing antibiotics, what aspects of the patient’s health history should the clinician ask about and why?

When is using a broad-spectrum antimicrobial drug warranted?

---

**Critical Thinking**

Why are yeast infections a common type of superinfection that results from long-term use of broad-spectrum antimicrobials?
Too often patients will stop taking antimicrobial drugs before the prescription is finished. What are factors that cause a patient to stop too soon, and what negative impacts could this have?

**14.3: Drugs Targeting Other Microorganisms**

### Multiple Choice

Which of the following terms refers to the ability of an antimicrobial drug to harm the target microbe without harming the host?

**A. mode of action**  
**B. therapeutic level**  
**C. spectrum of activity**  
**D. selective toxicity**

- D

Which of the following is not a type of β-lactam antimicrobial?

**A. penicillins**  
**B. glycopeptides**  
**C. cephalosporins**  
**D. monobactams**

- B

Which of the following does not bind to the 50S ribosomal subunit?

**A. tetracyclines**  
**B. lincosamides**  
**C. macrolides**  
**D. chloramphenicol**

- A

Which of the following antimicrobials inhibits the activity of DNA gyrase?

**A. polymyxin B**  
**B. clindamycin**
C. nalidixic acid
D. rifampin

C

Fill in the Blank
Selective toxicity antimicrobials are easier to develop against bacteria because they are ________ cells, whereas human cells are eukaryotic.

prokaryotic

True/False
β-lactamases can degrade vancomycin.

false

Short Answer
If human cells and bacterial cells perform transcription, how are the rifamycins specific for bacterial infections?

What bacterial structural target would make an antibacterial drug selective for gram-negative bacteria? Provide one example of an antimicrobial compound that targets this structure.

Critical Thinking
In considering the cell structure of prokaryotes compared with that of eukaryotes, propose one possible reason for side effects in humans due to treatment of bacterial infections with protein synthesis inhibitors.

14.4: Clinical Considerations

Multiple Choice
Which of the following is not an appropriate target for antifungal drugs?
A. ergosterol  
B. chitin  
C. cholesterol  
D. β(1→3) glucan  

C

Which of the following drug classes specifically inhibits neuronal transmission in helminths?

A. quinolines  
B. avermectins  
C. amantadines  
D. imidazoles  

B

Which of the following is a nucleoside analog commonly used as a reverse transcriptase inhibitor in the treatment of HIV?

A. acyclovir  
B. ribavirin  
C. adenine-arabinoside  
D. azidothymidine  

D

Which of the following is an antimalarial drug that is thought to increase ROS levels in target cells?

A. artemisinin  
B. amphotericin b  
C. praziquantel  
D. pleconaril  

A

Fill in the Blank

Antiviral drugs, like Tamiflu and Relenza, that are effective against the influenza virus by preventing viral escape from
host cells are called _______.
neuraminidase inhibitors

**True/False**

Echinocandins, known as “penicillin for fungi,” target β(1→3) glucan in fungal cell walls.

true

**Short Answer**

How does the biology of HIV necessitate the need to treat HIV infections with multiple drugs?

Niclosamide is insoluble and thus is not readily absorbed from the stomach into the bloodstream. How does the insolubility of niclosamide aid its effectiveness as a treatment for tapeworm infection?

**Critical Thinking**

Which of the following molecules is an example of a nucleoside analog?

Why can't drugs used to treat influenza, like amantadines and neuraminidase inhibitors, be used to treat a wider variety of viral infections?
14.5: Testing the Effectiveness of Antimicrobials

Multiple Choice

Which of the following resistance mechanisms describes the function of β-lactamase?

A. efflux pump  
B. target mimicry  
C. drug inactivation  
D. target overproduction

C

Which of the following resistance mechanisms is commonly effective against a wide range of antimicrobials in multiple classes?

A. efflux pump  
B. target mimicry  
C. target modification  
D. target overproduction

A

Which of the following resistance mechanisms is the most nonspecific to a particular class of antimicrobials?

A. drug modification  
B. target mimicry  
C. target modification  
D. efflux pump

D

Which of the following types of drug-resistant bacteria do not typically persist in individuals as a member of their intestinal microbiota?

A. MRSA  
B. VRE  
C. CRE  
D. ESBL-producing bacteria
Fill in the Blank

*Staphylococcus aureus*, including MRSA strains, may commonly be carried as a normal member of the ________ microbiota in some people.

nasal

Short Answer

Why does the length of time of antimicrobial treatment for tuberculosis contribute to the rise of resistant strains?

What is the difference between multidrug resistance and cross-resistance?

14.6: The Emergence of Drug Resistance

Multiple Choice

In the Kirby-Bauer disk diffusion test, the ________ of the zone of inhibition is measured and used for interpretation.

A. diameter  
B. microbial population  
C. circumference  
D. depth

Which of the following techniques cannot be used to determine the minimum inhibitory concentration of an antimicrobial drug against a particular microbe?

A. Etest  
B. microbroth dilution test  
C. Kirby-Bauer disk diffusion test  
D. macrobroth dilution test
C

The utility of an antibiogram is that it shows antimicrobial susceptibility trends

A. over a large geographic area.
B. for an individual patient.
C. in research laboratory strains.
D. in a localized population.

D

Fill in the Blank

The method that can determine the MICs of multiple antimicrobial drugs against a microbial strain using a single agar plate is called the ________.

Etest

True/False

If drug A produces a larger zone of inhibition than drug B on the Kirby-Bauer disk diffusion test, drug A should always be prescribed.

false

Short Answer

How is the information from a Kirby-Bauer disk diffusion test used for the recommendation of the clinical use of an antimicrobial drug?

What is the difference between MIC and MBC?

Critical Thinking

Can an Etest be used to find the MBC of a drug? Explain.