FNP Mastery
Family Nurse Practitioner

PMHNP Mastery
Psychiatric-Mental Health

ACPCNP Mastery
Adult/Gero Primary Care

ACACNP Mastery
Adult/Gero Acute Care

Pharmacology Cheat Sheet

Antibiotics

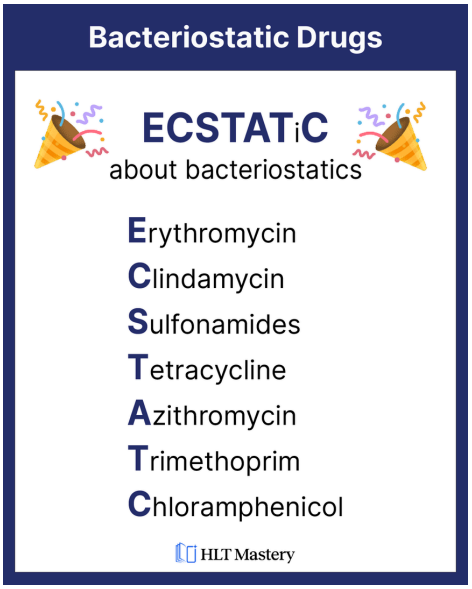
Find Your NP Specialty

Overview

There are two main ways antibiotics impact bacteria:

Bactericidal Drugs
Bactericidal drugs **directly kill bacteria**, leading to cell death.

Bacteriostatic Drugs
Bacteriostatic drugs **inhibit bacterial replication**, relying on the immune system to clear the infection.



Bactericidal Drugs

These directly kill bacteria, leading to cell death.

Classes of Bactericidal Drugs

- Vancomycin
- Fluoroquinolones
- Penicillin
- Amoxicillin/Amoxicillin-clavulanate
- Cephalosporins
- Metronidazole
- Rifampin

Used for a range of acute infections

- Pneumonia
- Cellulitis
- UTIs
- Otitis media
- Strep pharyngitis
- Osteomyelitis
- Sepsis

Metronidazole

Mechanism of Action

- Disrupts bacterial DNA
- Active only against anaerobes and protozoa

Common Clinical Uses

- Bacterial vaginosis
- Trichomoniasis
- Intra-abdominal infections (with other agents)

Adverse Effects

- Metallic taste
- GI upset
- Disulfiram-like reaction with alcohol

Penicillins

Mechanism of Action

- Block cell wall synthesis by inhibiting transpeptidase enzymes, causing cell death

Common Clinical Uses

- Strep pharyngitis (Penicillin V or Amoxicillin)
- Otitis media (Amoxicillin)
- Sinusitis (Amoxicillin-clavulanate [Augmentin])
- Cellulitis/erysipelas (Dicloxacillin, Augmentin)

Adverse Effects

- Allergy is the most common issue.
  - Around 10% of patients report a penicillin allergy, though <1% truly have an IgE-mediated allergy.

Clinical Decision Tips

- For most mild infections, amoxicillin or Augmentin remain the first-line treatment.
- In true penicillin allergy, use azithromycin or doxycycline depending on infection site.

Cross-Allergy Notes

- Cross-reactivity with cephalosporins. Avoid if anaphylactic history.

Cephalosporins

Mechanism of Action

- β-lactam antibiotics that inhibit bacterial cell wall synthesis
- Grouped into "generations," each with increasing gram-negative coverage

Common Clinical Uses

- **1st Generation:** Effective against streptococci and methicillin-susceptible staphylococci
  - Skin infections (cellulitis, impetigo)
  - Uncomplicated UTIs
- **2nd Generation:** Expanded gram-negative coverage compared to 1st generation agents
  - Sinusitis
  - Otitis Media
- **3rd Generation:** Broad coverage against many gram-negative and some gram-positive bacteria
  - Pneumonia
  - Gonorrhea
  - Resistant respiratory infections
- **4th Generation:** Broad spectrum, but does not cover MRSA
  - Hospital/ICU infections
- **5th Generation:** Unique, as they do cover MRSA
  - Hospital/ICU infections when MRSA is suspected

Adverse Effects

- Allergy or sensitivity: urticaria or rash
- GI upset
- *C. diff* (especially 3rd generation)

Cross-Allergy Notes

- Avoid cephalosporins in patients with anaphylactic penicillin allergies.
- Mild reactions (like rash) may still tolerate cephalosporins.

Fluoroquinolones

Mechanism of Action

- Inhibit bacterial DNA gyrase and topoisomerase, preventing DNA replication

Common Clinical Uses

- Ciprofloxacin
  - UTIs (especially *Pseudomonas*)
- Levofloxacin/Moxifloxacin
  - Community-acquired pneumonia
  - Chronic bronchitis exacerbations
  - Sinusitis

Serious Warnings!

- Tendon rupture (especially Achilles)
- QT prolongation
- CNS toxicity
- Avoid use in pregnancy and children

Clinical Decision Tip

Reserve fluoroquinolones for complicated infections or when first-line agents fail due to resistance or intolerance.

Fosfomycin

Mechanism of Action

- Blocks bacterial cell wall synthesis by inhibiting the enzyme MurA (UDP-N-acetylglucosamine-enolpyruvyltransferase), an early step in peptidoglycan formation

Common Clinical Uses

- Single-dose treatment for uncomplicated cystitis
- Option in pregnancy due to safety and single dose, which reduces fetal exposure
- Effective against multidrug-resistant *E. coli* and *Enterococcus faecalis*

Adverse Effects

- GI upset: diarrhea, nausea, or abdominal pain
- Headache and dizziness (mild, transient)
- Vaginitis or dysmenorrhea (less common)
- Generally well-tolerated and safe for most patients

Limitations

Not suitable for pyelonephritis or complicated UTIs, as it does not achieve therapeutic serum or renal tissue concentrations.

Nitrofurantoin

Mechanism of Action

- Damages bacterial DNA after enzymatic reduction inside the bacterial cell

Common Clinical Uses

- Uncomplicated cystitis (first-line per IDSA and CDC)
- Safe in pregnancy (except at term due to risk of hemolytic anemia in newborns)

Adverse Effects

- GI upset: nausea, loss of appetite
- Rare pulmonary fibrosis with long-term use
- Peripheral neuropathy: uncommon but risk increases in renal impairment
- Hemolytic anemia in newborns and patients with G6PD deficiency

Limitations

- Ineffective for pyelonephritis or systemic infections because it does not reach therapeutic serum or renal tissue levels.
- According to FDA labeling, it is **contraindicated for CrCl < 60 mL/min** (impaired excretion leading to systemic toxicity).

Bacteriostatic Drugs

Inhibit bacterial replication, relying on the immune system to clear the infection.

Classes of Bacteriostatic Drugs

- Sulfonamides
- Macrolides
- Lincosamides
- Tetracycline

Clinical Decision Tip

- Bacteriostatic drugs are not preferred in immunocompromised patients, as they rely on a functioning immune system to clear the infection. Bactericidal agents are favored when possible in this population.

Sulfonamides

Mechanism of Action

- Inhibit folate synthesis by blocking para-aminobenzoic acid (PABA) utilization.

Common Drug

- Trimethoprim-sulfamethoxazole (TMP-SMX / Bactrim)

Common Clinical Uses

- Uncomplicated UTIs
- MRSA skin infections
- Pneumocystis jirovecii pneumonia (PCP prophylaxis in HIV)

Adverse Effects

- Allergic reactions (rash, Stevens-Johnson)
- Photosensitivity
- Hyperkalemia and nephrotoxicity in renal impairment

Tetracycline

Mechanism of Action

- Bind the 30S ribosomal subunit, preventing bacterial protein synthesis.

Common Drugs

- Doxycycline
- Minocycline

Common Clinical Uses

- Acne
- Rosacea
- Tick-borne illnesses (Lyme disease, RMSF, Ehrlichiosis)
- Chlamydia
- COPD exacerbations
- Atypical pneumonia

Precautions

- Avoid in pregnancy and in children <8 years old due to permanent tooth discoloration and bone effects.
- Exception: RMSF should be treated with doxycycline in ALL patients, including pregnant patients and children
- Photosensitivity reactions are common.

Clinical Decision Tip

Doxycycline is often a first-line oral option for many mild-to-moderate outpatient infections due to its broad coverage and tolerability.

Lincosamides and Macrolides

Mechanism of Action

- Inhibit the 50S ribosomal subunit, halting bacterial protein synthesis.
  - Lincosamides (Clindamycin) → narrow spectrum
  - Macrolides (Azithromycin, Clarithromycin, Erythromycin) → moderate spectrum

Common Clinical Uses

- Azithromycin
  - Respiratory infections
  - Pertussis
  - Chlamydia
  - Traveler's diarrhea
  - Penicillin-allergic strep throat
- Clindamycin
  - Skin/soft tissue infections
  - MRSA coverage
  - Anaerobic infections (especially in penicillin-allergic patients)

Adverse Effects

- Clindamycin: High risk for *Clostridioides difficile* infection
- Azithromycin/Clarithromycin: Can cause QT prolongation and cardiac toxicity
- Erythromycin: Causes GI distress due to motilin receptor stimulation

Clinical Decision Tip

When treating penicillin-allergic patients, azithromycin is generally preferred over clindamycin due to safety and tolerability.

Bacteriocidal Drug Chart

Drug Class	Examples	Common Uses
Penicillins ends in -cillin	Amoxicillin Augmentin Dicloxacillin Penicillin G	Strep throat Otitis media Sinusitis Pneumonia Animal bites (Augmentin) Mastitis (Dicloxacillin) Syphilis (Pen G IM)
Cephalosporins ceph- or cef-	Cephalexin Cefdinir Ceftriaxone Ceftaroline	Skin infections UTIs (Gen 1) Sinusitis/OM (Gen 2) Pneumonia · Gonorrhea (Ceftriaxone IM + doxycycline) Hospital/ICU infections MRSA (Gen 5 only)
Fluoroquinolones ends in -floxacin	Ciprofloxacin Levofloxacin Moxifloxacin	Complicated UTIs / Pseudomonas (Cipro) CAP with comorbidities or recent abx use (Levo/Moxi)
Metronidazole	Flagyl	Trichomoniasis Bacterial vaginosis Intra-abdominal infections (paired with other agents)
Nitrofurantoin	Macrobid Macrodantin	Uncomplicated UTIs / cystitis (first-line)
Vancomycin	Vancocin	Serious gram-positive infections MRSA *C. diff* (oral)
Rifampin	Rifadin	Tuberculosis (always used in combination) Meningitis prophylaxis

Bacteriostatic Drug Chart

Drug Class	Examples	Common Uses
Macrolides ends in -mycin	Azithromycin Clarithromycin Erythromycin	Pneumonia Pertussis Chlamydia Strep throat (PCN allergy) *H. pylori* triple therapy (Clarithromycin)
Tetracyclines ends in -cycline	Doxycycline Minocycline	RMSF Lyme disease Purulent cellulitis Chlamydia Atypical/CAP pneumonia Acne Rosacea COPD exacerbations
Sulfonamides sulfa-	TMP-SMX (Bactrim)	UTIs Purulent cellulitis MRSA skin infections PCP prophylaxis (HIV/AIDS)
Lincosamides	Clindamycin	Skin/soft tissue infections MRSA Anaerobic infections (PCN-allergic patients)