

Bactericidal vs Bacteriostatic

What "cidal" and "static" mean, how they are measured, and why the difference matters at the bedside.

Bactericidal ("cidal")

Latin -cida = killer (as in pesticide, homicide)

The drug **kills** bacteria directly. Bacterial numbers fall even without help from the immune system.

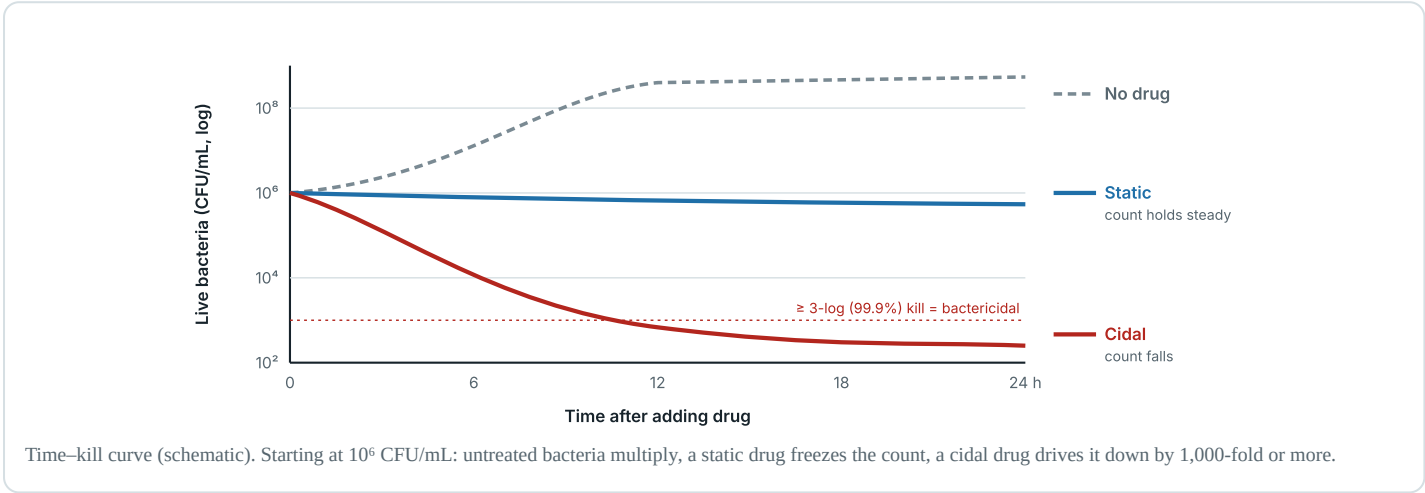
- Typical targets: cell wall, membrane, DNA
- Examples: penicillins, cephalosporins, vancomycin, aminoglycosides, fluoroquinolones, metronidazole

Bacteriostatic ("static")

Greek statikos = causing to stand still

The drug **stops growth and multiplication** but does not kill. White blood cells must clear the bacteria already present.

- Typical targets: protein synthesis, folate pathway
- Examples: tetracyclines, macrolides, clindamycin, chloramphenicol, linezolid, sulfonamides



How it is measured: MIC and MBC

- **MIC** (minimum inhibitory concentration): lowest drug concentration with **no visible growth**.
- **MBC** (minimum bactericidal concentration): lowest concentration that **kills ≥ 99.9%** of the starting bacteria.
- **MBC ÷ MIC ≤ 4** → bactericidal. **> 4** → bacteriostatic.

Example: MIC 1 µg/mL, MBC 2 µg/mL → ratio 2 → **CIDAL**. MIC 1 µg/mL, MBC 32 µg/mL → ratio 32 → **STATIC**.

Why it matters clinically

Prefer **CIDAL** drugs where the immune system cannot finish the job:

- Bacterial meningitis (CSF has few immune cells)
- Infective endocarditis (bacteria hidden in vegetations)
- Osteomyelitis
- Neutropenia, HIV, chemotherapy patients

Stopping a **STATIC** drug too early lets the surviving bacteria grow back.

FEATURE	BACTERICIDAL	BACTERIOSTATIC
Effect	Kills bacteria	Halts growth
Needs immune system?	No (helpful but not essential)	Yes
MBC/MIC ratio	≤ 4	> 4
Reversible on stopping?	No, dead cells stay dead	Yes, growth can resume
Mnemonic	"Very Finely Proficient At Cell Murder": Vancomycin, Fluoroquinolones, Penicillins, Aminoglycosides, Cephalosporins, Metronidazole	"ECSTaTiC": Erythromycin, Clindamycin, Sulfonamides, Trimethoprim, Tetracyclines, Chloramphenicol

Not absolute. The label depends on dose, organism and growth phase. Linezolid is static against staphylococci but cidal against streptococci; chloramphenicol is cidal against H. influenzae, S. pneumoniae and N. meningitidis. Combining a static drug with a β-lactam can blunt killing, since β-lactams act only on growing cells. Sulfonamide + trimethoprim together are cidal although each alone is static.