USMLE Step 1 microbiology bugs and drugs sheet

How to use this sheet

For every micro vignette: find the clue, name the bug before reading the options, then answer what the question asks about it (its stain, virulence factor, drug or resistance mechanism).

Gram-positive bacteria

Organism	Classic clue
Staphylococcus aureus	Abscess, toxic shock, vomiting within hours of eating
Streptococcus pyogenes	Sore throat, then glomerulonephritis weeks later
Streptococcus pneumoniae	Rusty sputum, lobar pneumonia, adult meningitis
Enterococcus	UTI or endocarditis after a urinary procedure
Clostridioides difficile	Diarrhoea after antibiotics such as clindamycin
Listeria monocytogenes	Neonate, older adult or pregnancy; soft cheese
Actinomyces israelii	Jaw abscess with sulfur granules

Gram-negative bacteria

Organism	Classic clue
Neisseria meningitidis	Petechial rash, meningitis
Neisseria gonorrhoeae	Urethritis, septic arthritis
Escherichia coli	Most UTIs; O157:H7 and HUS
Klebsiella pneumoniae	Currant jelly sputum, alcohol use disorder
Pseudomonas aeruginosa	Burns, cystic fibrosis, blue-green pus; oxidase-positive
Haemophilus influenzae	Epiglottitis in an unvaccinated child
Helicobacter pylori	Duodenal ulcer, urease-positive
Legionella pneumophila	Pneumonia with hyponatraemia; silver stain

Poor Gram staining: Mycoplasma (no cell wall), Chlamydia and Rickettsia (inside cells), Treponema (dark-field), Legionella (silver stain), Mycobacterium (acid-fast).

HIV and CD4 thresholds

- Below 200: Pneumocystis jirovecii
- Below 100: Toxoplasma gondii, Cryptococcus neoformans
- Below 50: Cytomegalovirus retinitis

Fungi by clue

- Histoplasma: Ohio or Mississippi valley, bird or bat droppings, yeast inside macrophages
- Blastomyces: large yeast with broad-based budding
- Coccidioides: Southwest US, spherules with endospores
- Mucor or Rhizopus: diabetic ketoacidosis, black eschar, non-septate hyphae at right angles
- Aspergillus: septate hyphae branching at acute angles
- Cryptococcus: India ink, thick capsule

Antibiotics

Drug class	Target	Classic resistance
Beta-lactams	PBPs, cell wall cross-links	Beta-lactamase; altered PBP (MRSA)
Vancomycin	D-Ala-D-Ala	D-Ala-D-Lac (VRE)
Aminoglycosides	30S	Modifying enzymes
Tetracyclines	30S	Efflux pumps
Macrolides	50S	Methylated 23S rRNA
Fluoroquinolones	DNA gyrase, topoisomerase IV	Gyrase mutations; efflux
TMP-SMX	Folate synthesis	Altered target enzymes

Memory aid: buy AT 30, CCEL at 50. Aminoglycosides and tetracyclines act on 30S. Chloramphenicol, clindamycin, erythromycin and linezolid act on 50S.

Aminoglycosides need oxygen to enter bacteria, so they don't work against anaerobes.

Four routes to resistance

- Destroy the drug: beta-lactamases, aminoglycoside-modifying enzymes
- Change the target: PBP2a, D-Ala-D-Lac, methylated 23S rRNA, mutated gyrase
- Pump it out: efflux pumps
- Keep it out: porin loss in Pseudomonas

Sources: USMLE Step 1 content outline; StatPearls (Gram-positive bacteria, Gram-negative bacteria, Antibiotics); National HIV Curriculum; CDC. Last checked: 19 November 2026.