

Sulfonamides Mechanisms

Sulfonamides are a group of bacteriostatic antibiotics that contain a sulfonamide moiety. These drugs have a wide spectrum encompassing most Gram positive and many Gram negative organisms including nocardia and Chlamydia. Sulfonamides are structural analogs and competitive antagonists of para-aminobenzoic acid (PABA) and compete with para-aminobenzoic acid (PABA) for incorporation into folic acid. Incorporation of sulfonamides causes inhibition of the enzyme dihydropteroate synthase in the folic acid synthesis pathway. Because folic acid is necessary for vital cell functions like DNA synthesis, bacteria that are deprived of folate will eventually die. Commonly used sulfonamides include sulfamethoxazole, sulfisoxazole, and sulfadiazine. Approximately 3% of the general population experience adverse reactions when treated with sulfonamide antimicrobials. Many people are allergic to the sulfonamide moiety and experience hypersensitivity reactions characterized by an overreaction of the body's immune response. Common symptoms include rashes, hives, itchy eyes, and swollen tongue or face. Some individuals can have an anaphylactic reaction. Sulfonamides are also associated with causes hemolysis of red blood cells in G6PD deficiency individuals. Additionally, they can cause nephrotoxicity, and photosensitivity. In the plasma, sulfonamides can bind to albumin and displace bilirubin to cause kernicterus in infants and can also displace warfarin, causing unexpected increases in clotting time and uncontrolled bleeding in individuals on warfarin therapy.



PLAY PICMONIC

Bacteriostatic

Bacteria-shocked

Bacteriostatic antibiotics limit the growth of bacteria by interfering with bacterial protein production, DNA replication, or other aspects of metabolism while not necessarily directly harming the organism. Upon removal of the bacteriostatic agent, the bacteria can regrow as opposed to bactericidal agents that directly kill bacteria.

Gram-Positive

Graham-cracker-Positive-angel

Gram positive organisms absorb crystal violet stain due to their thick peptidoglycan layer in the cell wall. Examples of Gram positive organisms include Staphylococcus and Streptococcus species. Due to their mechanism of action, sulfonamides are active against a wide spectrum of bacteria including Gram positive organisms.

Gram-Negative

Graham-cracker Negative-devil

Gram negative organisms do not stain to crystal violet due to their relatively thin peptidoglycan layer in the cell wall. Due to their mechanism of action, sulfonamides are active against a wide spectrum of bacteria including Gram negative organisms.

Nocardia

Note-card

Nocardia is a Gram positive rod which forms beaded branching filaments that resemble fungi. It is weakly acid fast and classically presents in immunocompromised patients as lung cavitations or brain and kidney infections. Nocardia is classically treated with a sulfonamide antibiotic.

Chlamydia

Chlamydia-clam

Chlamydia trachomatis is an obligate intracellular human pathogen that have three human serovars that cause disease including trachomas, urethritis, and lymphogranuloma venerum. Sulfonamides can also be used to treat infections caused by Chlamydia pneumoniae and Chlamydia psittaci.

PABA antimetabolites

Papa-bear Anti-sign Metal-tie

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Inhibit dihydropteroate synthase

Inhibiting-chains on two-headed-pterodactyl with Synthase-taser

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Sulfamethoxazole

SMX-snowmobile

Sulfamethoxazole is a sulfonamide antibiotic most often used as part of a synergistic combination with trimethoprim, commonly abbreviated as TMP-SMX or known under trade names like Bactrim. It is primarily used against susceptible forms of Staphylococcus and Streptococcus species, E. coli, and oral anerobes.

Sulfisoxazole

Sulfur-socks

Sulfisoxazole is a sulfonamide antibiotic with an oxazole component. This antibiotic has activity against a wide range of Gram positive and Gram negative organisms like the other sulfonamide antibiotics.

Sulfadiazine

Sulfur-dice

Sulfadiazine is a sulfonamide antibiotic that is used in combination with pyrimethamine to treat toxoplasmosis. It is also commonly used to treat urinary tract infections.