Penicillin

Penicillin, derived from the Penicillium fungi, is the first antibiotic that successfully treated previously deemed critical diseases such as syphilis, staphylococcus and streptococcus infections. There are different forms of penicillin such as penicillin G, penicillin V, benzathine penicillin, etc. All penicillins are beta-lactam antibiotics, and they are still widely used today for gram-positive organisms and spirochetes.Penicillin works via a few different mechanisms. First, it binds to the penicillin-binding protein (PBP), which is also known as the enzyme transpeptidase, to disrupt normal bacterial cell wall synthesis. Penicillin blocks transpeptidase (PBP), a critical enzyme involved in the peptidoglycan cross-linking in the bacterial cell wall. This causes bacterial death from osmotic pressure induced cytolysis. Penicillin's small size allows it to penetrate deeply into the cell wall. Another mechanism is that penicillin activates autolytic enzymes in the bacteria to cause cell death. This antibiotic is classified as bactericidal because it actually causes bacterial cell death. Common adverse reactions from penicillin include hypersensitivity reactions. High doses of penicillin can also induce immune-mediated hemolysis due to a hapten mechanism, which is when the antibodies target the combination of penicillin in association with the red blood cells and activate complements to induce hemolysis and removal of red blood cells.



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Gram Positive
Graham-cracker Positive-angel
Gram-positive organisms are bacteria that are able to retain crystal violet stain due to relatively high amount of peptidoglycan in the cell wall. Because penicillin inhibits the formation of peptidoglycan cross-linking in the bacterial cell wall, penicillin is bactericidal for many gram-positive organisms.

Spirochetes
Spiral-spirochete
Spirochetes are bacteria with a long, helical coiled structure. Penicillin remains the drug of choice for many spirochete infections including syphilis.

Bind PBPs
PBJ-sandwich
Penicillin-binding protein (PBP), also known as the enzyme transpeptidase, is a component of many bacterial cell walls and is important for cell wall synthesis. Beta-lactam antibiotics in general bind to this protein which leads to abnormal cell wall structure and cell death.

Block Transpeptidase Cross-linking of Cell Wall
Transformer-peptide character Cross Linking the Walls
Transpeptidase, also known as PBP, is a critical enzyme in bacteria that cross-links peptidoglycan to form the cell wall. Penicillin blocks this enzyme and therefore inhibits bacterial cell wall synthesis.

Activate Autolytic Enzymes
Auto-lights with Enzyme
This is the third mechanism of penicillin which activates autolytic enzymes in the bacteria to cause cell death.

Bactericidal
Bacteria-sliders
Unlike bacteriostatic agents, which simply stop bacteria from reproducing, bactericidal agents actually cause bacterial cell death.

Hypersensitivity Reactions
Hiker-sensitive-crying
Penicillin hypersensitivity reactions are characterized by an overreaction of the body's immune response to a penicillin antibiotic. Common symptoms include rashes, hives, itchy eyes, and swollen tongue or face. Some individuals can have an anaphylactic reaction.

Hemolytic Anemia
Hemolysing-RBCs from Anemone
Penicillin in high doses can induce an immune mediated hemolysis of red blood cells. This occurs via the hapten mechanism in which antibodies are targeted against the combination of penicillin attached to red blood cells. This leads to complement activation and removal of red blood cells by the spleen.

Beta-lactamase Sensitive
(B lac) Black Beta-fish crying
Beta-lactamase is an enzyme that is produced by some bacteria to cleave beta-lactam antibiotics rendering them ineffective. Antibiotics that are beta-lactamase sensitive are susceptible to cleavage by beta-lactamases and are therefore likely to be ineffective against beta-lactamase producing bacteria.

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