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Assignment Title: Antimicrobial resistance

Course Title: Pharmaceutical Microbiology II

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Question

List and explain 4 mechanism of antimicrobial resistance Answer

Mechanism of antimicrobial resistance

1. Drug inactivation or modification
2. Alteration of target or binding site
3. Alteration of metabolic pathway
4. Reduced drug accumulation drug

Using the antibiotic penicillin as an example,

Drug inactivation or modification: for example, the enzymatic deactivation of penicillin G in some penicillin-resistant bacteria through the production of β-lactamases. The protective enzymes produced by the bacterial cell will add an acetyl or phosphate group to a specific site on the antibiotic, which will reduce its ability to bind to the bacterial ribosomes and disrupt protein synthesis.

Alteration of target or binding site: for example, alteration of penicillin binding agent the in MRSA (Methicillin-resistant Staphylococcus aureus) and other penicillin-resistant bacteria.
A protective mechanism found among bacterial species is ribosomal protection proteins. These proteins protect the bacterial cell from antibiotics that target the cell's ribosomes to inhibit protein synthesis. The mechanism involves the binding of the ribosomal protection proteins to the ribosomes of the bacterial cell, which changes its conformational shape. This allows the ribosomes to continue synthesizing proteins essential to the cell while preventing antibiotics from binding to the ribosome to inhibit protein synthesis.

Alteration of metabolic pathway: for example, some sulfonamide-resistant bacteria do not require para-aminobenzoic acid (PABA), an important precursor for the synthesis of folic acid and nucleic acids in bacteria inhibited by sulfonamides, instead, like mammalian cells, they turn to using preformed folic acid.

Reduced drug accumulation: this occurs by decreasing drug permeability or pumping out the drugs across the cell surface. These pumps within the cellular membrane of certain bacterial

species are used to pump antibiotics out of the cell before they are able to do any damage. They are often activated by a specific substrate associated with an antibiotic as in fluoroquinolone resistance.