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MATRIC NUMBER: 18/MHS07/004

DEPARTMENT: PHARMACOLOGY

ASSIGNMENT TITLE: ANTIMICROBIAL RESISTANCE

COURSE TITLE: PHARMACEUTICAL MICROBIOLOGY II

COURSE CODE: PHA 206

DATE:22/05/2020

QUESTION

List and explain 4 mechanism of antimicrobial resistance

**ANSWER**

Antimicrobial resistance (AMR or AR) is the ability of a microbe to resist the effects of medication that once could successfully treat the microbe.

Antimicrobial resistance can be defined as a microorganism's resistance to an antimicrobial drug that was once able to treat an infection by that microorganism.

A person cannot become resistant to antibiotics. Resistance is a property of the microbe, not a person or other organism infected by a microbe.

**MECHANISM OF ANTIMICROBIAL RESISTANCE**

The four main mechanisms by which bacteria exhibit resistance to antibiotics are:

**A. DRUG INACTIVATION OR MODIFICATION**: for example, enzymatic deactivation of penicillin G in some penicillin-resistant bacteria through the production of β-lactamases. Most commonly, 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.

**B. ALTERATION OF TARGET- OR BINDING SITE**: for example, alteration of PBP—the binding target site of penicillins—in MRSA and other penicillin-resistant bacteria. Another 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 in turn 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.

**C. 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.

**D. REDUCED DRUG ACCUMULATION**: by decreasing drug permeability or increasing active efflux (pumping out) of the drugs across the cell surface[81] 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.