

Antibiotic Resistance

Humans developed antimicrobial drugs to destroy diseases caused by microbes. The most common known antimicrobial is antibiotic which targets the bacteria. At the beginning of the 21st century the antimicrobial resistance has become very common, so we have to understand this phenomenon scientifically to prevent it from becoming a fatal disaster later.

Bacteria are prokaryotic microorganisms that have the ability to enter the body replicating and growing causing serious diseases. Antibiotics agents interfere with specific processes that are essential for growth and/or division either for killing bacteria or at least stopping their growth. They can be separated into groups such as inhibitors of bacterial and fungal cell walls, inhibitors of nucleic acid synthesis and inhibitors of ribosomal function

Proteins are important components in the cell to function normally, so some antibiotics inhibit the protein synthesis by inhibiting ribosomes thus stopping protein synthesis which results in bacterial death.

Folic acid (one of B vitamins) can't enter the bacteria, so the bacteria have to synthesize it, as it is important for the bacterial growth, by the help of a certain enzyme called dihydropteroate synthase . Antibiotics like Sulpha drugs inhibit this enzyme thus stopping its growth.

HOW DRUGS INTERFERE WITH BACTERIAL GROWTH AND DEVISION

Since Bacteria contain peptidoglycans in the structure of their cell wall, so some antibiotics like Penicillin inhibit synthesis of peptidoglycans to destroy cell wall causing destruction of the bacteria.

DNA replication takes place thanks to a certain enzyme called DNA gyrase enzyme that relaxes the tightly wound DNA strands. Antibiotics like ciprofloxacin act by inhibiting this enzyme and finally stopping the growth of the bacteria.

Any reason helps reduce the reproductive success in a population exerts something called Selective pressure. With sufficient pressure the mutated resistant genes widespread and become more common in the population. That is exactly what happens to the bacteria,

Here is the answer

The inappropriate antibiotic treatment (overuse of antibiotics, Self-prescribing of antibiotics and the use of nonspecific antibiotics) will kill the sensitive bacteria but the resistant bacteria will proliferate and transfer their mutated genes either horizontally to other types or vertically to the next generations. So the first rule of antibiotics is to try not to use them, and the second rule is to try not to use too many of them.

The basic mechanisms by which microorganisms resist an antimicrobial agent vary from one bacteria to another, they can decrease the amount of drug that reaches the receptor by altering the entry way or increase removal of the drug. They also can alter the receptor on which the drug acts or they may seek to destroy or inactivate the drug directly.

The first mechanism is to restrict the entry of the drug. Some bacteria has the ability to surround itself with an outer membrane containing protein channels called porins which have the ability to prevent many drugs

from entering . Although some drugs – like broad spectrum drugs- have the ability to enter through these porins, another mutation takes place to overcome that and finally leads to decrease in the number of the porins channels to decrease the amount of the drugs that enter the cell.

Another mechanism is to modify the target molecules, for example, P enicillin binds the enzymes that cross-link peptidoglycans and inhibit their function which causes a defect in the cell wall synthesis , so some bacteria like Streptococcus pneumonia modifies these enzymes and turn them unable to bind with penicillin.

Finally, some bacteria can destroy the drug and this can be done by many mechanisms, but the most common are to secrete enzymes that destroy something in the structure of the drug.

Each year in the United States at least 2 million people are infected by antibiotic-resistant bacteria resulting in the death of at least 23,000. Many of the medical breakthroughs of the last century could become no more beneficial in the following years, and all of these disasters are due to the inaccurate drug prescription and the personal abuse of them, so Is the world ready for another epic war with a new version of a plague?

