

ANTIBIOTIC RESISTANCE

Certain antibiotics, such as the cephalosporin group, can result in resistance in *E. coli* and *Klebsiella spp.*, as well as other Gram-negative bacteria. Use of antibiotics, either through overuse or indiscriminant use exerts selective pressure to develop resistant bacterial strains. Selective pressure results in a competitive advantage for resistant microorganisms. In addition, some Gram-negative bacteria may transfer plasmids to other species conferring resistance to these other microorganisms.

The Causes of Antibiotic Resistance

A major cause of the spread of resistance is believed to be overuse or inappropriate use of drugs, such as antibiotics, in preventing or treating infections in people, animals, and plants. Microorganisms constantly adapt to their environment and have the ability to take on the characteristics of other bacteria. When antibiotics are used inappropriately, the weak bacteria are killed, while the stronger, more resistant, ones survive and multiply.

Links have also been made between providing antibiotics to animals and the spread of resistant bacteria in humans. Drugs are often given to food-producing animals to treat and prevent infections in the agrifood industry and to promote growth. Similar products are also sprayed on fruit trees to prevent or control disease.

Other factors that can lead to development of resistance include prescribing antibiotics for infections caused by viruses (e.g., cold or influenza) or prescribing the inappropriate drug for an infection, or the person not taking the antibiotic according to instructions; for example, not taking all of a prescription or giving their unused antibiotics to others. In addition, in some countries, antibiotics can be purchased over the counter without a prescription and may be of very poor quality.

Each antibiotic is effective against only a certain segment of the microbial world, so for a given antibiotic there are some species of bacteria that are susceptible and others not. Bacterial species not susceptible to a particular drug are “naturally resistant.” Species that were once susceptible but eventually became resistant to it are said to have “acquired resistance.” It is important to note that “acquired resistance” affects a subset of strains in the entire species; that is why the prevalence of “acquired resistance” in a species is different according to geographic location.

Bacterial Changes

Antibiotic resistance occurs when bacteria change in some way that reduces or eliminates the effectiveness of drugs, chemicals, or other agents designed to cure or prevent infections. Bacteria can do this through several mechanisms. Some bacteria develop the ability to neutralize the antibiotic before it can do harm, others can rapidly pump the antibiotic out, and still others can change the antibiotic attack site so it cannot affect the function of the bacteria.

Resistance to antibiotics can either be naturally occurring for a particular microorganism/drug combination or acquired resistance. Bacteria can also adapt, as a group, to their environment and resist the antibiotics that are used to try to kill them. The bacteria do this by changing their genetic make-up. Once these bacteria mutate so they are resistant to an antibiotic, this new genetic structure is carried on as the bacteria grow and replicate.