Antibiotic resistance

A resistant organism is one that will not be inhibited or killed by an antibacterial agent at concentrations of the drug achievable in the body after normal dosage. Some bacterial species are innately resistant to some families of antibiotics because they lack a susceptible target, are impermeable to or enzymatically inactive the antibacterial agent. However, within species that are innately susceptible, there are also strains that develop or acquire resistance.

Genetics of resistance

Chromosomal mutation may result in resistance to s class of antimicrobial agents- cross resistance. Resistance may arise from; a single chromosomal mutation in one bacterial cell resulting in the synthesis of n altered protein eg. streptomycin resistance via alteration in a ribosomal protein or the single amino acid change in the enzyme dihydropteroate synthase resulting in a lowered affinity for sulphonamides, or a series of mutations eg. changes in penicillin binding proteins in penicillin-resistant pneumococci. In the presence of antibiotics, these spontaneous mutants have a selective advantage to survive and outgrow the susceptible population. Chromosomal mutations are relatively rare events and generally provide resistance to a single class of antimicrobials.

Genes on transmissible plasmids may result in resistance to different classes of attancrobial agents- multiple resistance. Bacteria are able to acquire resistance genes contransmissible plasmids, such plasmids often code for resistance determinents to everal unrelated families of antibacterial agents. Therefore a cell may occure number resistance to many different drugs at once. Some plasmids are promissions, crossing species barrier and the same resistance gene is therefore found to widely different species, eg. TEM1, the most common plasmid-mediated results and also accounts to pencillin resistance in Neisseria gonorrhoeae and ampicillin resistance in H. influenza.

Resistance may be acquired from transposons and other mobile elements. Resistance genes on transposable elements move between plasmids and the chromosomes and from one plasmid to another, thereby allowing greater stability or greater dissemination of the resistance gene.

Multiple resistance genes may be organized into genetic elements called integrons. The integron encoded a site-specific recombination enzyme, which allows insertion and akso excision of antibiotic resistance gene 'cassettes' (resistance gene plus additional sequences including an 'attachment' region) into the integrin attachment site (att). A strong integron promoter controls transcription of the inserted genes. Whether acting as independent mobile genetic elements or inserted into transposons, integrons are capable of moving into a variety of DNA molecules. With their ability to capture, organize and rearrange different antibiotic-resistance genes, integrons represent an important mechanism for the spread of multiple antibiotic resistance in clinically important microorganisms.