Based on the relative complexity of their cells, all living organisms are broadly classified as either prokaryotes or eukaryotes. Bacteria are prokaryotes. The entire organism consists of a single cell with a simple internal structure. Unlike eukaryotic DNA, which is neatly packed into a cellular compartment called the nucleus, bacterial DNA floats free, in a twisted thread-like mass called the nucleoid. Bacterial cells also contain separate, circular pieces of DNA called plasmids. Bacteria lack membrane-bound organelles, specialized cellular structures that are designed to execute a range of cellular functions from energy production to the transport of proteins. However, both bacterial and eukaryotic cells contain ribosomes. These spherical units are where proteins are assembled from individual amino acids, using the information encoded in a strand of messenger RNA. On the outside, bacterial cells are generally surrounded by two protective coverings: an outer cell wall and an inner cell membrane. However, certain bacteria, like the mycoplasmas do not have a cell wall at all. Some bacteria may even have a third, outermost, protective layer called the capsule. Lastly, bacterial surfaces can be covered by whip-like extensions: flagella or pili. According to the authors of "Mims Medical Microbiology, 5th Ed" (Saunders, 2013), long flagella aid in motility while short pili help bacteria to attach to host surfaces.

ANTIBIOTIC RESISTANCE

Antibiotics are medicines used to prevent and treat bacterial infections. Antibiotic resistance occurs when bacteria change in response to the use of these medicines. Bacteria, not humans or animals, become antibiotic-resistant. These bacteria may infect humans and animals, and the infections they cause are harder to treat than those caused by non-resistant bacteria. Antibiotic resistance leads to higher medical costs, prolonged hospital stays, and increased mortality.

The world urgently needs to change the way it prescribes and uses antibiotics. Even if new medicines are developed, without behaviour change, antibiotic resistance will remain a major threat. Behaviour changes must also include actions to reduce the spread of infections through vaccination, hand washing, practising safer sex, and good food hygiene. Antibiotic resistance is rising to dangerously high levels in all parts of the world. New resistance mechanisms are emerging and spreading globally, threatening our ability to treat common infectious diseases. A growing list of infections – such as pneumonia, tuberculosis, blood poisoning, gonorrhoea, and foodborne diseases – are becoming harder, and sometimes impossible, to treat as antibiotics become less effective. Where antibiotics can be bought for human or animal use without a prescription, the emergence and spread

of resistance is made worse. Similarly, in countries without standard treatment guidelines, antibiotics are often over-prescribed by health workers and veterinarians and over-used by the public. Without urgent action, we are heading for a post-antibiotic era, in which common infections and minor injuries can once again kill. Antibiotic resistance is accelerated by the misuse and overuse of antibiotics, as well as poor infection prevention and control. Steps can be taken at all levels of society to reduce the impact and limit the spread of resistance.

To prevent and control the spread of antibiotic resistance, individuals can:

Only use antibiotics when prescribed by a certified health professional. Never demand antibiotics if your health worker says you don't need them. Always follow your health worker's advice when using antibiotics. Never share or use leftover antibiotics.

Prevent infections by regularly washing hands, preparing food hygienically, avoiding close contact with sick people, practising safer sex, and keeping vaccinations up to date.

Prepare food hygienically, following the WHO Five Keys to Safer Food (keep clean, separate raw and cooked, cook thoroughly, keep food at safe temperatures, use safe water and raw materials) and choose foods that have been produced without the use of antibiotics for growth promotion or disease prevention in healthy animals.

To prevent and control the spread of antibiotic resistance, policy makers can:

Ensure a robust national action plan to tackle antibiotic resistance is in place. Improve surveillance of antibiotic-resistant infections. Strengthen policies, programmes, and implementation of infection prevention and control measures. Regulate and promote the appropriate use and disposal of quality medicines. Make information available on the impact of antibiotic resistance.

To prevent and control the spread of antibiotic resistance, health professionals can:

Prevent infections by ensuring your hands, instruments, and environment are clean.

Only prescribe and dispense antibiotics when they are needed, according to current guidelines. Report antibiotic-resistant infections to surveillance teams. Talk to your patients about how to take antibiotics correctly, antibiotic resistance and the dangers of misuse.

To prevent and control the spread of antibiotic resistance, the health industry can:

Invest in research and development of new antibiotics, vaccines, diagnostics and other tools.

While there are some new antibiotics in development, none of them are expected to be effective against the most dangerous forms of antibiotic-resistant bacteria. Given the ease

and frequency with which people now travel, antibiotic resistance is a global problem, requiring efforts from all nations and many sectors. When infections can no longer be treated by first-line antibiotics, more expensive medicines must be used. A longer duration of illness and treatment, often in hospitals, increases health care costs as well as the economic burden on families and societies. Antibiotic resistance is putting the achievements of modern medicine at risk. Organ transplantations, chemotherapy and surgeries such as caesarean sections become much more dangerous without effective antibiotics for the prevention and treatment of infections.

Description

Antibiotic resistance is the ability of bacteria to resist the effects of an antibiotic. Antibiotic resistance occurs when bacteria change in a way that reduces the effectiveness of drugs, chemicals, or other agents designed to cure or prevent infections. The bacteria survive and continue to multiply, causing more harm. ntibiotic resistance has been called one of the world's most pressing public health problems. Antibiotic resistance can cause illnesses that were once easily treatable with antibiotics to become dangerous infections, prolonging suffering for children and adults. Antibiotic-resistant bacteria can spread to family members, schoolmates, and co-workers, and may threaten your community. Antibiotic-resistant bacteria are often more difficult to kill and more expensive to treat. In some cases, the antibiotic-resistant infections can lead to serious disability or even death.

Bacterial Resistance

Some bacteria are naturally resistant to certain types of antibiotics. However, bacteria may also become resistant in two ways: 1) by a genetic mutation or 2) by acquiring resistance from another bacterium. Mutations, rare spontaneous changes of the bacteria's genetic material, are thought to occur in about one in one million to one in ten million cells. Different genetic mutations yield different types of resistance. Some mutations enable the bacteria to produce potent chemicals (enzymes) that inactivate antibiotics, while other mutations eliminate the cell target that the antibiotic attacks. Still others close up the entry ports that allow antibiotics into the cell, and others manufacture pumping mechanisms that export the antibiotic back outside so it never reaches its target.

Bacteria can acquire antibiotic resistance genes from other bacteria in several ways. By undergoing a simple mating process called "conjugation," bacteria can transfer genetic material, including genes encoding resistance to antibiotics (found on plasmids and transposons) from one bacterium to another. Viruses are another mechanism for passing resistance traits between bacteria. The resistance traits from one bacterium are

packaged into the head portion of the virus. The virus then injects the resistance traits into any new bacteria it attacks. Bacteria also have the ability to acquire naked, "free" DNA from their environment. Any bacteria that acquire resistance genes, whether by spontaneous mutation or genetic exchange with other bacteria, have the ability to resist one or more antibiotics. Because bacteria can collect multiple resistance traits over time, they can become resistant to many different families of antibiotics.

Genetically, antibiotic resistance spreads through bacteria populations both "vertically," when new generations inherit antibiotic resistance genes, and "horizontally," when bacteria share or exchange sections of genetic material with other bacteria. Horizontal gene transfer can even occur between different bacterial species. Environmentally, antibiotic resistance spreads as bacteria themselves move from place to place; bacteria can travel via airplane, water and wind. People can pass the resistant bacteria to others; for example, by coughing or contact with unwashed hands.