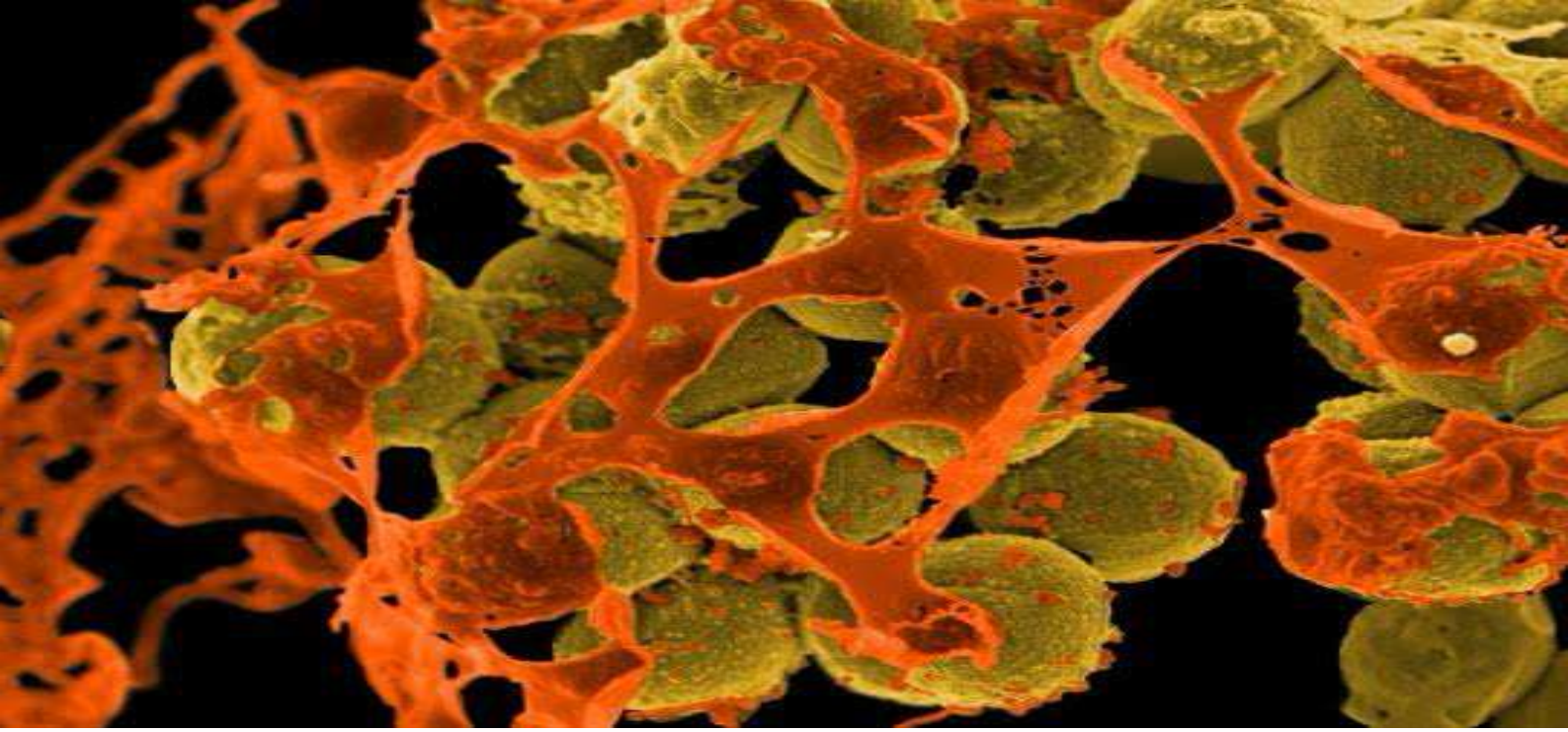


EFFECTS OF POLLUTION ON BACTERIAL RESISTANCE

As we all know, the world has evolved from traditional medicines to antibiotics and other drugs that work more efficiently than herbs and other conventional treatments. The modern-day medications that work against the infectious pathogens in our body need an alternative as the pathogens adapt against these drugs and later become resistant to these drugs, posing a threat to our health. Microbes, such as bacteria, viruses, fungi, and parasites, are living organisms that evolve. Their primary function is reproducing, thriving, and spreading quickly and efficiently. Therefore, microbes adapt to their environments and change in ways that ensure their survival. If something stops their ability to grow, which is the antimicrobial drug, genetic changes that enable the microbe to survive can occur.

WHAT IS ANTIMICROBIAL RESISTANCE?

Antimicrobial resistance is a condition where Microbes such as bacteria, viruses and parasites no longer respond to the drugs explicitly designed to prevent infections caused by these pathogens.

Antimicrobial resistance is usually caused by various factors, such as mutation, as the microorganisms reproduce spontaneously, leading to increased genetic mutations. The new microbes show better adaptability than the older ones from which they have been produced. Gene transfer is also a factor through which the resistant bacteria may transfer their genes to the non-resistant strains, leading to the development of resistance in them.

HOW IS POLLUTION LINKED WITH ANTIMICROBIAL RESISTANCE?

Researchers have conducted studies on antimicrobial resistance and its linkages to air pollution and observed that black carbon, which is a component of fine particulate matter (PM 2.5), is a leading air pollutant. Black carbon is a sooty black material emitted from vehicles, coal-based power plants and other sources depending upon fossil fuels. Upon constant inhalation of this pollutant, human health faces various risks, such as respiratory and cardiovascular disease, cancer (particularly lung cancer), and even congenital disabilities.

Researchers explored how air pollution affects pathogenic bacteria. Bacteria within biofilms are highly protected against environmental stresses, including metals, protease degradation, the host immune response and antibiotics. To observe the impact of air pollution on bacterial resistance, researchers from University of Leicester, England, conducted an experiment in which the biofilms were grown in the presence and absence of Black Carbon and later washed and incubated with a particular type of antibiotic. Streptococcus pneumoniae and Staphylococcus aureus were exposed to antibiotics Penicillin G and ß-lactams Oxacillin, respectively, which inhibit cell wall synthesis.

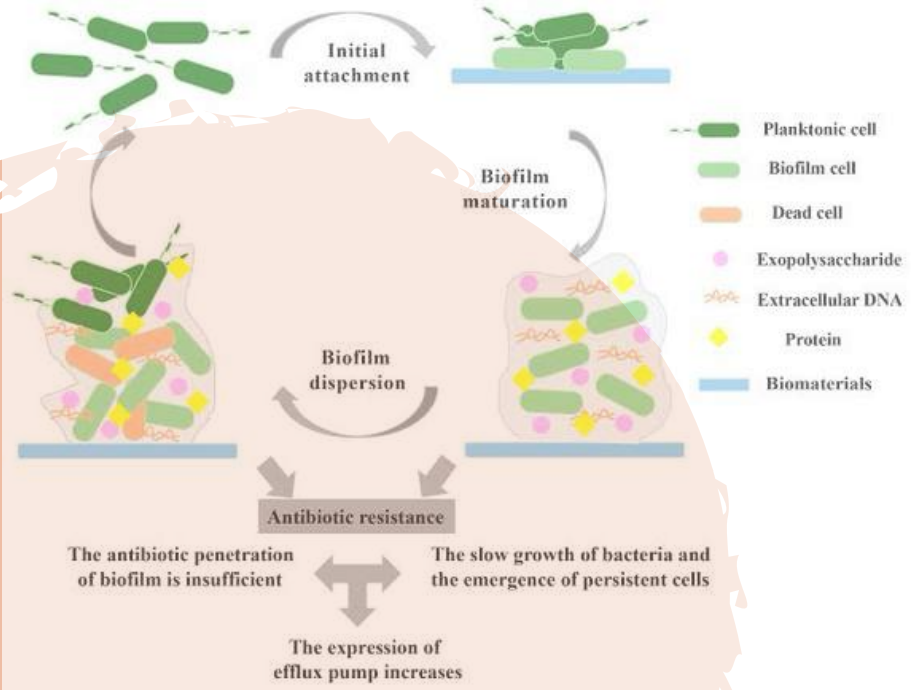
It was observed that Black Carbon caused a significant alteration in the architecture of bacterial biofilms, resulting in a structure with complex protrusion and channels. The biofilms cultured in the absence of BC had relatively flat structures and low surface area. In contrast, BC-induced biofilms were found to be thicker with relatively more irregularity and surface area.

It was noted that the concentration of each antibiotic required to markedly reduce the viability of bacteria with controlled biofilms was remarkably higher than the Minimum Inhibitory Concentration (MIC).

None of the antibiotic concentrations resulted in total bacterial eradication in controlled biofilms, clearly indicating that biofilms have increased their tolerance to antibiotics in the presence of Black Carbon as compared with Planktonic cells.

HOW TO PREVENT ANTIMICROBIAL RESISTANCE?

The best and only way to prevent antimicrobial resistance is to use antibiotics prudently, that is, consume them only when required and complete the course of treatment throughout as prescribed by the medical professional and not skipping or leaving the doses, not taking antibiotics for viral infections as antibiotics don't work against viruses—preventing any physical contact with infected person and keeping up with regular vaccination along with finding better alternatives to antibiotics, learning from the following research, limiting the amount of pollutants of any type especially carbon to reduce the possibility of bacteria from developing further resistance and prevent threats to humans from diseases that have the potential to become incurable in the foreseeable future.



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