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IBM develops macromolecule that reverses antibiotic resistance

Antibiotics we used to rely on have lost their efficacy and the drug pipeline is not delivering new ones anytime soon. Thus, researchers are considering alternatives, including the use of antibiotic adjuvants: chemicals that do not kill pathogens directly but boost the potency of pre-existing antibiotics by interacting with, and modifying, bacteria.

This is precisely what the IBM Research team has been working on and published the results of this week. They used a biodegradable polymer of their own design (a guanidinium-based polycarbonate) on bacteria with surprising results: there was no development of resistance after several rounds of sub-lethal treatments, no increase in the effective dose, and no upregulated expression of resistance-associated genes. The polymer was shown to reverse the antibiotic resistance phenotype and thus made resistant bacteria more susceptible to existing antibiotic drugs. The mechanism for this is fairly straightforward: the polymer crosses the bacterial membrane and binds to genes or enzymes in the cytoplasm that confer the pathogen antibiotic resistance, inhibiting these features and allowing antibiotics to act again.

To prove its efficacy, the team carried out several experiments on Multidrug Resistant bacteria combining the polymer with various antibiotics with known diminished efficacy. The results were impressive, as effective doses were drastically reduced. In the future, IBM hopes to combine this research and its AI technology to develop more polymeric adjuvants.

Source: IBM, 21 July 2020

Overuse of antibiotics in Asian rice farming

A report on 32 low and middle-income countries found that in Southeast Asia and the Western Pacific, agricultural advisers are regularly prescribing important antibiotics reserved for humans (such as streptomycin and tetracycline) for rice farming. Phil Taylor, co-author of the study, stated that "*they use it like a general tonic almost*" against infections, and worst of all, against insects, which antibiotics have no effect on.

The wider issue with this practice is that the antibiotics and any resistant bacteria they create can remain in the crop once it is harvested and enter the human food chain, or can remain in the soil and leave resistant bacteria free in the environment. Antibiotic usage in agriculture is not as discussed as in medical and livestock farming, so researchers are calling for more data.

Source: Scroll, 22 July 2020
From: CABI Agriculture and Bioscience, 23 June 2020

Factors Associated with Antimicrobial Prescription in Dogs and Cats

The use of antibiotics in our animal companions is an often overlooked but important avenue to resistance arising. This is why researcher David Singleton and his group published a study on the CDC investigating the prescription of antibiotics in veterinary settings. By analyzing 300,000 voluntary health records of canine and feline pets from all over the United Kingdom, they discovered which factors had the biggest effects on reducing antibiotic prescriptions.

Interestingly, these were all based on preventative health: whether the pet had been vaccinated, whether they had pet insurance, and whether the veterinarian was accredited by the Royal College of Veterinary Surgeons. The study thus suggests that antimicrobial stewardship in

pets is most successful when the client is engaged and preventative healthcare measures are taken.

Source: CDC, August 2020

Graphene-wrapped particles kill drug-resistant bacteria in wastewater

Trap-and-zap strategy for antibiotic-resistant bugs becomes wrap, trap and zap

Antibiotic-resistant bacteria are emerging as a serious public health threat, and part of the reason is that the bugs can pass resistance genes to each other. Now, researchers at Rice University have developed a system using nanoparticles wrapped in graphene oxide to kill both the superbugs and their free-floating resistance genes in wastewater.

The core of the new technology is photocatalysts in the form of "nano-spheres" made of bismuth, oxygen and carbon. When stimulated by light, these produce molecules called reactive oxygen species (ROS), which are deadly against bacteria and ARGs alike. The graphene-wrapped spheres kill nasties in effluent by producing three times the amount of ROS as compared to the spheres alone.

"*Wrapping improved bacterial affinity for the microspheres through enhanced hydrophobic interaction between the bacterial surface and the shell*," said co-lead author Pingfeng Yu, a postdoctoral research associate at Rice's Brown School of Engineering. "*This mitigated ROS dilution and scavenging by background constituents and facilitated immediate capture and degradation of the released ARGs*."

Source: New Atlas, 21 July 2020
From: Elsevier journal *Water Research*, 1 October 2020

Probiotic Use Among Older Care Home Residents Does Not Reduce Antibiotic Use

Probiotics have been looked at for their potential to prevent infections and limit the need for antibiotics. While studies on pediatric patients have shown some promise, the evidence in older adults, who are more prone to infections, is still lacking.

In the study: PRINCESS trial (Probiotics to Reduce Infections in Care Home Residents), led by University of Oxford investigators along with collaborators at Cardiff University and the University of Southampton. Researchers investigated whether a daily dose of an oral probiotic would be effective at reducing the cumulative use of antibiotics for all-cause acute infections over one year in a population of home care residents.

Findings suggest that the probiotic combination was not effective at reducing the frequency of antibiotic use compared to placebo. With the variable results in the growing field of probiotics, these findings provide objective data through its double-blind study approach. However, future studies may look to take a more directed approach as the probiotic strain and method of administration used may yield variable results depending on the specific infection of interest.

"*The particular probiotics we studied, if taken daily by care home residents, did not prevent infections or reduce antibiotic use*," lead author Christopher C. Butler.

Source: 2 Minute Medicine, 20 July 2020
From: JAMA *Journal of the American Medical Association*, 7 July 2020

IBBL and LNS launch MIRABANK in Luxembourg

The Laboratoire national de santé (LNS) and the Integrated Biobank of Luxembourg (IBBL) have launched MIRABANK. This joint project, which is based on the creation of a bank of multi-resistant bacterial strains in Luxembourg, was selected following a European call for tender launched in May 2019 on behalf of the European Centre for Disease Prevention and Control (ECDC).

Under the coordination and responsibility of IBBL, the biobank will be tasked with collecting bacterial strains – which are a new type of sample for the institute – as well as temporarily storing them prior to analysis. The LNS, for its part, will be responsible for confirming the identification of the strains, and carrying out the antibiogram according to a reference method following European directives. The strains studied are resistant to

carbapenems and/or colistin – the antibiotics of last resort in human medicine.

"*This project is of great importance in the fight against resistance to antibiotics of last resort, as carbapenem resistance is a problem that has particularly increased in Europe in recent years and needs to be studied for the health of patients in Europe*." Dr Kristin Kornerup, Project Manager at IBBL.

Source: News Medical Life Sciences, 22 July 2020

Specialized cellular compartments discovered in bacteria

Researchers at McGill University have discovered bacterial organelles involved in gene expression, suggesting that bacteria may not be as simple as once thought. This finding could offer new targets for the development of new antibiotics.

Stephanie Weber, an assistant professor in McGill's Department of Biology, and her team are the first to show that bacteria do, in fact, have such specialized compartments."*Our paper provides evidence for a bacterial organelle that is held together by "sticky" proteins rather than a membrane*," says Weber, who is the study's senior author.

Weber is now trying to understand exactly how the proteins assemble into organelles. As proteins are involved in the first steps of gene expression - transcription - Weber believes they might also be an interesting target for the development of a new generation of antibiotic drugs, which are urgently needed to combat drug resistance.

Source: ScienceDaily, 20 July 2020
From: PNAS, 16 July 2020