BEYOND THE CLINIC: HOW NOVEL ANTIMICROBIAL DRUGS WILL AID IN SUSTAINABLE DEVELOPMENT

In 2015, the United Nations adopted the 2030 Agenda for Sustainable Development, which comprises 17 Sustainable Development Goals centered on ending poverty and other inequalities through improved human and environmental health[1]. However, two years later the World Health Organisation stated that the growing problem of antimicrobial resistance jeopardizes these goals on multiple fronts[2]. At Amphoraxe we are developing novel antimicrobial agents based on antimicrobial peptides, with applications in human and veterinary medicine to ensure continued progress towards sustainable development.

Antimicrobial peptides (AMPs) are short immune system proteins, produced by all classes of life as a natural defense against bacterial, yeast, and viral infections. AMPs have different structures, mechanisms, and metabolization compared to conventional small molecule antibiotics. They act faster, do not induce resistance to the same degree, and do not persist in the environment. As such, AMP-based therapeutics will be an essential part of the sustainable response to antimicrobial resistance.

Our work on human and veterinary applications of AMPs addresses the following nine Sustainable Development Goals from the UN's list of 17 targets:

"Good Health and Well-Being": The spread of multidrug resistant bacteria, or superbugs, will slow or even reverse modern medical advances in surgery, burn care, organ transplantation, and cancer treatment. Currently, it is estimated that several million people die every year due to superbugs; the death toll is rapidly rising, exacerbated by the changing climate, to reach an estimated 10 million by 2050. Drug-resistant bacteria can spread in the same way as viruses, and can affect anybody anywhere in the world. New solutions to treating multidrug resistant infections are therefore critical to achieving the UN's health and well-being goals.

"No Poverty": Antimicrobial resistance also has an economic cost. Patients with drug-resistant infections have higher mortality, are more likely to need surgery, and require lengthier hospital stays than those with treatment-responsive infections. Further, the growing incidence of hospital-acquired drug-resistant infections adds further human and economic costs to the treatment of diverse other conditions. The economic burden of the problem is estimated at USD 100 trillion each year by 2050, equivalent to a drop of 2-3.5% in global economic output[3]. Reducing mortality and morbidity from multidrug resistant infections will therefore also contribute to anti-poverty measures.

"Clean Water and Sanitation", "Sustainable Cities and Communities", and "Life Below Water": Trace amounts of antibiotics can persist in agricultural run-off water, while prescription antibiotic use can contaminate urban water with antimicrobial chemicals, even following treatment at modern sewage plants[4]. Exposure to these subtherapeutic doses of antibiotics contributes to the emergence and spread of resistance in environmental and pathogenic bacteria[5], harming human health and endangering environmental microbiomes. In contrast to conventional small molecule antibiotics, AMPs are metabolized by the host and do not persist in agricultural or urban water.

"Zero Hunger", "Responsible Consumption and Production", "Climate Action", and "Life on Land": Our first veterinary target is in poultry farming, where restrictions on the preventive use of medically relevant antibiotics are having unintended consequences in terms of higher animal mortality and morbidity from infectious causes, food safety concerns, and productivity losses. Our AMPs will reverse these trends to improve the efficiency of poultry farming.

Poultry, especially chicken, is a popular source of protein around the globe. Poultry farming makes more efficient use of land, water, feed, and other resources compared to the farming of other food-producing animals such as cattle, and has a smaller impact on greenhouse gas emissions and environmental contamination, making this sector a key target for food security and environmental initiatives.

We are developing diverse classes of AMP and will select structurally and mechanistically distinct peptides for human and veterinary applications, thus avoiding the drug resistance problems that have occurred through agricultural use of medically important conventional antibiotics.

We are seeking co-development partnerships to further the progress of our lead peptides. Please contact us at **info@amphoraxe.ca** for more information.

References

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October 2020