Reducing antimicrobial resistant bacteria with the use of cold atmospheric plasma: Mechanism of action and influence on mutation and horizontal gene transfer

Supervisory team:
Lead supervisors: Prof Matthew B. Avison (University of Bristol), Dr Alexandros Stratakos (University of the West of England)
Dr Saliha Saad (University of the West of England), Dr Nihal Bandara (University of Bristol)

Host institution: University of Bristol, University of the West of England (UWE)

Submit applications for this project to University of Bristol

Project description:
The widespread use and misuse of antibiotics in animal production has led to the emergence of antimicrobial-resistant AMR bacteria on farms, which adds to the global burden of AMR, which has significant impacts on human health and food security. Significant efforts to limit AMR on animal farms have so far focused on controlling the supply and use of antimicrobial drugs. However, evidence shows that AMR pathogenic bacteria can persist and spread despite reducing antimicrobial use to almost zero. AMR development and persistence in livestock is therefore not only an issue to be addressed by reducing antimicrobial use. We have shown that cleaning and disinfection have a very important role to play, but the extensive use of chemical disinfectants has been associated with the emergence of AMR and has a considerable environmental impact. Therefore, new sustainable strategies for decontamination at the farm level are necessary.

Cold atmospheric plasma (CAP) is a novel, residue and antibiotic-free, non-thermal technology shown to have antibacterial properties in a variety of different settings. Plasma describes the state of an ionised gas (4th state of matter), with natural examples including the northern lights, lightening and solar winds. In our lab, we produce CAP by excitation of gas molecules using electrical discharges. CAP has the potential to inhibit bacteria due to the reactive molecules and species it contains (e.g. oxygen/nitrogen reactive species). Our previous studies have proved that CAP is effective in eliminating bacterial pathogens on different surfaces. This project aims to explore the viability of using CAP to reduce AMR bacterial contamination on surfaces frequently found on farms, and the biological effects of CAP on bacteria. You will investigate: i) the efficacy of CAP against AMR bacteria previously identified on farms; ii) the CAP-mediated mechanism of action against AMR bacteria using functional genomics; iii) The influence of CAP on mutation and horizontal transfer of AMR in bacteria; iv) the efficacy of CAP in controlling AMR bacteria on abiotic surfaces.

The successful student will join a consortium of two interdisciplinary research groups with access to world-class research facilities at University of Bristol (molecular bacteriology, proteomics/functional genomics) and University of the West of England-Bristol (cold plasma technology, microbiology). The student will receive excellent training and meaningful support from their supervisory team, and develop the technical skills and enterprising mind-set that employers seek.

Please note: *This project in collaboration with the University of Bristol and the University of the West of England (UWE) is subject to a* ***joint degree award****. Successful applicants will be registered at both these institutions, and graduates will be awarded a joint degree from these two institutions upon successful completion of the PhD programme.*

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.