

Great Western Four+ Doctoral Training Partnership (GW4+ DTP)

The role of natural antimicrobials in selection for antibiotic resistance?

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Scientific Background: The increasing prevalence of antimicrobial resistance (AMR) in bacteria is one of the most pressing problems in global health care. Selection for antibiotic resistance occurs through antibiotic use in the clinic and community and contamination of the environment with heavy metals, biocides and antibiotic residues. However, AMR mechanisms are ancient and their presence in environments with no or minimal exposure to human activity indicates that not all AMR selection is anthropogenic. It is here proposed to test for the first time whether naturally produced antimicrobials can select for resistance to clinical antibiotics.



Seaweeds form a diverse and abundant component of coastal ecosystems and commonly exhibit antimicrobial activity. Seaweed species are colonized by distinct bacterial assemblages, and this process is at least in part mediated by the high diversity of exuded secondary metabolites. Our research has demonstrated that *Staphylococcus aureus* strains that were more resistant to clinical antibiotics were on average also more resistant to seaweed extracts. The fact that seaweeds can select for bacteria that are resistant to their metabolites and the observation of cross-resistance between seaweed antimicrobials and clinical antibiotics suggests that there is potential for seaweeds to select for AMR.

This PhD project will 1) test whether distinct seaweeds harbour distinct antibiotic resistance genes using metagenomic sequencing, 2) test whether reservoirs of resistance genes can be transferred from seaweed-associated bacterial metagenomes to opportunistic pathogens using functional metagenomics and 3) identify human pathogens on seaweeds and test whether they are more resistant to antibiotics than conspecifics from other environmental reservoirs using whole genome sequencing. This project will allow a first insight into the potential of species interactions to select for AMR mechanisms that confer cross-resistance to clinically relevant antibiotics.



Training: UoE pays particular attention in supporting researchers in their career development, as testified by the "HR excellence in research" award obtained from the European Commission. The PhD student will be able to enrol in a variety of Researcher Development Programme courses, e.g. 'Researcher Development for Postgraduate Researchers'. The candidate will be encouraged to attend external training courses such as the 'Summer School in Bioinformatics' at EMBL-EBI in Cambridge. Vos and Gaze share laboratories with a variety of groups working on microbial ecology which will offer many more informal opportunities for knowledge transfer.

For more information about this opportunity, email Mick Vos: M.Vos@exeter.ac.uk