**BBSRC Strategic Research Priority**

**Food Security**
- **Microbiology**

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PhD project title: **Bacterial survival in the host and in the environment is promoted by horizontal gene transfer of additional metal resistance genes.**

University of Registration: University of Leicester.

**Project outline**

1. Project outline describing the scientific rationale of the project (max 4,000 characters incl. spaces and returns)

Excess copper is highly toxic and forms part of the host innate immune system’s antibacterial arsenal, accumulating at sites of infection and acting within macrophages to kill engulfed pathogens.

All bacteria possess mechanisms to tolerate the inherent toxicity of the essential micronutrient copper. However, our recent publication (Purves et al., 2018) showed that the highly virulent, epidemic, community acquired methicillin resistant *Staphylococcus aureus* USA300, which shows altered infectivity compared to typical *S. aureus*, has acquired an additional copper hyper-resistance mechanism.

Our data show that this novel, horizontally gene transferred copper resistance locus is associated with the SCCmec elements of USA300. This locus confers copper hyper-resistance and is required for *S. aureus* USA300 intracellular survival within macrophages. These genes are additional to existing core genome copper resistance mechanisms, and are not found in typical *S. aureus* lineages, but are increasingly identified in emerging pathogenic isolates.

Our hypothesis is that acquisition of copper hyper-resistance via horizontal gene transfer plays a crucial role in the emergence of *S. aureus* strains, and potentially other pathogenic bacteria, with increased infectivity conferred through their improved resistance to the copper-dependent killing mechanisms of the host’s immune cells.

*L. monocytogenes* is a major food borne pathogen, commonly found in food processing environments, that causes life threatening listeriosis after eating contaminated foods including processed cheeses, meat and vegetables. Multiple genes for heavy metal resistance have been identified in *L. monocytogenes*.

The aim of this project is to investigate the role of related additional copper resistance mechanisms in increased infectivity and environmental persistence of *Listeria monocytogenes*. 
References


Techniques that will be undertaken during the project

Microbiological techniques, RNA and DNA analysis, bioinformatics, biochemistry, metalloproteomics, transcriptomics, infection models.