

Case Study

RAMAN AGAINST RESPIRATORY INFECTION

Helping to support biofilm models to assess novel interventions

Diagnosing a bacterial infection and determining the best treatment for it is typically a slow process, taking days, while successful clinical outcomes often depend on rapid prescription with effective antibiotics. This promotes the use of broad-spectrum or unnecessary antibiotics, which in turn contributes to the rise of antimicrobial resistance (AMR).

Dr Callum Highmore and his team at the University of Southampton have been investigating a rapid alternative to conventional infection diagnostics called Raman spectroscopy. The group have used this technique to characterise bacterial pathogens at the strain level and are now applying it to identify phenotypic information such as AMR profiles.

The team have developed and patented a new methodology for improved identification of bacteria called MX-Raman, and Dr Highmore has recently been awarded a Bridging Fellowship to transition from using pure bacterial cultures to examining clinical sputum samples using MX-Raman. This chapter of the project will be completed in summer 2024.

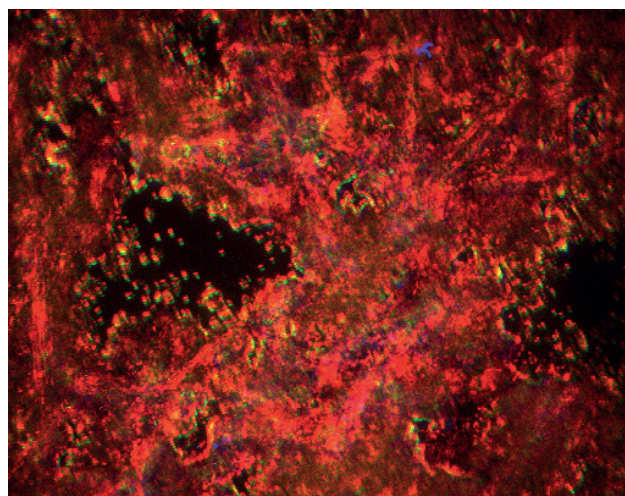
The outcome of this work will significantly benefit the public through rapid diagnosis of infection and treatment recommendations, reducing the burden of bed space on the NHS, improving clinical outcomes, and slowing the global development of AMR. Dr Highmore said,

“Being an NBIC-funded research fellow has really helped with both my professional development and with the progression of my research. We received some NBIC seed funding money, which has helped us open up a new dimension for this project, where we can use

Raman imaging to start to interrogate how biofilms sit together and interact without the use of labels. This will give us some important data for future fundamental studies into biofilms, particularly regarding how different species take prominence in infection and what that might mean for patients”

“NBIC has also offered a valuable framework for me to work with companies on several different projects, which pays for my time so I can work on this main Raman project for longer”.

The team are currently working to translate their work towards the clinic, by investigating clinical samples and building large data libraries to build predictive models for diagnosis. In the longer term, this will require greater input from engineers and computer scientists as they work towards a prototype commercial product.



Coherent anti-Stokes Raman spectroscopy (CARS) label-free image of a PAO1 biofilm, false colour. Excitation at 797 nm indicates the presence of lipids (red), protein (green), and DNA (blue). Image by Dr Callum Highmore.



Dr Callum Highmore

Dr Highmore is an NBIC Interdisciplinary Research Fellow at the University of Southampton investigating rapid and reagentless detection methods for pathogens and biofilms. His main research focus is developing Raman spectroscopy into a clinical diagnostic tool.