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School of Pharmacy PhD Project 2017 / 2018

Surface enhanced Raman spectroscopy (SERS) for rapid detection of lung infection in patients with Cystic Fibrosis (CF)

Professor Michael Tunney and Professor Steven Bell

Cystic fibrosis (CF) lung disease is characterized by chronic infection, inflammation and lung function decline. Patients frequently have flare-ups of their condition (pulmonary exacerbations) which result in a permanent loss of lung function and are a significant cause of morbidity and mortality. Culture-based detection of micro-organisms causing CF lung infection is slow, labour intensive and may overlook fastidious or slow-growing pathogens, thereby hindering prompt and effective treatment. Therefore, the aim of this project will be to develop a novel method for the rapid and simultaneous detection of multiple infectious agents directly from sputum without the need for culture using surface-enhanced Raman spectroscopy (SERS).

Initial work will focus on the identification of biomarkers unique to the principal pathogenic bacteria (Pseudomonas aeruginosa, Staphylococcus aureus and Burkholderia cepacia complex) detected in CF pulmonary infection by routine bacterial culture methods; these biomarkers will act as species specific bacterial footprints. There is a single published study relevant to this work which has shown that Pseudomonas aeruginosa has at least one SERS-active biomarker. Given that diverse polymicrobial communities are present in the CF airways, subsequent work will identify similar biomarkers for a range of other potentially pathogenic organisms including Stenotrophomonas, Achromobacter, Streptococcus, Mycobacterium, Prevotella and Veillonella. The SERS-based diagnostic method will then be used to determine the presence of these bacterial species in clinical CF sputum samples. As part of ongoing studies, we have an extensive biobank of >500 clinical sputum samples and associated clinical metadata collected from adult and paediatric CF patients. Bacteria present in these samples have already been determined by both culture and state-of-the-art Illumina next-generation sequencing. This will enable comparison of detection by SERS, culture and next-generation sequencing and determination of the sensitivity and specificity of the SERS assay.

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How to Apply

Postgraduate applications should be made using Queen's University Direct Applications Portal. Please note that there are two application processes: one for admission to the university and another for postgraduate awards.

Further Information

Additional information for prospective postgraduate students can be found on the School of Pharmacy website and the Queen's Postgraduate website.

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