Case Study

REDUCING BIOFILM FORMATION

National Biofilms Innovation Centre

Helping industry find academic partners to solve unmet needs

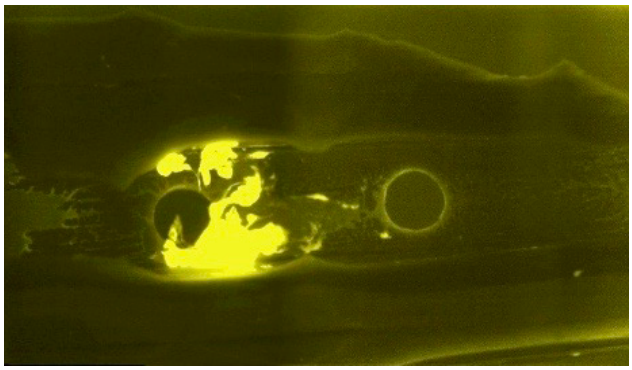
Central Venous Catheters (CVCs) are used in hospitals to deliver fluids, including medication, blood products, and nutrients into the veins of patients for extended periods of time. However, bacterial adhesion to the surface of catheters can lead to the growth of attached bacterial communities, known as biofilms.

Biofilm growth on catheters poses a serious infection risk for patients. In the UK alone, central venous catheter-related bloodstream infections account for 10-20% of hospital-acquired infections, increasing mortality, treatment costs and lengthy hospital stays.

Kimal PLC are a leading manufacturer and supplier of CVCs and dialysis catheters, providing disposable medical devices to hospitals around the world. At their innovation centre in Bromsgrove, their dedicated research and development team work on new products to improve patient outcomes.

Bacterial biofilm formation is complex and despite the severe infection problem that biofilms pose, there is little insight into how they form in venous catheters.

Through a Proof of Concept award from NBIC, researchers at the University of Edinburgh, Dr Susana Direito and Professor Rosalind Allen, worked with Kimal PLC to explore how three aspects of catheter design impact biofilm formation, using fluorescence microscopy, Scanning Electron Microscopy (SEM) and X-ray computed tomography; with a long-term goal of optimising their catheter products to reduce catheter-associated infections.



Fluorescence microscopy image showing a biofilm (Escherichia coli expressing Yellow Fluorescent Protein) within the lumen of a catheter, magnification: x2

The catheter design elements investigated were the shape of the lumen (interior tube), the size and shape of the skives (holes through which fluids exit the lumen) and the catheter surface coating.

The project was highly successful, and it identified immediate manufacturing steps that could be taken to improve catheter design and reduce biofilm formation.

To support future work with Kimal PLC, a PhD studentship was established through the Engineering and Physical Sciences Research Council (EPSRC) Soft Matter and Functional Interfaces (SOFI) CDT programme which works to provide industrially integrated post-graduate training in research, enterprise and innovation for future industry leaders. Further funding applications are also in the pipeline.

Professor Rosalind Allen

Principal Investigator

Professor Rosalind Allen is a Professor of Biological Physics at the University of Edinburgh. Her research interest is on how nutrient-cycling microbial ecosystems establish themselves and maintain their function.

Dr Susana Direito

Co-Investigator

Dr Susana Direito is a part of the Edinburgh Complex Fluids Partnership team within the University of Edinburgh. Her research interests include biofilm formation and advancing antimicrobial technologies.