

Case Study

FINDING TREATMENTS FOR EYE INFECTIONS

Helping to support biofilm models to assess novel interventions

Antibiotic-resistant bacterial and fungal eye infections pose a significant threat resulting in vision impairment or even blindness particularly in lower- to middle-income countries. In established eye infections, biofilms often form and are difficult to treat with conventional antibiotics, a problem exacerbated by the rise of antimicrobial resistance in a wide range of organisms. Biofilms are responsible for several chronic, ocular infections in man e.g. bacterial keratitis and lacrimal/periorbital infections.

In the Sheffield Collaboratorium for Antimicrobial Resistance and Biofilms (SCARAB), an Innovate UK-funded research facility within the University of Sheffield, a porcine corneal explant culture system has been developed for longer-term bacterial and fungal infection that allows us to study the initial, planktonic infection as well as microcolony and mature biofilm formation. Over the longer time-periods, the microbes cause disruption of the epithelium and penetrate into deeper layers of the corneum resulting in ulceration and eventual tissue destruction (see figure below).

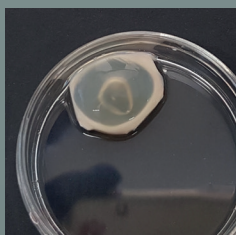


NBIC funded a study in SCARAB to examine the effectiveness of novel antimicrobial-drugs (Tecrea Ltd and Blueberry Therapeutics), against both clinically relevant bacterial and fungal species in the explant. We are exploiting the explant model of biofilm formation to determine the efficacy of a series of nanoparticle formulations of antimicrobial drugs on developing and mature biofilms. Such formulations are predicted to enhance efficacy through the disruption of biofilms and improved drug retention in the eye. The outcomes of the study will enable the identification of a core set of formulations that will be taken forward for commercialisation.

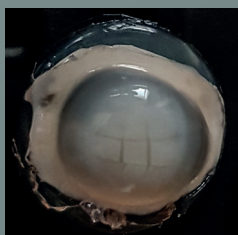
Project Summary

Bacterial and fungal keratitis is a major problem in many low/middle-income countries (LMIC). There is a need for stable and affordable treatments that can control diverse eye infections. Antimicrobial nanoparticle formulations can provide the antimicrobial and physical properties needed to destroy biofilm structures without damage to sensitive eye tissue.

A



B



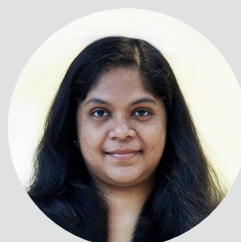
*Corneal explant biofilm model. A) Representative image of an uninfected corneum maintained in the laboratory for 5 days. B) Representative image of a corneum infected with *Pseudomonas aeruginosa*.*



Professor Peter Monk

Principal Investigator

Professor Peter Monk is a Professor of Immunology based at the Department of Immunology at the University of Sheffield. His research interest is in modelling infection in human tissues.



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Co-Investigator

Dr Esther Karunakaran is a Lecturer in the Department of Chemical and Biological Engineering at the University of Sheffield. Her research interests revolve around the investigation and application of biofilms in bio-processing.



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