MONASH University
Engineering

PhD Research Project

Understanding the interaction of biomimetic antimicrobial polymers with single species and mixed species biofilms

Supervisors:	Prof. Laurence Meagher, Dr Ana Traven and Professor Anton Peleg
Email:	Laurence.meagher@monash.edu
Phone:	9905 9395
Department:	Materials Science and Engineering

Description

The development of resistance by bacteria to commonly used antimicrobial agents such as antibiotics is one of the most significant threats to human health today. The formation of complex bacterial microenvironments or "biofilms" is particularly problematic in medicine today. There has been a significant effort over the last decade or so in the identification and testing of "non-traditional" antibiotic agents that do not develop resistance in microorganisms. One class of compounds are naturally occurring, host defence peptides which form a first line of defence against infection in most species. There are a number of key chemical features of these host defence peptides that can be mimicked simply in polymers, such as hydrophobicity and positive charge. We have developed a series of polymethacrylate compounds that have shown significant promise against a variety of microorganisms and some preliminary work has been carried out *in vitro* against established biofilms.

The experiments carried out in this project will increase our understanding of how the polymethacrylate compounds interact with the matrix components of established biofilms in order to optimise the composition and structure of the polymers with a view to maximising their efficacy in vitro and in vivo. In particular we would like to understand which interactions are important, any synergistic interactions that are present and also how to manipulate the interactions to increase efficacy and broaden the spectrum of action. The skill sets of relevance are the synthesis and characterisation of polymers with defined composition, structure and properties using controlled radical polymer chemistry. Characterisation of the components of the components of biofilm matrix and determination of the relevant interactions with polymers using a variety of molecular and physical characterisation techniques as well as techniques such as surface plasmon resonance and calorimetry. The efficacy of the surfaces prepared against bacteria will be assessed through existing collaborations in the Medicine, Nursing and Health Science Faculty as well as clinical collaborators at the Alfred Hospital in Melbourne and polymer chemistry collaborators at CSIRO Manufacturing.