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"The use of Experimental Microcosms in Studying the Effect of Selection on Ecological Dynamics and Biofilm Characteristics of Multi-species Bacterial Communities"

Multi-species biofilms are complex community assemblages pivotal within many ecological processes and prevalent in hospital infections, however little is known about the complex establishment, maturation and succession of these ubiquitous structures. Static liquid microcosms not only allow for the study of air-liquid (A-L) biofilm formation but also provide a system to explore the ecological dynamics of both bacterial populations and multi-species communities. Utilising this microcosm system we aim to explore the key steps and attributes required in accessing the A-L interface for subsequent biofilm formation using the model bacterium *Pseudomonas fluorescens* SBW25. We will then use this system to examine the impact of selection within a complex multi-species biofilm forming community, examining changes in biofilm characteristics and phenotypic behaviours as it undergoes selective pressure. We will explore interactions and dynamics within these communities, with an overall aim in concluding the key changes and factors that drive succession within a community. Finally as communities undergo selection and become less diverse we will investigate the impact this has on the resistance of these biofilm-forming communities. Developing an understanding of the succession and maturation within microbial communities, and the impact this has on the communities' response to disturbances has applications to both medical and ecological processes, allowing for an understanding of the progress of acute infections, and the maintenance or improvement of ecological beneficial microbial communities.

Within our current findings we have established a model of the key steps to successful biofilm formation within our microcosm system, and can confirm that biofilm formation is more successful than constant flagella-mediated aerotactic swimming at maintain cell within the high-O_2 A-L region. We have subjected a multi-species soil bacterial community to various selective pressures in serial transfer and preliminary findings have shown a decrease in community diversity as selection occurs. There is selection for oxidase, siderophore and catalase producing members within the community, however selection had very little impact on the overall community biofilm, with fluctuation of total growth, biofilm strength and biofilm attachment throughout. Within these selected communities more than one dominating member was responsible for contributing to the biofilm, with optimum biofilm characteristics reached between 4 and 8 members, after which competition or exploitation hinders further development. Along with further evidence of members being able to interact competitively, competition appears to be the main diver for selection when a community consists of similarly-capable member all trying to occupy the same niche. Our future work aims at comparing the resistance of our various communities, examining the effect a loss in diversity has on a communities ability to adapt or resist disturbance.