Novel Treatment of Chronic Bacterial Infection: Investigation and Multi-Compound Inhibition of Acyl-homoserine Lactone-Based Quorum Sensing in Pseudomonas aeruginosa and Its Role in Biofilm Development in vitro

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Pseudomonas aeruginosa (PA) is an opportunistic gram-negative bacterium that causes serious infection in immunocompromised patients. PA becomes much more pathogenic when it develops a biofilm where there are few effective treatments. Quorum sensing, which refers to the method by which bacteria communicate with each other via small signal molecules, has been proposed as a therapeutic target, as QS regulates biofilm development. The excessive use of antibiotics to treat bacterial infections has led to the emergence of multi-drug resistant bacteria. As a result, QS inhibition is being investigated for potential antibiotic development. Caffeine and vanilla extract have recently been shown in literature to have QS inhibitory properties in Chromobacterium violaceum. This study aimed to determine the role that QS plays in biofilm development through the use of these two novel inhibitor compounds. Microtiter plate assays were used to grow PA under optimal conditions. Crystal Violet assays, spectrophotometry, and plate reading were used to quantify biofilm mass. These analyses were performed over a 5-day period during which treatments of inhibition solutions were added to the media. It was observed that the biofilm mass of PA treated with the caffeine solution was notably less than the untreated samples. Samples treated with vanilla extract and samples treated with both solutions showed minimal decreases in biofilm mass. Since both water and alcohol were controlled for, it can be assumed that caffeine and vanilla show QS inhibition properties. These findings can be translated into development of novel methods for treating biofilm-based infection in cystic fibrosis patients.

Awards Won:
Second Award of $2,000