Silent Signals: Boronic Acids Quench E. coli Quorum Sensing

Lee, Eun Jae (School: Peachtree Ridge High School)

Quorum Sensing (QS) is a bacterial communication pathway that mediates population-based activity activities such as virulence, motility, conjugation, and biofilm formation. Specifically, QS-induced biofilms lead to higher resistance against antimicrobials, host immune response, and other external stresses. Escherichia coli is an opportunistic pathogen that performs quorum sensing through the luxS/lsrR-mediated system utilizing Autoinducer-2 (AI-2) as the primary signaling molecule. The LuxS synthase is also present among WHO's priority pathogens including Staphylococcus aureus, Salmonella typhimurium, and Streptococcus pneumoniae, and AI-2 acts as a "universal autoinducer" between species with differing characteristics, making E. coli a great candidate for quorum sensing research. This study explores the effects of boronic acid analogues on the E. coli QS system. Indole-4-boronic acid and 6-Bromo-3-pyridinylboronic acid were discovered to significantly decrease QS-induced biofilm production, and consequently, increase antibiotic efficacy. This study clearly demonstrates the potential of QS-based treatments in the medical field. As inexpensive, accessible, non-toxic, and low-risk supplements to traditional antibiotics, these treatments reverse resistance mechanisms and drastically increase the efficacy of existing therapies.

Awards Won: