Utilizing Glycolysis in Streptococcus pyogenes To Model Gastrointestinal Stromal Tumors (GISTs) in Response to Endogenous Stimulus-Powered Nanoreactors (Year 6)

Patel, Om (School: Eau Gallie High School)

This research stems from the growing threat of antibiotic resistance, lack of a swift and efficient drug delivery system, and the necessity of precision medicine in cancer and viral treatment. This study contrasted the performance of synthetic antibiotics versus natural antibiotic hybrids in an inorganic model of the jejunum consisting of acellular vasculature scaffolds parameterized by extracellular matrices. The potentials of such treatments were accompanied by the invention of nanoreactors (novel endogenous-powered nanocarriers) as a prospective economical and controlled therapy for cancers and infections. The multi-factor study utilized Streptococcus pyogenes' glycolytic pathway to model the carbohydrate metabolism of gastrointestinal stromal tumors' (GISTs). This research involved developing the hybrids in specified ratios amongst the Piper betel leaf and Ocimum tenuiflorum which served as the natural antibiotic hybrid test stock compared to tetracycline, which represented the synthetic antibiotic group. Both groups were encased in nanoreactors or traditional injections and released into an S. pyogenes infected jejunum consisting of cellulose-based decellularized spinach scaffolds. Following, data and statistical analysis were conducted to isolate deviations in strain spread, colony growth, and chemical signaling (through biofilm production and quorum sensing or QS) to derive the most reactive treatment along with the concentration group and drug delivery medium. Methodologies of image analysis entailed the calculation of area and pixel value statistics of colonies. Further procedures included the identification and cataloging of microbial growth, along with the quantification procedures of QS and biofilm growth.

Awards Won: