Targeting Unique Spectral Absorptions through Multi-Treatment Laser Therapies for Corresponding Differential Mortality Rates between Escherichia coli and Micrococcus luteus Bacteria

Feltham, Shana (School: Niles Township West High School)
Martinsen, Melanie (School: Niles Township West High School)

The focus of this project was the exploration of bacterial response to high-powered lasers over the course of multiple doses. Treatments by laser therapies are made possible by the unique spectral absorptions of different bacteria strains. With the emerging concern of bacterial resistance to antibiotics and antibacterial products – thus creating mutant strains of bacteria such as CREs (Carbapenem-resistant enterobacteriaceae) – we realized that new methods of eradicating bacteria are needed. Unlike other techniques of killing these pathogens, which aim to exterminate all bacteria, we wanted to develop a new therapy using lasers to preferentially kill the “bad” bacteria while avoiding harm to the “good.” We compared two strains – Escherichia coli (bad bacteria) and Micrococcus luteus (good bacteria) – spectroscopically and found a natural differentiation in spectral absorption at the green wavelength (532nm) where the E. coli was 1% more absorbent. From there, we evaluated the efficacy of multiple laser treatments on our bacteria cultures. We did this by applying our most effective irradiance we found last year (8 minutes at 11.5W) and testing the corresponding effect of multiple doses. By analyzing our samples using flow cytometry, we discovered that a mere 1% difference in spectral absorption yielded more than a 10x differential mortality rate of the E. coli bacterium with respect to M. luteus. This leads us to believe that increasing the difference in spectral absorption could potentially result in even higher differential mortality rates directly proportional to the amplified absorption variance.