Greater San Diego Science and Engineering Fair
2015 PROJECT SUMMARY

Name: Janie Kim **School:** Scripps Ranch High School **Grade:** 10 **Advisor:** Elaine Gillum

Project Title: Developing a Contact Lens Solution with an Expanded Range of Antimicrobial Activity

Abstract

Objectives/Goals: This third year project tested three combinations of contact lens solution preservatives—Chlorhexidine Gluconate (CHD)+Polyaminopropyl Biguanide (PAPB), Benzyl Alcohol+Edetate Disodium (EDTA), and Benzyl Alcohol+EDTA+CHD—for effectiveness against the Gram-Negative bacteria MRSA and the Gram-Positive *Pseudomonas Aeruginosa.*

Methods/Materials: This project tested the above three preservative combinations by performing serial dilutions to find the minimum inhibitory concentration (MIC). The preservatives' dilutions started at concentrations similar to what they were in commercial contact lens solutions that contain them. CHD was started at 0.002%, Benzyl Alcohol at 0.5%, and EDTA at 0.5%. The combination columns added these together. Bacteria were inoculated into the assay plate wells, and the MICs were determined after incubation.

Results: It was found that CHD+PAPB is more effective against the Gram-Positive MRSA (MIC of 0.00025% total amount of preservative) than Pseudomonas (MIC of 0.002%), and that Benzyl Alcohol+EDTA is more effective against MRSA (MIC of 0.0675%) than the Gram-Negative Pseudomonas (MIC of 0.135%). It was also found that the MIC against both MRSA and Pseudomonas was 0.06769% total amount of preservative (0.03375% Benzyl Alcohol + 0.03375% EDTA + 0.00019% CHD).

Conclusions/Discussions: CHD+PAPB was much more effective against MRSA than *P. aeruginosa.* It was found that CHD+PAPB is an ineffective combination with no synergy. Benzyl Alcohol+EDTA was more effective against MRSA than Pseudomonas, and CHD+PAPB was more effective against Pseudomonas than was Benzyl Alcohol+EDTA. However, there was synergy between Benzyl Alcohol and EDTA against Pseudomonas, both having individual MICs of 0.27% that dropped down to 0.135% when combined.

It was also discovered that Benzyl Alcohol, EDTA, and CHD combined have a synergistic effect against Pseudomonas. It was found that in Pseudomonas, the three preservatives' individual performance increased when in the presence of each other, each of their MICs when alone decreasing when within the combination. Despite no synergy against MRSA, the combination of the three was as effective against it as against Pseudomonas. This data suggests that adjusting the ratios of the three preservatives may result in a powerful contact lens solution effective against Gram-negative and Gram-positive bacteria.

Summary Statement

This project compared the antimicrobial effectiveness of Chlorhexidine Gluconate+Polyaminopropyl Biguanide, Benzyl Alcohol+Edetate Disodium, and Benzyl Alcohol+Edetate Disodium+Chlorhexidine Gluconate against MRSA TCH 1516 and *Pseudomonas aeruginosa* PA01 to find the combination with the greatest antimicrobial strength against both a Gram-Negatvie and Gram-Positive bacteria.

Help Received

Professor Victor Nizet graciously provided a lab to work in, and Mr. Leo Lin guided me through my experiment. Parents drove me to UCSD to conduct my experiment. Mrs. Elaine Gillum gave me advice on my project.