CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

S1518

Project Title

Effect of Novel Shock Inhibition on Efflux Pump Inhibitor NMP

Abstract

Objectives/Goals

My project aims to improve the efficiency of efflux pump inhibitor Naphthylmethyl Piperazine (NMP).

Methods/Materials

I performed my tests in New England Biotech's C2992 E. Coli strain. My idea of shock inhibition was dosing an efflux pump inducer (sodium dodecyl sulfate or ciprofloxacin), and then administering the putative inhibitor NMP. Using agar dilution, I compared the MIC's of the treatment groups. I then isolated RNA and performed rt-pcr in order to measure comparative gene expression.

Results

Shock inhibition decreased the MIC of ciprofloxacin by four fold, as opposed to two fold. Expression of resistance nodulating genes (AcrA/B, TolC, ompF, norE, marA) was significantly mitigated among the treatment groups.

Conclusions/Discussion

The performance of NMP was improved using Novel Shock Inhibition. Not only is a decrease in the amount of antibiotic needed achieved, but down regulation of key stress response genes was observed. Shock Inhibition offers a novel opportunity to increase efficiency of modern antibiotics, and my project also offers insight on the mechanistic action of NMP.

Summary Statement

I created and implemented a new way of fighting the antibiotic resistance crisis by trapping more antibiotic molecules within the bacterial cell.

Help Received

Dr. Jason Magida from Salk Institute trained me in mammalian RNA isolation and rt-pcr, but I am self-taught in how to translate these methods to bacterial models. I used equipment within Salk Institute Gene Expression Lab for my project. I also discussed my ideas with Mr. Ariel Haas, my biology teacher.