# CALIFORNIA STATE SCIENCE FAIR
# 2015 PROJECT SUMMARY

**Name(s)**

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**Project Number**

35538

**Project Title**

## TraY-cing the Origins of Antibiotic Resistance Spread through F Conjugation

**Abstract**

**Objectives/Goals**

With the increasing problem of antibiotic resistance in bacteria, there is a need for a different approach to combat bacterial infections without the continual abuse of antibiotics. This experiment demonstrates the viability for a novel approach; inhibition of horizontal gene exchange within a bacterial population to slow or halt the spread of antibiotic resistance genes.

**Methods/Materials**

To emulate the effects of TraY inhibition on conjugation rates, a predictive MatLab simulator was written using conditional probabilities to determine the effect of a TraY mutation on the colony populations of F' and F- bacteria. Results were then lab verified using F' DH5alpha E-Coli with an inhibited TraY site to test its effect on tetracycline resistance distribution within the population. Two oligo sequences encoding different TraY gene regions were electroporated into experimental F' groups, which were then integrated into F- populations to conjugate before being transferred into selective tetracycline media. Population densities of surviving F' were finally quantified by spectrophotometry.

**Results**

Simulation results using 0%, 50%, 80%, and 100% mutation in TraY showed that higher mutation percentages in F' resulted in restricted F' population growth. In vitro data similarly displayed significantly increased containment of the antibacterial resistant genes by the F' bacteria when the TraY gene was restricted in both oligo groups compared to the untreated control F'.

**Conclusions/Discussion**

Based on ANOVA analysis for simulation and lab experimental results, the simulation and lab data showed matching significant variances between the TraY restricted experimental and non-restricted control groups. This indicates that TraY plays a significant role in conjugation and thus the spread of antibiotic resistance within a bacterial population.

Here, targeting F conjugation is shown to effectively slow the rate antibiotic resistance distribution within a colony. With future research, novel medications targeting such processes within bacterial infections could be developed, allowing for horizontal containment of antibiotic resistance within a smaller population of bacteria.

**Summary Statement**

My project addresses the problem of antibiotic resistance in bacterial infections using a novel approach focusing on the genetic transfer of resistant genes between bacteria.

**Help Received**

Primarily used the lab space and equipment at my high school. Used the electroporator machine in Dr. Alexandre de Andrade's lab at ThermoFisher Scientific.

Preliminary