



**CALIFORNIA STATE SCIENCE FAIR  
2017 PROJECT SUMMARY**

<b>Name(s)</b> <b>Suhanee S. Mitragotri</b>	<b>Project Number</b> <b>J1714</b>
<b>Project Title</b> <b>Improving Selectivity of Antibiotics towards Pathogenic Bacteria</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Antibiotics have revolutionized medicine by providing an effective treatment against bacterial infections. While pathogenic bacteria cause serious health issues, our bodies also contain trillions of healthy bacteria that help our metabolism. Current antibiotics kill healthy and pathogenic bacteria alike, thus compromising our natural metabolism. The goal of this project was to test whether the selectivity of antibiotics towards pathogenic bacteria can be improved by using a combination rather than a single antibiotic.</p> <p><b>Methods/Materials</b> The main materials I used for this experiment include: petri dishes, Luria Broth agar, Escherichia Coli (pathogenic bacteria), Staphylococcus Epidermidis (non-pathogenic bacteria), ampicillin and kanamycin (antibiotics), and kitchen oven (Thermador, used as incubator). All bacteria were obtained from Home Science Tools and culture materials were obtained from Carolina Science Supplies. I prepared agar plates with ampicillin alone, kanamycin alone, 50:50 ampicillin: kanamycin, and no antibiotic in them (control). After the agar settled, I streaked E.Coli and Staphylococcus Epidermidis onto separate plates for 48 hours at 38 degrees C.</p> <p><b>Results</b> My hypothesis was largely supported by my experimental data. The combination of antibiotics eliminated pathogenic bacteria better than either antibiotic alone. Further, the combination spared non-pathogenic bacteria better than one of the antibiotics. A combination of ampicillin and kanamycin reduced the growth of E.Coli to only 6% coverage of the plate compared to 27.5% for untreated controls. This bactericidal effect was significantly higher compared to that observed for ampicillin alone (14.5%) or kanamycin alone (19%). The same combination of antibiotics enabled Staphylococcus Epidermidis to grow to cover 9% of the plate, which was greater than what kanamycin alone allowed (0%), but not as high as that allowed by ampicillin alone (20.5%).</p> <p><b>Conclusions/Discussion</b> My results show that the combination of antibiotics is effective in eliminating pathogenic bacteria, and has the potential to spare non-pathogenic bacteria. In future, this experiment could be conducted in a professional laboratory, which has greater access to a broader variety of antibiotics and bacterial species. Combining antibiotics is a frugal way to create more selective therapies for treating bacterial infections and diseases.</p>	
<b>Summary Statement</b> Combinations of antibiotics offer a safer and more effective method of treating pathogenic bacteria while sparing non-pathogenic native bacteria in the body.	
<b>Help Received</b> I conducted this experiment at home on my own, with occasional advice from Dr. Samir Mitragotri.	