



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY**

Name(s) Nathaniel Shin	Project Number J1611
Project Title Using Cu, Fe, ZnO, and AgNO₃ Microparticles as Antibacterial Agents to Create Inhibition Zones on DH5a E. coli Cultures	
<p style="text-align: center;">Abstract</p> <p>Objectives Antibiotic resistance is thought to be one of the greatest public health crises of the future. Microparticles possess unique properties that may lend themselves to inhibiting the growth of microorganisms. The utility of these compounds in this capacity has not been extensively explored. In this experiment, I attempted to create growth inhibition zones on colonies of DH5a E. coli as well as prove that these microparticles were able to create sterile fields by homogenizing Cu, Fe, ZnO, and AgNO₃ microparticles with the agar growth medium.</p> <p>Methods Antibacterial activity was measured by counting the number of visible colony forming units (CFUs). Each compound was pulverized into microparticles before being mixed with agar. All tests were conducted in a sterile area, and all contaminated materials were properly disposed of.</p> <p>Results The untreated control plates grew on average 43.25 ± 29.1 CFUs, the zinc oxide plates grew on average 3 ± 6 CFUs, and both the copper and silver nitrate groups had 0 CFUs.</p> <p>Conclusions My hypothesis was proven to be partially supported, as the Cu, ZnO, and AgNO₃ groups proved to be effective ($p < 0.05$) relative to the untreated control plates. Fe was not effective, while the Cu and AgNO₃ groups were completely devoid of visible CFUs. Because the microparticles were completely mixed into the agar, the exhibited antimicrobial effects were due to the creation of a sterile field, not contact killing. The present study demonstrates the antimicrobial properties of Cu, ZnO, and AgNO₃ and further highlights the potential of microparticles for advancing human health.</p>	
Summary Statement I used the unique properties of copper, iron, zinc oxide, and silver nitrate microparticles to create statistically significant inhibition zones on DH5a E. coli.	
Help Received I received help in gaining an understanding of the scientific method and editing my lab report from my teacher and Project Adviser, Ms. Gramajo. Contaminated materials were disposed of by Mr. Don Shin.	