



**CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY**

Name(s) Janie Kim	Project Number S1512
Project Title Development of an Effective, Low-Cost Hospital Room Disinfection System	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective was to develop an effective, low-cost, energy-efficient hospital room disinfection system, to target outbreak-causing Gram-negative bacteria such as CRE. This project aimed to create a novel combination of non-caustic disinfectants that could be nebulized by a surface acoustic wave (SAW) to be effective against multidrug-resistant bacteria.</p> <p>Methods/Materials The novel combination of non-caustic disinfectants (C30/P5/E5000) was first developed in six stages of experimentation that involved identifying the most potent antiseptic compounds contained within contact lens solutions and then confirming its effectiveness against multidrug-resistant bacteria. I then SAW-nebulized C30/P5/E5000 (as well as 10% bleach and 70% ethanol, two common hospital disinfectants) within a testing chamber that contained cutouts of 5 common hospital surfaces (plastics, stainless steel, rubber, glass) that each harbored 500,000 CFUs of bacteria, and then enumerated surviving CFUs after 60 minutes of total exposure time.</p> <p>Results C30/P5/E5000 in liquid form was very effective against the carbapenem-resistant Gram-negative bacteria (including <i>P. aeruginosa</i>, <i>K. pneumoniae</i>, <i>A. baumannii</i>, and ESBL-1 <i>E. coli</i>), and was more effective than any of the other disinfectants tested. When SAW-nebulized, it was still extremely effective against the CRE pathogens, almost eradicating all CFUs in a 5.7 log reduction (p-values < .0001). The SAW device was also able to successfully nebulize the other disinfectants.</p> <p>Conclusions/Discussion The SAW device, which is inexpensive (\$1) and requires little power (1 watt), was able to nebulize my novel disinfectant combination, C30/P5/E5000, to decontaminate five different types of surfaces harboring multidrug-resistant bacteria. This project showed the SAW device's potential for use in nebulizing disinfectants to kill pathogens on surfaces of important vehicles of disease transmission, such airplane cabins and hospital rooms. Use of this SAW-device+C30/P5/E5000 disinfection system would eliminate human error or inconsistencies from decontamination procedures, and help in preventing future CRE outbreaks.</p>	
Summary Statement I developed a novel low-cost and energy-efficient hospital room decontamination system that is especially effective against Gram-negative bacteria.	
Help Received Monika Kumaraswamy and Leo Lin supervised me, helped me, and taught me lab procedures. The Nizet Lab and the Friend Lab at UCSD provided equipment and lab space.	