



**CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY**

Name(s) Carol Tran	Project Number J1134
Project Title Comparing Effectiveness of Titanium Dioxide with Oxybenzone in Protecting Serratia marcescens against UV Radiation	
Abstract Objectives/Goals My objective was to use the Serratia marcescens bacteria to simulate a human body in a series of experiments that would determine whether the physical ingredient titanium dioxide in sunblocks or the chemical ingredient oxybenzone in sunscreens is more effective in protecting against ultraviolet radiation. Methods/Materials The sunblock and sunscreen tested had been carefully selected so that their only difference in active ingredients would distinctly be titanium dioxide or oxybenzone. Nutrient agar plates were streaked with a diluted Serratia marcescens bacteria solution and allowed to cultivate. Titanium dioxide sunblock and oxybenzone sunscreen were each spread onto separate plastic wrap sheets, which were placed over the bacteria as a protective covering from the ultraviolet radiation that the plates were to be exposed to. Two controls were also created: bacteria that would be exposed to UV radiation without any protection and bacteria that would not be exposed to any UV radiation. Ultraviolet radiation was induced using a germicidal lamp for specific time lengths throughout five trials. The Serratia marcescens were then observed, measured, and compared to identify the sun lotion that was more effective in protecting the bacteria from death. Results The titanium dioxide sunblock protected at least 10% more Serratia marcescens bacteria against ultraviolet radiation than the oxybenzone sunscreen. Bacteria growth of those exposed to the ultraviolet radiation without any protection decreased by approximately 50%, while the bacteria growth of those not exposed to the germicidal lamp increased by nearly 20% in most cases. Conclusions/Discussion Ultraviolet radiation exposure can result in extremely detrimental effects to living organisms unless sheltered with some form of effective protection. From my results, I can conclude that titanium dioxide is more effective in protecting against ultraviolet radiation than oxybenzone. Titanium dioxide is a physical ingredient that works by physically reflecting ultraviolet photons with its molecules' opacity rather than absorbing the photons as oxybenzone does. Its refractive index, resistance to discoloration under ultraviolet light, and insolubility enhances its stability and ability to protect human skin from the devastating effects of ultraviolet radiation overexposure.	
Summary Statement My project determined that in sun lotions, the physical ingredient titanium dioxide is more effective than the chemical ingredient oxybenzone in protecting against ultraviolet radiation.	
Help Received My mother helped me to cut and paste papers on to my display board.	