



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Laurine J. Shahmirian	Project Number J1234
Project Title Do Metallic Medical Implants Corrode in the Human Body?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this project is to investigate corrosion effects of human body fluid on titanium, stainless steel and copper.</p> <p>Methods/Materials I used titanium, stainless steel and copper and immersed them in distilled water, in saline, and in hydrochloric acid, representing gastric acid solution with pH of 1.5. I used 3 pieces of titanium, copper and stainless steel, measured their initial weight, and placed each in a lidded jar filled with the solutions and kept them in an incubator set at 37 oC. I took each metal out of its jar, measured its weight, the pH level of the solution, and the conductivity of the solution. I repeated this experiment for three trials.</p> <p>Results My results show that the weight loss for copper was 8 times that of stainless steel and 16 times that of titanium in hydrochloric acid solution. Titanium and stainless steel weight loss in saline solution and distilled water was less than 1%. The pH level of all three solutions with all three metals changed about 30%, however, the pH of the hydrochloric acid solution with copper increased by 180%. The increase of pH in hydrochloric acid and copper could be attributed to the increase in H⁺ ions in the solutions which are released by the chemical reaction of the hydrochloric acid with copper. Conductivity in all of the solutions remained about the same. The conductivity of copper in the hydrochloric acid solution decreased by 50%. This could be due to additional charged particles that are released in the solution due to corrosion of copper. The copper and HCl solution turned greenish blue with visible solid precipitates that covered the surface of the solution. I believe that when hydrochloric acid solution reacts with the solid copper, the hydrogen ions, H⁺, and the chloride ions, Cl⁻, in the HCl react with the copper resulting in a complex copper chloride ion, CuCl₃⁻. As the solution becomes diluted, the CuCl₃⁻ ions tend to lose Cl⁻ and their color shifts toward green indicating a mixture of different copper/chloride material, and eventually to blue indicating Cu²⁺ ions.</p> <p>Conclusions/Discussion My results indicate that the titanium and stainless steel are less likely to corrode in saline and hydrochloric acid solution, and my hypothesis was proven to be correct</p>	
Summary Statement This project compares corrosion effects on titanium, stainless steel, and copper immersed in distilled water, saline solution, and hydrochloric acid	
Help Received Father helped getting the material and test set up.	