



**CALIFORNIA STATE SCIENCE FAIR  
2014 PROJECT SUMMARY**

<b>Name(s)</b> Nicholas L. Finke	<b>Project Number</b> <b>J0209</b>
<b>Project Title</b> <b>The Amazing Power of the Microbial Fuel Cell! Making Energy from Organic Waste</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> A microbial fuel cell can generate electricity from organic waste. Bacteria in the organic waste generate extra protons and electrons during their digestive process. The electrons move from anode to cathode to create an electrical circuit. My objective with this project is to build a working microbial fuel cell and measure how the energy it produces increases and decreases over time. This project is important because it demonstrates how to make energy and fresh water from something that costs almost nothing and is widely available - organic waste. This can help disadvantaged people who live in underdeveloped countries.</p> <p><b>Methods/Materials</b> I had to build an anode, cathode, electrodes, and proton exchange membrane, and assemble them into the fuel cell. For the anode, I collected a benthic mud sample from a nearby lake as a substitute for organic waste, and for the cathode I used a conductive salt solution made from the lake water. I used an aquarium filter to pump air into the cathode. For one month I measured the current and voltage produced by the fuel cell using a digital multimeter. I built 3 separate fuel cells to be able to compare the measurements between them, and to have backups in case one didn't work.</p> <p><b>Results</b> The microbial fuel cell actually did produce electricity. The voltage output started out slowly increasing over a few days, made a steep upward incline, then leveled out reaching a peak of 470mV after 18 days, then finally started decreasing. The current also increased and decreased - it's graph had sort of a rainbow shape over the month.</p> <p><b>Conclusions/Discussion</b> My hypothesis was that the energy produced by the microbial fuel cell would increase for about 4 days, then decrease to zero as the bacteria in the benthic mud sample died out. My hypothesis was partially correct. For example, the voltage increased for 18 days (not 4), and it never went all the way down to zero. It stopped at 175mV. I think this happened because the bacteria didn't completely die out, because they still had matter in the benthic mud to feed on. If I had let the fuel cell run for a longer time, then probably all the bacteria would die out and the voltage would have gone to zero. Since I have demonstrated that the fuel cell works, I would like to build a huge one to generate energy for people who need it.</p>	
<b>Summary Statement</b> A microbial fuel cell can generate energy and fresh water from organic waste!	
<b>Help Received</b> My dad helped me use a power drill to build to the fuel cells.	