



**CALIFORNIA STATE SCIENCE FAIR  
2013 PROJECT SUMMARY**

<b>Name(s)</b> Colin S. Takeda	<b>Project Number</b> <b>J0297</b>
<b>Project Title</b> <b>Electricity from Garbage: Using a Microbial Fuel Cell to Create Energy from Food Waste</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> It is estimated that the average American throws out 33 pounds of food waste each month. For my family of four, that adds up to 1,584 pounds a year or about 4/5 of a ton. At the same time the world is facing an energy crisis by depending on fossil fuels, which will run out and are ruining our climate. My goal was to study if Microbial Fuel Cells could be a possible solution to both of these problems. Specifically with this project, I wanted to find out what types of food waste produce the greatest amount of electricity in a Microbial Fuel Cell (MFC).</p> <p><b>Methods/Materials</b> I built a two-chambered MFC out of PVC pipes and fittings. I used agar-agar and table salt to create a salt bridge between the chambers, replacement parts for a power drill as carbon electrodes, and commercially available septic tank treatment as a source of anaerobic bacteria. In a series of experiments I measured the electrical output of the MFC over one hour after adding a pureed sample of three food groups (fruits, vegetables and meats) as well as a mixture of all the food groups together. I also measured the output when sugar was added to the MFC. I measured the output of the MFC with only the septic tank treatment in it as the control. My independent variables were the different food blends and sugar. My dependent variable was the amount of electricity produced by the MFC.</p> <p><b>Results</b> All the food blends and sugar raised the electrical output of the MFC over the control. Sugar had the highest average output of 381.2 mV followed by fruits at 302.4 mV, the food mixture at 235.1 mV, meats at 210.0 mV, and vegetables at 195.4 mV. The control had an average output of 77.6 mV.</p> <p><b>Conclusions/Discussion</b> My hypothesis was correct: foods that release sugar faster (have a higher glycemic index) will generate more electricity. Sugar (sucrose) and fruits had a greater output than meats and vegetables. The food mixture sample had an output in the middle of these groups. I can see a future in which our houses are equipped with MFCs. It could be buried in the backyard and be attached to the garbage disposal underneath our kitchen sinks. This study, and other studies like it, could help us learn what it takes to maximize the electrical output of a home MFC. Having a home MFC would not only put to use all that food waste we now throw out, it would also decrease our dependence on fossil fuels.</p>	
<b>Summary Statement</b> This project evaluates the energy output of food waste when used for fuel in a Microbial Fuel Cell.	
<b>Help Received</b> My Mother help me with some of the cutting for my display board and my father taught me how to use Adobe Photoshop and Apple Numbers.	