



**CALIFORNIA STATE SCIENCE FAIR  
2015 PROJECT SUMMARY**

<b>Name(s)</b> <b>Ayan Bandyopadhyay</b>	<b>Project Number</b> <b>S1004</b>
<b>Project Title</b> <b>A Novel Microbial Fuel Cell Using Cobalt (II) Biomineralization to Increase Power Density</b>	
<div><div><b>Objectives/Goals</b> Wastewater treatment plants consume a significant portion of the electricity produced in the U.S. Microbial fuel cells(MFC's) have been developed to mitigate this problem by producing electricity from the organic waste while breaking it down. However, these MFCs have low power output due to low reduction potential at the cathode. Biocathodes involving bacterial oxidation of ions provide a possible solution to this problem. The purpose of this experiment was to determine whether a novel cobalt biocathode would increase power density more than the previously developed manganese biocathode.</div><div><b>Abstract</b></div><div><b>Methods/Materials</b> Shewanella oneidensis was used to oxidize organic material in the anode chamber and Leptothrix cholodnii was used in the biocathodes. Three types of MFCs were built. One used a manganese biocathode, and another used a cobalt biocathode. A control group with oxygen reduction at the cathode was used. Power output was measured for 30 seconds, the amount of time it took to stabilize. An Arduino micro was used to measure voltage.</div><div><b>Results</b> While the manganese biocathode increased power density by 267% with respect to the control group, the cobalt biocathode increased power density by 594% with respect to the control group.</div><div><b>Conclusions/Discussion</b> The cobalt biocathode resulted in a higher power density than both the control group and the manganese biocathode, but its effects can be further improved by increasing the rate of microbial cobalt oxidation. Another benefit of using the cobalt biocathode is that it will remove Cobalt(II), which is a carcinogen in industrial waste.</div></div>	
<b>Summary Statement</b> The ability of a novel cobalt biocathode to increase power density while purifying wastewater in an MFC was tested	
<b>Help Received</b> Used equipment under the supervision of Dr. Khalaf and Dr. Ismail at Schmahl Science Workshops. Parents helped set up board.	