# CALIFORNIA STATE SCIENCE FAIR
## 2012 PROJECT SUMMARY

**Name(s)**
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**Project Number**
**S0504**

**Project Title**
# Effect of Temperature + Electrode Size on Electric Production + Growth of Electric Production of Microbial Fuel Cells

**Abstract**

**Objectives/Goals**
The objective is to increase efficiency of a microbial fuel cell. It is predicted that increased temperature and surface area will increase the voltage the microbial fuel cell produces.

**Methods/Materials**
Nine microbial fuel cells (MFC) were built using plastic containers, carbon cloth and copper wire, using mud as the source of bacteria in the anode. Each MFC was placed in one of three different temperature environments and built with one of three electrode surface areas. Voltage was taken from these MFCs twice daily for five days, then the mud was refreshed and the experiment repeated for a total of 4 trials.

**Results**
The results showed that increased temperature increased the voltage, up to 27ºC, and had no effect on the growth of the voltage over the five days. Increased surface area of the electrode increased the voltage but had no effect on the growth of the voltage. The combination of the variables had no effect on both the voltage and its growth rate. Based on the data from this experiment, for an optimized MFC, the fuel cell should be in an environment of 27ºC, and have a large 40 cm2 electrode.

**Conclusions/Discussion**
MFCs are devices that utilize the chemical reactions of anaerobic bacterial respiration to create electricity. The results supported my hypotheses and gave a good general range for temperature, and showed that maximizing electrode surface area improves efficiency. The data also showed that temperature had a larger effect on the voltage than the electrode size, which leads to the conclusion that improving the bacteria#s environment is more effective than improving aspects of MFC design. Microbial fuel cell technology can be a very useful technology in the emerging renewable energy market. With its capability to process waste and power itself at the same time, an integrated MFC would be the perfect counterpart to a waste treatment facility.

**Summary Statement**
This project is designed to improve the electrical production efficiency of a microbial fuel cell through the variation of temperature and electrode surface area.

**Help Received**
Parents provided financial aid