



# CALIFORNIA STATE SCIENCE FAIR 2015 PROJECT SUMMARY

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<b>Project Title</b> A Novel Approach to the Analysis of Soil-Based Microbial Fuel Cells	
<b>Objectives/Goals</b> This experiment was designed to determine if bacterial metabolism plays an important role in soil-based Microbial Fuel Cells based on its increase or decrease in voltage, amperage, wattage, and chemical process the soil microbes (bacteria) undergo. <b>Abstract</b> <b>Methods/Materials</b> Using one control (100% soil) and seven variables I added soil (From under the roots to obtain bacteria) and mixtures accordingly into 8 mason jars. I then put in copper and zinc electrodes on opposite ends in the soil. Soldered the wires to the electrodes. Checked every day for the voltage and amperage until the 21 day period and repeat it. Also I did agar plating, gram staining, and microscopic viewing of bacteria. In addition, I conducted an Oxidative-Fermentation test to see if the bacteria oxidized or fermented and to test motility. <b>Results</b> The variable 90% soil 10% coffee grounds had the highest linear trend and 90% soil 10% coffee grounds had the second highest linear trend. Soil + peptone had the highest average of all three trials in microwatts and 90% soil 10% coffee grounds had the second highest average of the three trials. Soil + peptone + glucose had the third highest average in microwatts. The soil microbes (bacteria) were mostly all gram negative and the pH was neutral. The seven variables and one control were mostly fermentative except for 100% soil and soil + peptone which were oxidative. <b>Conclusions/Discussion</b> Proteins, glucose, and organic matter along with bacterial metabolism do play an important role in soil-based MFC's. Soil microbes metabolize proteins and organic matter into smaller molecules to release energy or ATP using oxidation or fermentation. They undergo glycolysis and the Krebs cycle to metabolize. These chemicals then get transferred to the electrodes to make electricity. The more electron producing, metabolic bacteria are in the soil, the more electricity the soil-based MFC produces. The more knowledge we have about how bacteria metabolize, the more energy can be produced from a single soil-based Microbial Fuel Cell.	
<b>Summary Statement</b> The analytical analysis of how soil-based Microbial Fuel Cells work.	
<b>Help Received</b> Mom helped keep a schedule. Dad paid all the materials/supplies I needed. Mr. Maxwell an AP Biology teacher from San Jacinto High School helped me with the Oxidative-Fermentation Test.	