



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

Name(s) Jack D.S. Ireland	Project Number J0816
Project Title Poop to Power: Microbial Fuel Cell Uses Chemistry and Microbiology to Ease Environmental Problem and Create Electricity	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Cleaning our country's (and others') waste water (poop) requires significant electricity which creates more pollution, chemicals and water in other places of society. Furthermore poorer countries often have bad sewage disposal or none at all which can make people sick. My goal is to see if building a giant Microbial Fuel Cell (MFC) would be a rational way of generating electricity, and cleaning water on a higher level. If I can succeed, it could help poorer countries bring more electricity to society, clean their water more efficiently and kill two birds with one stone.</p> <p>Methods/Materials I built two Microbial Fuel Cells (one small one and one three times larger) using two chambers (anode/cathode) and identical materials. I used carbon fiber brushes as electrodes and sewage fortified with E. Coli in the sealed anode chamber. I also dissolved L-Cysteine in the sewage solution to remove dissolved oxygen, hopefully forcing the E. Coli to break down the poop anaerobically, which releases more electrons. In the cathode chamber I used carbon fiber-platinum catalyst as electrodes and phosphate buffered saline as the conductive solution. I bubbled air through this solution constantly to maintain a high level of oxygen so there would be plenty of cations. I separated the anode and cathode chambers with a membrane that allows cations to pass through, but not electrons, forcing electrons to travel up the electrode's wire and generate electricity. I used two digital multimeters connected to a computer to log the voltage and amperage every minute for a few days for each MFC.</p> <p>Results The voltage output of the MFCs jumped around during the first twelve hours, but then both MFCs leveled off (except when it dropped during the cold early morning hours) around 200 millivolts. The larger MFC put out much more than three times the amperage of the smaller MFC.</p> <p>Conclusions/Discussion I couldn't get enough volts or amps to run my iPod. Even though an MFC using millions of gallons of sewage every day could generate significant power, it still is not enough to run the plant or cover the cost of building and running the giant MFC. My conclusion is that using an MFC to treat waste water for a whole city is an irrational idea until further scientific breakthroughs.</p>	
Summary Statement I wanted to build a microbial fuel cell using poop that would run my iPod and see if a large MFC at a water treatment plant would generate (not consume) significant electricity while breaking down wastewater contaminants at the same time.	
Help Received Dr. Nielson: anode brushes; Dr. Grot (Ion Power): proton exchange membranes; Mr. Morse (E-tek): platinum-carbon catalyst; Mr. Voller (Ajinomoto): L-Cysteine; Mr. Donati: sewage sample; Mrs. Vodraska: lab materials, 2 rubber stoppers and 30 grams of potassium chloride. My parents paid for stuff.	