THE OHIO STATE UNIVERSITY

Microbial Fuel Cell questions for discussions, exams, essays, and projects

- Describe the flow of electrons and protons in a microbial fuel cell and how it converts chemical energy into electrical energy.
- Describe how the microorganisms acquire energy from substrates and release energy to the MFC's electrical circuit.
- List 3 technologies for generating renewable energy. Compare each with the MFC in terms of availability of materials, applicability, relative cost, ease of use, and effectiveness. Which technology would you recommend? Could different technologies be more appropriate for different applications? List two.
- Scientists did not predict that global warming could have resulted from increased use of energy derived from fossil fuels during early development Could you predict any negative unintended consequences (environmental/social) that might arise from potential future widespread use of MFCs?
- What could be the benefits to society arising from potential future widespread use of MFCs?
- CLASS PROJECT: Construct a MFC and operate it for two weeks (have a student take it home for weekend measurements and fun). Take voltage measurements twice daily, record date, time, voltage, and how much you are feeding them. Have the instructor compile and distribute the data you collected. Make a graph of the voltage over time. What trends do you see in the data? For example, could feeding events have anything to do with peaks? Is the MFC's overall performance improving over time? Extra: record temperature and make a graph with a secondary y-axis that presents both voltage and temperature over time. Is there a trend?
- ADVANCE PROJECT: Some argue that a design should be continually assessed and the ideas of the design should be tested, adapted and redefined. Observe the MFCs in Figure 1 and Figure 2. Figure 1 illustrates the 1st generation of MFC design at OSU and Figure 2 the 2nd generation. Table 1 presents the maximum performance values of each fuel cell design. Why do you think changes were made in the first design? What kind of changes would you make to design the 3rd generation MFC? Draw a model of your proposed design. Build it and test it!

Table 1: Comparison of voltage, power, and volume between 1st and 2nd generation MFC design

	1st Generation Design	2nd Generation Design
Voltage	600 mV	740 mV
Volumetric Power Density	1.3 W/m3	3.5 W/m3
Working Volume (per compartment)	400 ml	100 ml