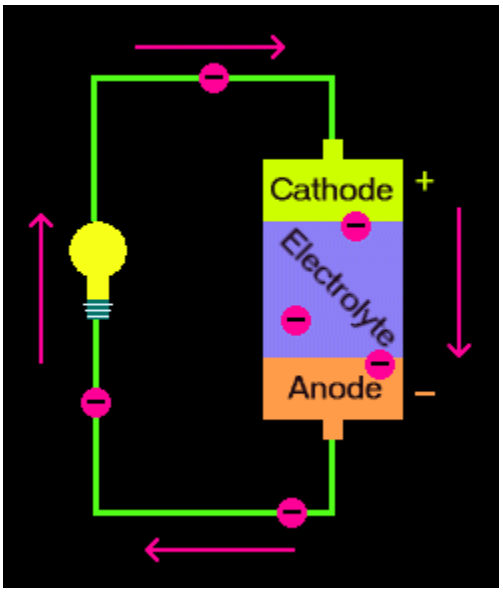
The Power of Algae:

The Creation of an Algae Battery to Generate Electricity

Objective: We will learn Ohm's law and basic background of battery function. We will measure the voltage produced by a cell of algae and determine the amount of algae needed to power various processes.

Introduction:

Electricity is a form of energy that results from the existence of charged particles - such as electrons or protons - either statically or dynamically as a current.



A battery can be defined as a container consisting of one or more cells, in which chemical energy is converted into electricity and used as a source of power. Figure 1 shows a schematic of a battery

- The anode is negatively charged.
- The cathode is positively charged.
- The electrolyte is a chemical medium between the anode and cathode that carries electrical charge.

Chemical reactions within the electrolyte cause a buildup of electrons at the negatively charged anode, resulting in an electrical difference between the anode and cathode. The electrons will want to rearrange themselves in order to get rid of the electrical difference, so they will want to go to the cathode. The electrolyte prevents electrons flowing straight from the anode to the cathode through the battery, however when there is a closed circuit, as shown in Figure 1, electrons will be able to flow to the cathode through the wire. This flow of electrons produced electricity.

Voltage, which defines the power potential of a battery, can be measured using a voltage meter. Knowing the voltage, the current can be calculated using Ohm's Law, shown in Equation 1. Current is defined as the flow of electricity which results from the ordered directional movement of electrically charged particles.

$$I = V/R \qquad \text{Eq. 1}$$

Where: I is current in amperes (A) V is voltage in volts (V) R is resistance in Ohms (Ω)

Algae as an electrolyte

An electrolyte is a liquid or gel that contains ions and can be decomposed by electrolysis. Microorganisms, like algae, are naturally negatively charged and contain negative ions. Thus, algae can be utilized as an electrolyte in a battery. The use of algae as a battery electrolyte would mitigate the use of toxic compounds that are currently found in most batteries. The purpose of this experiment is to determine the voltage that can be produced by a cell of algae.

Materials:

- ☐ 400 mL of algae per cell
- ☐ (4) 1000 mL beakers
- ☐ Algae stock
- ☐ Anode (
- ☐ Cathode (
- ☐ Small alligator clips

Procedure:

- ☐ Obtain 400 mL of algae in a clean beaker.
- ☐ Insert anode and cathode.
- ☐ Attach one alligator clip to top of cathode and the other clip to the top of the anode. This creates the closed loop.
- ☐ Place the probe of the voltage meter in the algae cell.
- ☐ Allow voltage reading to stabilize and record.
- ☐ Repeat this procedure with cells in series, recording the total volume of algae and voltage measurement for each trial.
- ☐ Calculate the conductivity for each trial.
- ☐ Determine the relationships between algae volume, voltage, and conductivity.

Data Collection:

Number of Cells	**Total Volume of Algae (mL)**	**Voltage**

Cathode

Material	**Resistance (Ω*m)**	**Length (m)**	**Resistance (Ω)**

Anode

Material	**Resistance (Ω*m)**	**Length (m)**	**Resistance (Ω)**

Results:

Based on your results, determine the volume of algae that would be necessary to power the following processes.

Process	Power Requirement (V)	Algae Needed (mL)
Computer		
Light bulb		