**Improving Electricity Generation from Bacteria**

*Escherichia coli* are bacteria that live in most mammal intestines. There are many strains of this microbe: some cause gastrointestinal and urinary tract infections, while others aid digestion. Researchers are now finding that *E. coli* can also help to power new types of fuel cells.

Fuel cells, which convert chemical energy into electrical energy, offer many advantages over conventional energy devices. Fuel cells use renewable energy sources, and they generate energy without combustion, which makes them environmentally friendly. In addition, their efficiency is not limited by temperature, as is the case of the heat engine.

A microbial fuel cell (MFC) uses organisms such as *E. coli* as catalysts to convert organic matter into electricity. The microbes consume fuels such as glucose (sugar) and then produce carbon dioxide, protons, and electrons. From these electrons comes the electricity generated by the MFC.

In contrast to conventional fuel cells, MFCs operate at relatively low temperature and pressure, and they do not require expensive precious metals as catalysts. Because they can employ diverse microbes, they can use many different organic fuels as electron sources. They provide a clean and promising source of energy.

However, MFC technology is still in its early stages of development, and several areas need improvement. At present, the power output from these fuel cells is small. *E. coli* fuel cells need further development so that they can generate more power. In addition, researchers need a model to predict what additional changes can be made to bacterial cells to enhance their generation of electricity in MFCs.

This project aims to create a more productive strain of *E. coli* and therefore to significantly increase the power output from MFCs. Its goal is to engineer *E. coli* cells that produce electrons at higher rates. Each time a new mutation is introduced, its rate of electron production will be measured. If the mutation is more productive than its parent, the mutation will be retained for further use. The research will also apply a promising model for predicting additional, potentially useful mutations.

Possible uses for MFCs include both small-scale applications, such as medical devices powered by glucose in the blood, and large-scale applications, such as water treatment plants powered by organic waste.

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*Escherichia coli*: a renewable source of energy

Photo: Rocky Mountain Laboratories, National Institute of Allergy and Infectious Disease, NIH