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Motivation

Due to our increasingly depleting fossil fuel sources, the quest for new energy sources has raised a great interest in Microbial Fuel Cell technology as a possible candidate for long-term, sustainable, energy generation.

Following the principle of a chemical fuel cell, energy is converted to electricity, efficiently and free of harmful end products utilizing living micro-organisms as a catalyst. The Microbial Fuel Cell concept is possible due to exocellular electron transfer where electrons are passed on from the organism to an inert electrode (fig. 1).

Soluble compounds, certain antibiotics, quinones, riboflavin, sulfur compound shuttles and even humic substances can function as extracellular electron mediators thus facilitating respiration via exocellular electron transfer.

Certain microbes seem to also possess another means of transferring electrons directly without the use of mediator, instead special conductive pili are utilized, the so-called nanowires.



Above: Cyanobacterium *Synechocystis* sitting on an electrode in a photovoltaic microbial fuel cell (Susan Jones, *Nature Reviews Microbiology* 4, 642 (2006) <http://www.nature.com>, Yuri Gorby).

Right: Mixed anaerobic culture on electrode in a heterotrophic microbial fuel cell (Wageningen University, Nienke Stein & Jingjing Zhao).

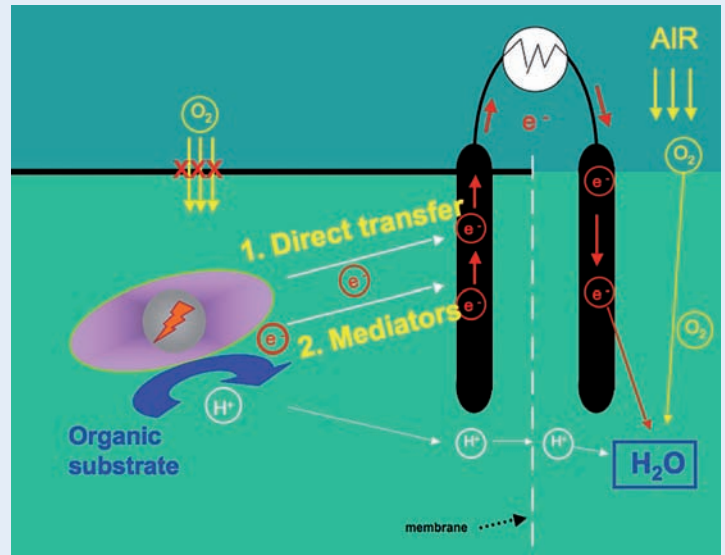


Fig. 1. A microbial fuel cell where an anaerobic bacterium degrades organic substances thus generating protons and electrons. Electricity is produced due to electrons "passed-off" to an electrode

Technological challenge

The challenge of this research is to control the microbial ecology of a running MFC in order to efficiently generate electricity. Further optimization is needed in order for the system to operate as a large-scale application. Improving the electron transfer in a MFC is crucial for electricity production. This can be achieved by gaining a better understanding of the microbial community and the microbial mechanisms of electron transfer in a MFC.

