WIRELESS COMMUNICATION BY AN AUTONOMOUS SELF-POWERED CYBORG INSECT

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A trehalose/oxygen biofuel cell was implanted in *Blaberus discoidalis* to convert chemical energy stored within the insect hemolymph into electrical energy which was then used to power a custom-designed oscillator mounted on the back of the insect, capable of producing signals in the audible range. The ability of this cyborg to generate and transmit signals wirelessly was demonstrated by placing an external receiver up to a few centimeters away from the insect while it was tethered to a device that enabled it to walk in place on top of a light weight, air-suspended solid sphere. Wireless communication could also be established between the transmitter powered by the same type of biofuel cell implanted in the moth *Manduca sexta* and the receiver, while the live insect was being restrained with wax in a Petri dish. Possible means of reducing the weight and size of the transmitter so as to allow the moth to carry it in flight are discussed.

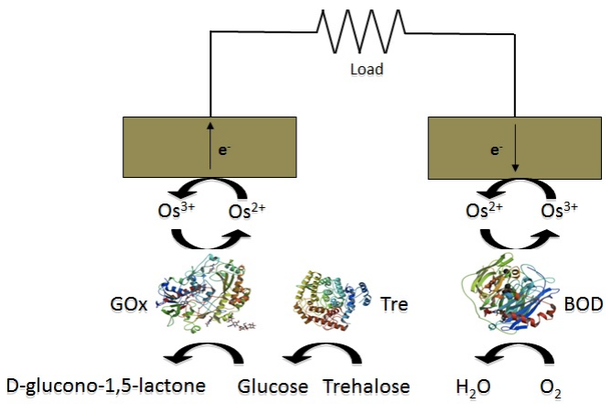
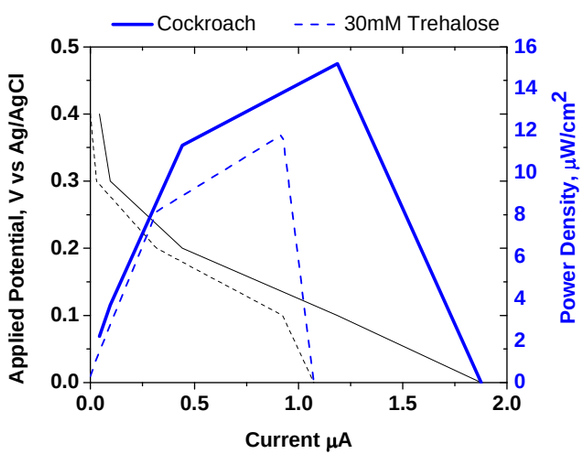


Figure 1. Schematic of trehalose/ dioxygen biofuel cell

A.



B.

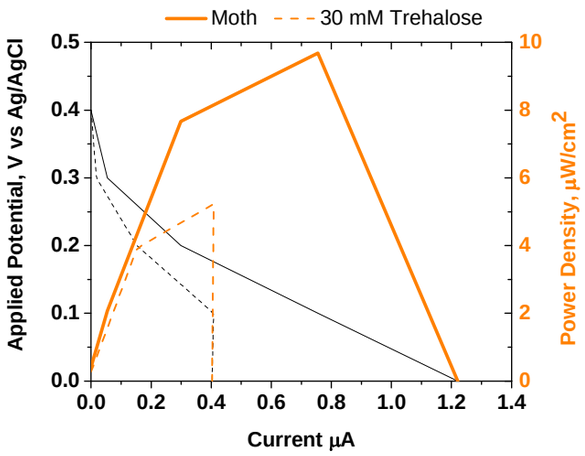


Figure 2. Applied potential vs. current and power density vs. current of 2 different biofuel cells implanted in **A)** a cockroach and **B)** a moth, geometric area of anode 0.0078cm^2 and cathode 0.031cm^2. The biofuel cell was tested in vitro before implantation in a 30mM trehalose solution exposed to O_2.

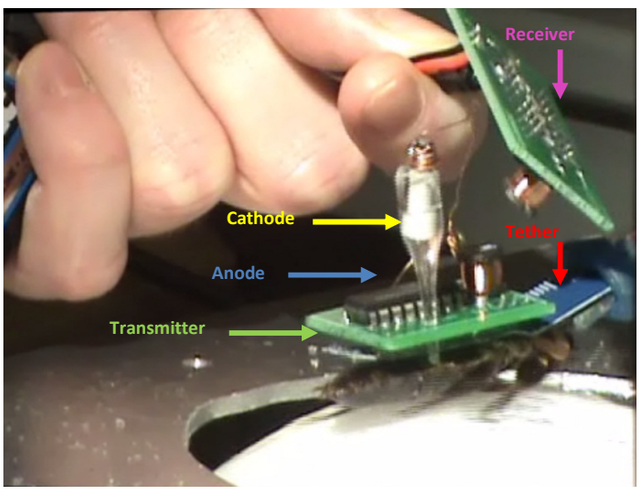


Figure 3. Biofuel cell implanted in a cockroach