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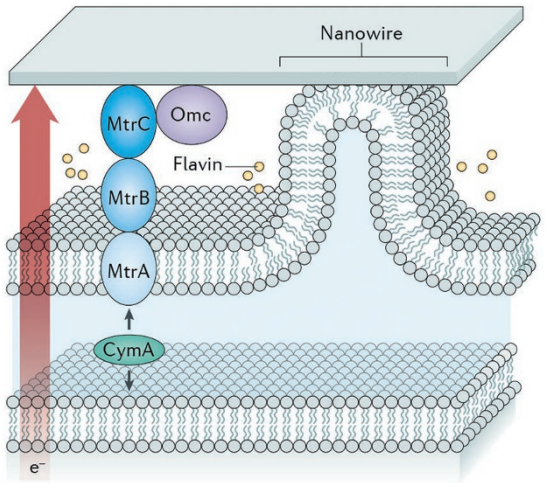
IN BRIEF

BIOCATALYSIS

Electrons travel between the animate and the inanimate



Adapted from Kumar, A. et al. (2017), Macmillan Publishers Limited

The metabolisms of electrotrophic and electrogenic microorganisms involve enzymatic catalysis of cathodic and anodic reactions, respectively. In principle, we can mediate these fuel-forming and fuel-consuming reactions by using solid-state electrodes colonized by these bacteria. Preparing functional bioelectrodes may require genetic engineering to enhance catalytic activity and stability, and to tune product distributions. When multiple microorganisms are required, there are many ways in which one can grow communities, of which only a few may happily thrive and process fuels for us.

The utility of bioelectrodes also depends on the solid-state component, the surface of which may need to be functionalized in order to encourage microorganisms to densely populate it. Of course, the electrode must also participate in rapid heterogeneous electron transfer with the microorganisms. Penned by Amit Kumar and colleagues, a recent *Nature Reviews Chemistry* article describes the mechanisms by which microorganism–electrode electron transfers occur. For example, electrons can be shuttled by small molecules or proteins, or instead hop along pili — towers of stacked redox-active proteins that bridge the space between microbes and the electrode. Knowledge of these processes will help us develop a highly active and stable bioelectrochemical system, a goal shared by many interdisciplinary teams across the globe.

David Schilter

ORIGINAL ARTICLE Kumar, A. et al. The ins and outs of microorganism–electrode electron transfer reactions. *Nat. Rev. Chem.* **1**, 0024 (2017)