Enhancing microbe-electrode interactions for bioelectrochemical devices

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Microbial metabolisms offer large reaction networks that can be exploited for both energy and chemical production in bio-electrochemical devices. These systems rely on extracellular electron exchange between microbes and electrodes. Catabolic processes can fuel electron transfer from microbes to electrodes for bioelectricity generation, while anabolic processes can benefit from an electron influx for intracellular regeneration of reducing equivalents. This versatility enables a wide range of applications, including bioremediation, biosensing, and chemical production. However, electron transfer between electrodes and microbes is often limiting, thus negatively impacting device performances [1]. We address this bottleneck from both biological and electrode engineering perspectives. Our work focuses on engineering microbes and electrodes using nanoparticles [2], biosynthetic and conductive polymers [3-5], as well as the heterologous expression of extracellular electron transfer pathways [6]. These advances in improving the electrode-microbe interactions increase energy production in microbial fuel cells for wastewater treatment and in bio-photovoltaics for solar energy conversion. The combination of these cross-disciplinary advances thus pushes forward the development of efficient microbial bioelectronic technologies.

References

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