



ScienceDirect

Biotechnology Advances

Volume 37, Issue 6, 1 November 2019, 107351

Research review paper

Towards development of electrogenetics using electrochemically active bacteria

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Abstract

Owing to the ability for efficient electric interaction with electrodes, electrochemically active bacteria (EAB) attract considerable attention in biotechnology. These bacteria are involved not only in the generation of electricity from organic wastes in microbial fuel cells but also in the production of valued chemicals with the aid of electric energy in microbial electrosynthesis systems. It has been known that metabolic activities in EAB are affected by electrode potentials, while a recent work has found that in an EAB, *Shewanella oneidensis* MR-1, an Arc regulatory system regulates the expression of diverse catabolic genes by sensing electrode potentials. This finding suggests that the Arc system can be used for electrode potential-dependent control of gene expression in living cells and opens up a novel biotechnology platform, termed “electrogenetics”. This article summarizes current knowledge on the catabolic and regulatory systems in EAB with a particular focus on the role of the Arc system and suggests the potential of electrogenetics in biotechnology.

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Keywords

Exoelectrogen; Electrotroph; Bioelectrochemical system; Microbial fuel cell;

Microbial electrosynthesis; Potentiostat; Two-component system; Extracellular electron transfer

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