Microbial Bioelectrochemistry

A central part of the work of the Rosenbaum Lab is focused around bioelectrochemical systems and defined microbial mixed cultures. Specifically, our research interests are the investigation, understanding, and manipulation of microorganisms, which are in electrochemical interaction with electrodes and of inter-microbial relationships in these environments. While the overall goals of our efforts are the development and advancement of new biotechnological applications, we seek to uncover the bioelectrochemical and physiological principles of the microbial systems we use.

Our main work concerns the investigation of ecological effects of different *Pseudomonas aeruginosa* strains in bioelectrochemical systems especially under the influence of 2,3-butanediol producing partner organisms. We investigate the genetic, regulatory and functional foundation of phenazine redox-mediator based electron transfer by *P. aeruginosa* and its partners and translate phenazine-based electroactivity to new biotechnological systems. In a collaboration with Lars Blank (iAMB, RWTH Aachen), we genetically introduced phenazine electroactivity into the biotechnologically promising host *Pseudomonas putida* to allow it to discharge electrons to an anode under oxygen limitation conditions. From this, new possibilities for oxygen limited bioproductions of for example the biodetergents rhamnolipids arise.

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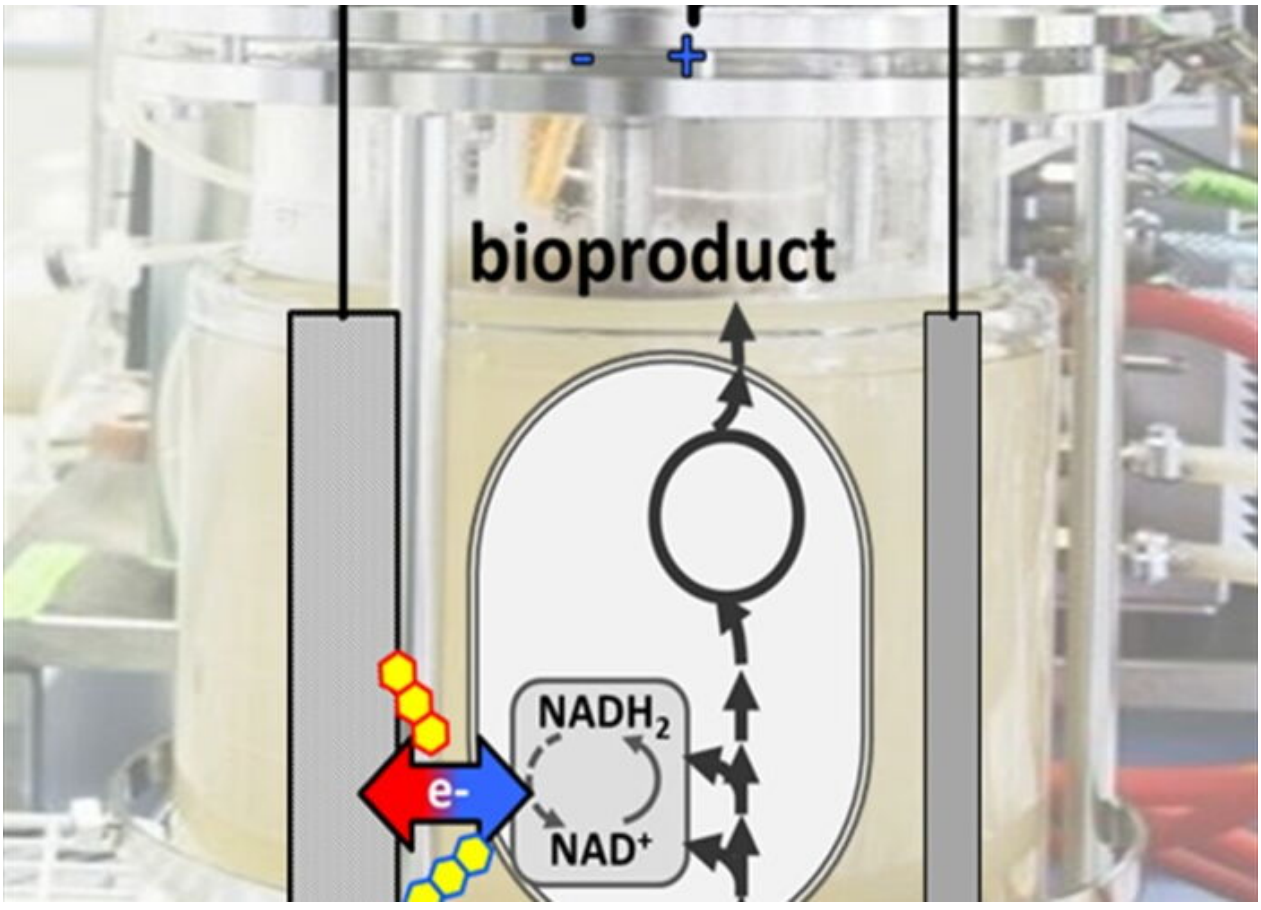
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The initial work on phenazine synthesis in *P. putida* won the best scientific paper award 2015 of the International Society of Microbial Electrochemistry and Technology – ISMET: "Engineering mediator-based electroactivity in the obligate aerobic bacterium *Pseudomonas putida* KT2440" Frontiers in Microbiology 2015.

Besides phenazine-based electron discharge to an anode, we also investigate cathodic electron uptake by acetogenic microorganisms. We are searching for new electroactive candidates and are developing molecular tools to develop biotechnologically-relevant reactions for *Clostridium ljungdahlii* as cathodic host.

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