Biosens J 2018, Volume 7
DOI: 10.4172/2090-4967-C1-003

Enzyme engineering in bioelectrochemical systems

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Coupling between redox enzymes and electrodes relies first and foremost on a successful interfacing between the enzymes and the inorganic surfaces with which they interact. An interface that allows from one hand a specific analyte recognition and on the other hand an efficient signal transduction. Some of the challenges in interfacing between biological molecules and inorganic materials stem from wrong orientation of the enzyme towards the interface and from the need to use mediated electron transfer with a diffusional redox mediator due to a difficulty in relaying a signal from a redox center that is deeply buried inside the protein matrix. Using genetic code expansion tools, and genetic engineering approaches we were able to modify redox enzymes and surfaces for biosensing and biofuel cell applications so they could have superior properties over native enzymes. In my talk, I will demonstrate how does site-specific wiring of redox enzymes which is genetically encoded, can improve electron transfer due to controlled and short electron transfer distances and due to proper enzyme orientation. I will also demonstrate how a rational genetic engineering of an enzyme gives it superior properties and activity, compared to those of the native enzyme.

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