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Chemical Utility of Flavin Monooxygenases: Classification and Biotechnological Applications

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ABSTRACT

Flavin monooxygenases (FMOs) catalyze many redox reactions that have profound biotechnological applications. Substrate oxidation occurs through the incorporation of a single atom of dioxygen into the molecule with the other atom being reduced to water. FMOs are grouped into eight types (Groups A-H) based on structural homology, flavin type and the strategy employed to reduce the isoalloxazine ring of the cofactor for subsequent substrate oxidation. Group A and B FMOs are single component enzymes that carry out their entire reaction cycle in a single protein using reduced nicotinamide adenine dinucleotide as electron source. Groups C-F are two comment FMOs that contain a reductase to reduce the flavin cofactor to be delivered to a monooxygenase component as a substrate. Reduced flavin then activates molecular oxygen in the second component to oxidize the organic metabolite of the system. Finally, Groups G and H are self-sufficient internal monooxygenases that receive electrons from one substrate for the oxidation of a second one all within a single protein unit. FMOs carry out an array of biotechnologically important reactions including the degradation of antibiotics by pathogens, the biocatalytic production of drugs in pharmaceutical industries and as reporters of gene expression. Given this diversity of both reaction type and application, the field of FMO enzymology can rapidly become overwhelming. This lecture provides a general overview of each FMO group and is intended to guide researchers just entering the field. Canonical enzymes are detailed along with biomedically important members of each group. It is hoped the presentation will introduce attendees to FMOs and provide a foundation for studies and applications of these enzymes.

Keywords: Flavin monooxygenases, Profound biotechnological applications, Canonical enzymes

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