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Silencing of lipoxygenase pathways in the diatom genus *Pseudo-nitzschia*

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Abstract

Diatoms are unicellular eukaryotic organisms that are responsible for about 40% of the marine primary production. They also contribute to the biogeochemical cycles in the oceans. Diatoms produce oxylipins, a varied family of lipoxygenase-derived metabolites that share a structural motif arising from the addition of oxygen to polyunsaturated fatty acids (PUFAs). Oxylipins are widely distributed in animals and plants, where they are involved in a broad spectrum of actions including stress and defense responses, regulation of growth and development, signaling, and innate immunity. In diatoms, oxylipins have been proposed as ecological and physiological mediators but their function has not been proven in any species mostly because of the lack of molecular tools. The aim of this doctoral thesis was the functional study of lipoxygenase (LOX) pathways in the ecologically relevant *Pseudo-nitzschia* genus. Transformation of *Pseudo-nitzschia arenysensis* empowered the use of RNAi to silence for the first time *LOX* genes in this species. Experimental evidence showed that the two LOX pathways previously described in *P. arenysensis* were affected by this process with resulting reduction of the levels of corresponding oxylipins. The silenced diatom cells revealed a reduced growth compared to wild type cells and showed a phenotype with a marked photoinhibition, thus confirming the regulatory role of LOX pathways in diatoms and suggesting a direct link between oxylipins and cell resilience. Overall, this study shows the first correlation between a diatom gene and the synthesis of lipid mediators, providing direct evidence that the reduction of lipoxygenase expression levels are correlated to a marked physiological effect.