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RESEARCH ARTICLE

Toxic Diatom Aldehydes Affect Defence Gene Networks in Sea Urchins

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Abstract

Marine organisms possess a series of cellular strategies to counteract the negative effects of toxic compounds, including the massive reorganization of gene expression networks. Here we report the modulated dose-dependent response of activated genes by diatom polyunsaturated aldehydes (PUAs) in the sea urchin *Paracentrotus lividus*. PUAs are secondary metabolites deriving from the oxidation of fatty acids, inducing deleterious effects on the reproduction and development of planktonic and benthic organisms that feed on these unicellular algae and with anti-cancer activity. Our previous results showed that PUAs target several genes, implicated in different functional processes in this sea urchin. Using interactomic Ingenuity Pathway Analysis we now show that the genes targeted by PUAs are correlated with four HUB genes, *NF-κB*, *p53*, *δ-2-catenin* and *HIF1A*, which have not been previously reported for *P. lividus*. We propose a working model describing hypothetical pathways potentially involved in toxic aldehyde stress response in sea urchins. This represents the first report on gene networks affected by PUAs, opening new perspectives in understanding the cellular mechanisms underlying the response of benthic organisms to diatom exposure.

Introduction

Marine organisms are constantly exposed to environmental stimuli and natural and/or dissolved anthropogenic compounds, including both physical (e.g. cold, heat and osmotic condition) and chemical (e.g. endocrine disruptor chemicals and hydrocarbons) stressors [1]. Organisms may react to these stressors by activating a series of cellular defence systems, by changing gene expression levels and altering interactions among genes [2]. Studying changes in expression levels is straightforward, but examining the extent to which cells rewire gene network connections is more difficult [3]. Knowledge of these gene interactions provides a more comprehensive view of cellular responses to stressors and is important for the development of