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Insights into the biological role of ovothiol in sea urchins and diatoms

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Abstract

Ovothiols are π-methyl-5-thiohistidines, first isolated and characterised from ovary, eggs and biological fluids of marine invertebrates (Palumbo et al., 2018). They are produced in large amounts by sea urchin eggs as a protection from the oxidative burst at fertilisation and from environmental cues during embryonic development (Castellano et al., 2016).

The position of the thiol group on the imidazole ring confers to these molecules unique chemical properties allowing them to play numerous biological roles in nature, as well as they are receiving an increasing interest as pharmacological compounds for a potential therapeutic use in humans (Castellano and Seebeck, 2018).

The key enzymes responsible for ovothiol biosynthesis, OvoA and OvoB, have been characterised revealing that its biosynthesis is much more widespread than previously thought (Braunshausen and Seebeck, 2011; Naowarojna et al., 2018).

In this thesis, the physiological roles of ovothiol have been investigated in two marine organisms inhabiting coastal areas, sea urchins and diatoms, with the aim to highlight new biological functions and possible applications for human health.

Through molecular and functional analyses of OvoA transcript and protein carried out during development of the Mediterranean sea urchin Paracentrotus lividus, this study has revealed that ovothiol biosynthesis is fundamental for the progression of a correct developmental program. In particular, the role of this metabolite is likely related to fundamental processes like cell cycle during early development, skeletogenesis and gut functionality in larval stages.

On the other hand, molecular experiments performed in the centric diatom Skeletonema marinoi have revealed that OvoA transcription is modulated by light and is associated with

reactive oxygen and nitrogen species variations, thus suggesting that ovothiol can be involved in the antioxidant response triggered by light in diatoms. These studies are relevant considering the possibility to use diatoms to produce high amounts of the compound necessary for applied research.