Prostaglandin pathway based functional studies to unveil plankton communication networks

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Project Summary

Prostaglandins (PGs) are a group of physiologically active lipid compounds very important in complex animals, where behaving like hormones mediate many physiological and pathophysiological processes. They are enzymatically derived from 20-carbon polyunsaturated fatty acids (PUFA) and together with oxylipins constitute a unique class of lipid derivatives known as eicosanoids. PGs are present in all vertebrates, in some terrestrial and aquatic invertebrates and also some marine macroalgae.

From 2017 on, also diatoms were added to the list of organisms producing PGs thank to our studies that identified in two centric diatom species, i.e., *Skeletonema marinoi* and *Thalassiosira rotula*, a wide panel of PG molecules produced and released outside the cells.

Marine diatoms are a vast and diverse group of marine phytoplanktonic organisms able to produce a great variety of biomolecules required for the primary metabolism and the chemical defense to counteract external stress conditions.

Due to their hormone like function in animal, the finding of an active PG pathway in diatoms opened a new perspective on the study of these lipid mediators as possible players in the response to external stimuli.

The objective of this PhD call is the understanding of prostaglandins role in diatoms adaptation to the broad range of many different marine environment, to survive to pathogens (both bacteria and viruses), to escape predators and to regulate the population dynamic equilibrium.

Molecular biology, omics technologies and biochemistry technique, including mass spectrometry, will be used to perform functional studies to discover the role of such molecules in so “simple” and ancient organisms. The limiting enzyme in the PG synthesis, the cyclooxygenase, will be inhibited and the effect of such inhibition will be explored in different experimental conditions. The kinetic of the recombinant diatom cyclooxygenase will also be characterized to understand its best condition of activity to develop a biotechnological production of diatoms prostaglandins.

The results obtained during this PhD will add new and important information about the microbial ecology and physiology of microeukaryotes that could be of great interest for the marine biology community. In addition, considering that diatom prostaglandins are equal to those of animals, an interesting evolutionary question regarding the conservation of the cell-signaling prostaglandin pathway from unicellular algae to humans will also be addressed. Moreover, the global results of the PhD study will certainly be useful for the start of a new project with a biotechnological focus and application.