Cues triggering formation and germination of resting stages in marine diatoms

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Doctor of Philosophy (PhD)

in School of Life, Health and Chemical Sciences

September 2018

Abstract

The project of my PhD thesis was focused on understanding the factors that induce spore formation and germination in the marine planktonic diatom *Chaetoceros socialis*. Among the candidate triggers of spore formation, nitrogen depletion is the most common while light is the principal trigger of spore germination. The link between spore formation and nitrogen starvation in the natural environment is however elusive and this lead me to test other factors, such as cell crowding and viral infections, which were never tested before.

The results of my experimental work show that nitrogen depletion is not the only factor that induces the formation of resting spores, even though it remains the most effective in laboratory experiments. Spore formation was in fact induced when nitrogen and other nutrients were still available; it was induced by culture medium conditioned by the presence of high cell density, by culture medium obtained after killing cells by sonication. This is evidence for the presence of chemical compound/s that induced the formation of spores. Moreover, spores were produced in nutrient replete cultures infected by a species-specific virus. A transcriptomic approach in which the differential expression of genes in key time points during spore formation *versus* the control (exponentially growing cells), provided insights on the molecular mechanisms involved in this life cycle transition.

I evaluated the role of blue, red and white light at very low intensity (1.2 µmol m^2 sec^{-1}) below the threshold for photosynthesis and slight higher white light (20 µmol m^2 sec^{-1}) in inducing spore germination. Results showed significantly higher germination rates only at higher light levels, while low and similar germination rates although germination occurred in other conditions including the controls in the dark. This study adds new and relevant information for understanding how and why spores are formed, underlying their potential importance in population dynamics and, in turn, in the ecosystem functioning.