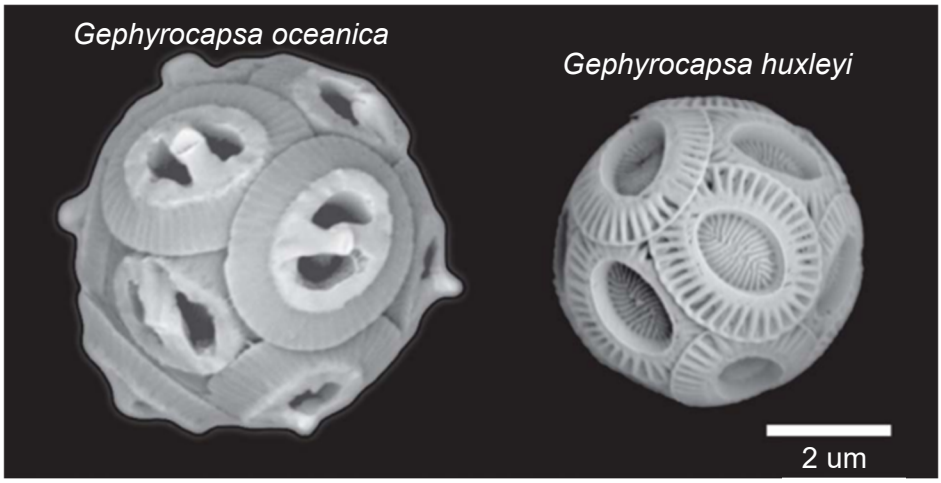
PhD position in evolutionary genomics at ISMER
Project: Life cycles and microevolution in marine phytoplankton



Background
Coccolithophores are widespread marine phytoplankton that play an important role in the oceanic carbon cycle through photosynthesis and calcification. Among them, *Gephyrocapsa huxleyi* and *G. oceanica* are two closely related bloom-forming species. Their life cycles involve a calcifying, non-motile phase and a non-calcifying, flagellated phase, traditionally associated with diploidy and haploidy, respectively. Recent studies have revealed that flagellated cells of *G. huxleyi* can also be diploid and that gene copy numbers do not always follow the expected ratio between the two phases. Moreover, some strains have lost genes associated with the flagellated phase. These observations raise questions about the stability of ploidy, the genomic consequences of life cycle differentiation and the role of these processes in the generation and maintenance of genetic diversity.

Project
This project will investigate the relationship between life cycle differentiation and microevolution in *Gephyrocapsa*. We will first characterise ploidy, allelic diversity and gene copy number variation in genetically related cultures representing different life cycle forms. Using flow cytometry and genome sequencing, we will then follow genomic changes during the proliferation of selected *G. huxleyi* cultures under controlled conditions. Comparisons with available cultures and genomic data from *G. oceanica* will help determine whether the observed patterns are shared between the two species. The project will assess whether genomic variation is associated with ploidy, cellular differentiation or both, without assuming that the two are invariably coupled.

Implications
Understanding how life cycle organisation influences genetic diversity is fundamental to explaining microevolution in marine microbial eukaryotes. This project will help establish whether genomic changes associated with different life cycle forms contribute to the evolutionary dynamics and adaptive potential of coccolithophores in the ocean.

Supervisory team
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