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Functional and Molecular Diversity of the Diatom Family Leptocylindraceae

Thesis submitted for the degree of Doctor in Philosophy (Ph.D.) in Life and Biomolecular Sciences

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Abstract

The focus of this PhD project is the functional and molecular diversity of Leptocylindraceae diatom species, the study of which can lead to a better understanding of long standing questions regarding the ecology and evolution of phytoplankton. A wide range of tools, spanning from microscopical observations and physiological measurements to molecular techniques and high throughput sequencing, is utilized during this attempt. The genus *Leptocylindrus* has been chosen as the main target species due its worldwide and at the same time local importance in the Gulf of Naples and also because of the already extended study of the species in Stazione Zoologica Anton Dohrn (SZN) towards the direction mentioned above.

Leptocylindraceae are centric diatoms that occupy a basal position in the diatom phylogeny and are abundant in marine plankton worldwide. In the Gulf of Naples (GoN), five out of the six species are found; *L. minimus* is known to be absent from the Mediterranean environment. The family shows a morphological conservation but the seasonal patterns between the species differ considerably. Indeed, physiological experiments of two *Leptocylindrus* species that show contrasting seasonality confirmed their opposed preferences regarding temperature as well as a high intraspecific phenological variability. In addition, the analysis of transcriptomes acquired for the three temperatures of one of them (*L. aporus*) indicated the possibly important role of transposable elements in response to stress and diatom adaptation. Furthermore, the transcriptomes of all *Leptocylindrus* species were explored in order to detect basic intra- and interspecific similarities and/or differences. HTS sequencing data from the MareChiara station in GoN and from the Tara expedition in the world's seas were analyzed in order to assess the actual diversity of this important diatom family. A significant level of intraspecific variability was detected while the distribution of species and populations at spatial and temporal scale supported the functional differences among them that account for their distinct seasonality and their adaptation to different environmental conditions.