

# Title: Molecular diversity and evolution of microalgae in symbiosis in Radiolaria

**Supervisors:** Dr. Fabrice Not, CNRS Station Biologique de Roscoff, équipe Diversité et Interaction du Plancton Océanique (DIPO), E-mail: [not@sb-roscoff.fr](mailto:not@sb-roscoff.fr) Tel: 02 98 29 25 37 & Miguel M. Sandin (PhD student), UPMC Station Biologique de Roscoff, équipe Diversité et Interaction du Plancton Océanique (DIPO), E-mail: [miguel.mendez-sandin@sb-roscoff.fr](mailto:miguel.mendez-sandin@sb-roscoff.fr)

## Scientific context and objectives

Radiolaria are holoplanktonic amoeboid protists belonging to the Rhizaria eukaryotic lineage. They are active predators feeding on a large variety of preys, from bacteria up to mollusc larvae contributing significantly to trophic webs dynamics. A number of radiolarian species can also host photosynthetic algal symbionts contributing indirectly to the primary production in oligotrophic surface waters and greatly influencing their distributions patterns, being in surface tropical waters the greatest diversity and abundance values. While benthic photosymbiosis (*e.g.* coral reef) has been deeply studied, little is known about planktonic photosymbiosis. The microalgae belonging to the dinoflagellate genus *Symbiodinium* are largely widespread in benthos, however the situation seems different in the plankton with a larger variety of species involved (*e.g.* *Brandtodinium n.*, *Gymnodinium r.*, *Phaeocystis sp.*) based on both culture isolation attempts and molecular diversity surveys. Studying the molecular diversity and co-evolutionary patterns of the partners involved in such symbiotic interactions demonstrated to be crucial to understand their ecological impact and the evolution across geological time frames.

In this context, ***the main objective of the research proposed is to investigate the extent of the symbiotic microalgae diversity within two orders of Radiolaria (Nassellaria and Spumellaria).*** In order to achieve our objective we will (1) explore the molecular diversity of the symbionts from a range of radiolarian specimens (single cells) isolated from the environment and from symbionts that have been isolated in culture and (2) build contextualized molecular phylogenies to compare symbiont and host diversity, in order to evaluate potential co-evolutionary patterns and/or identify driving environmental forces.

The Master student will benefit from the expertise and facilities available in the plankton group of the Roscoff Biological Station. The Roscoff plankton group currently encompasses 16 researchers and technical staff, 21 PhD student and post-doc, and turns out to be one of the world leading group for molecular ecology of planktonic ecosystems (<http://www.sb-roscoff.fr/en/adaptation-and-diversity-marine-environment/research-teams>). More specifically for its research internship the student will perform polymerase chain reaction (PCR) and DNA sequencing of taxonomic molecular marker (*e.g.* 16S rDNA, 18S rDNA genes) from samples already available in a home built database of single cell specimens (<http://renkan.sb-roscoff.fr/>) and from symbiont in culture in the RCC (<http://roscoff-culture-collection.org/>). Molecular data and phylogenies inferred for the hosts of the studied symbiosis are already available. We anticipate that the outcome of the work proposed will be submitted for publication in a peer-reviewed scientific journal.

## Recent publications on the research topic

- 1- Decelle, J., Colin, S., Foster, R.A., **2015**. Chapter 19. Photosymbiosis in Marine Planktonic Protists, in: **Marine Protists**. pp. 465–500. doi:10.1007/978-4-431-55130-0
- 2- Probert, I., Siano, R., Poirier, C., Decelle, J., Biard, T., Tuji, A., Suzuki, N., Not, F., **2014**. Brandtodinium gen. nov. and B.nutricula comb. Nov. (Dinophyceae), a dinoflagellate commonly found in symbiosis with polycystine radiolarians. **J. Phycol.** 50, 388–399. doi:10.1111/jpy.12174
- 3- Biard, T., Bigeard, E., Audic, S., Poulain, J., Stemmann, L., Not, F., **2016**. Biogeography and diversity of Collodaria (Radiolaria) in the global ocean. **Nature** 1–42. doi:10.1038/ismej.2017.12
- 4- Boltovskoy, D., Correa, N., **2016**. Biogeography of Radiolaria Polycystina (Protista) in the World Ocean. **Prog. Oceanogr.** doi:10.1016/j.pocean.2016.09.006
- 5- Suzuki, N., Not, F., **2015**. Biology and Ecology of Radiolaria, in: **Marine Protists**. pp. 179–222. doi:10.1007/978-4-431-55130-0
- 6- Decelle, J., Probert, I., Bittner, L., Desdevises, Y., Colin, S., de Vargas, C., Galí, M., Simó, R., Not, F., **2012**. An original mode of symbiosis in open ocean plankton. **Proc. Natl. Acad. Sci. U. S. A.** 109, 1–6. doi:10.1073/pnas.1212303109