Job title: **Deciphering the circalunar clock of brown algae**

General information:

The PhD will take place at the Station Biologique de Roscoff (CNRS – Sorbonne University) under the supervision of Andrés Ritter, starting date is due to **October 1rst, 2023**.

Description of the PhD subject:

Thesis objective and topic, scientific field and themes:

Due to gravitational forces on Earth, life has evolved in an environment marked by recurrent but predictable changes. Most living organisms anticipate rhythmic environmental cycles through endogenous molecular clocks that adapt their physiology and behavior accordingly, thus maximizing fitness[1]. Examples of processes controlled by endogenous clocks include seasonal reproduction, the sleep-wake cycle, daily growth control, metabolic regulation, or immune responses. Coastal marine life has evolved in harmony with the periodic changes caused by the tides. Brown algae (Phaeophyceae) are photosynthetic sessile macro-organisms of major ecological importance to coastal ecosystems. Although they live in only a small part of the oceans, they build kelp forests with a net primary production comparable to that of the Amazon rainforest. Despite their importance, little is known about the biology of these organisms and, given their particular evolutionary history, they are expected to have atypical physiological adaptations.

In the brown alga *Dictyota dichotoma*, gamete release is timed by semi-lunar and tidal cycles, allowing an efficient fertilization and subsequent dispersal of offspring during spring tides. An endogenous clock synchronizes this process, but little is known about its nature[2]. The PhD student will conduct pioneering research to decipher the nature of the circalunar clock in marine brown algae. Laboratory and field physiological experiments in this species will extend the current knowledge of brown algal chronobiology. Transcriptome and/or quantitative genetics approaches will then identify alleles involved in the brown algal circalunar (and/or circatidal) clock. We will next perform extensive functional characterization by establishing loss-of-function mutants using CRISPR-Cas9 genome editing technology. The most promising candidate proteins will be then used as an entry point to identify other clock components such as protein-protein and protein-DNA interaction studies. Finally, this project will address the relevance of the identified clock components by exploring their emergence and diversification in the tree of life.

Deciphering the functions of a tidal synchronization system in brown algae may provide entirely new information about adaptive synchronization mechanisms in a branch of the tree of life that has not yet been extensively studied. In the long term, understanding brown algal clocks will lead to a better understanding of the reproductive biology, growth, and stress tolerance of these organisms, which could open up new opportunities for the cultivation and conservation of marine algae in the context of global change.

1. Wijnen, H. & Young, M. W. in Annual Review of Genetics Vol. 40 Annual Review of Genetics 409-448 (2006).

2. Kaiser, T. S. & Neumann, J. Circalunar clocks—Old experiments for a new era. BioEssays 43, 2100074 (2021).

Working context:

Prof. A. Ritter's group is located at the Roscoff biological station in France (CNRS - Sorbonne University). The Roscoff Marine Station is an internationally recognized academic institution in the field of marine biology. We have a modern and competitive working environment covering a wide spectrum of disciplines in marine life sciences. The student will integrate a creative and supportive atmosphere of an international Research Unit (UMR8227 LBI2M) with a strong background in culture, molecular biology, biochemistry, genetics and genomics of marine algae. We offer a fully funded position with the aim at obtaining a PhD degree from Sorbonne University (3 years). The position provides access to the French social security system, including health care.

Additional information:

We are looking for a highly motivated and independent student, eager to embark on this exciting new line of research. The PhD candidate should have a strong background in molecular biology, genetics and bioinformatics. Experience in chronobiology, photobiology, genome editing, microscopy or phycology is an advantage. He/she will work in a stimulating environment and gain expertise in molecular biology and genetics, combining field and laboratory work of marine algae. In addition, he/she will have access to state-of-the-art technologies (e.g., genome editing, genome sequencing, RNAseq), and high-level training courses.

For applications or further information please contact via Andrés Ritter to andres.ritter@sb-roscoff.fr

Applications should be submitted as a single PDF document by June 30, 2023 at latest.

The following documents should be attached:

- CV

- Motivation letter

- Copies of Bachelor and Master degrees

- Contact details of at least two referees