

2024 DOCTORAL INPhINIT FELLOWSHIPS PROGRAMME – INCOMING

## **Algal chloroplasts: a new source of bioactive compounds for biotechnological applications**

Area of Knowledge: LIFE SCIENCES

Group of disciplines: Biotechnology, Bioinformatics, Pharmacy, Food Technology

### **Research project**

**Relevance:** The chloroplast is the organelle responsible for harnessing sunlight, carbon dioxide, and water to produce energy-rich organic molecules and release oxygen. Within this organelle, the machinery involved in these processes comprises molecules of biotechnological significance, including lipids, fatty acids, and pigments.

**Main Goal:** The aim of this study is to conduct a biochemical characterization of chloroplasts from both microalgae and macroalgae belonging to various phyla. This characterization is intended to facilitate the identification and quantification of bioactive compounds with potential applications in biotechnological industries.

**Novel ideas & Approaches:** Algae have gained recognition as a sustainable source of valuable biomolecules with promising applications in food, pharmaceutical and cosmetic industries. While the traditional bioprospecting approach involves using the entire alga, it's noteworthy that many bioactive compounds are exclusive to the chloroplast membranes. Isolating chloroplasts and utilizing omics tools for their exploration will enable a more comprehensive characterization and bioprospecting of bioactive compounds within algae.

**Research plan:** The proposal is divided in three main tasks:

- **Isolation and characterization of chloroplasts:** Isolation and purification of chloroplast from algae of different phyla for their biochemical characterizing using omics and bioinformatics tools.
- **Optimization of algal cultures to a smart valorisation of their biomolecules:** Algae will be cultivated under different conditions to assess those potentiating the production of bioactive compounds. Diverse bioactivity assays will be tested to obtain antioxidant and anti-inflammatory agents.
- **Encapsulation of chloroplasts and biotechnological prospections:** Isolated functional chloroplasts will be encapsulated and explored as smart delivery systems of bioactive molecules for biotechnological applications.

### **Job position description**

**Supervision team:** The PhD fellow will be supervised by two researchers with distinct yet complementary expertise in the research of algae. Felisa Rey is an expert in the application of lipidomics in marine organisms, while Paulo Cartaxana specializes in algal ecophysiology. The supervision team shares a robust professional bond forged through collaboration on multiple research projects. The PhD fellow will become part of a well-established research group in marine biotechnology, as well as a leading research group focused on lipid analysis in algae.

**Workplace:** Chemistry and Biology Departments and CESAM (Centre for Environmental and Marine Studies) of the University of Aveiro (UA), Portugal.

**Main fellow responsibilities:** The PhD fellow will be responsible for algae collection and cultivation, will conduct the omics analyses (Mass Spectrometry Centre, UA) and bioactivity assays. Mass spectrometry techniques and bioinformatic tools will be used for omics approaches. The PhD fellow will elaborate scientific reports to be submitted to scientific journals with peer reviewing.

**PhD fellow skills:** It is expected of the PhD fellow to have the following skills and improve some of them during this project:

#### **Technical skills**

- Bachelor's and/or master's degree in Biological Sciences, Biochemistry, Chemistry or related fields.
- Ability to prepare technical reports and research papers.
- Training in laboratory tasks.
- Computer skills in data processing.
- High communication skills in spoken and written scientific English.

#### **Soft skills**

- Teamwork.
- Adaptability to embrace new challenges.
- Time management: ability to plan and carry out tasks in accordance with the planning to achieve the objectives.
- Critical thinking: reflect, analyse, summarize and cross-reference with other information to reach an own opinion.
- Problem-solving: facing challenges intelligently and finding the right solutions.
- Self-motivation: positive attitude and initiative to work.
- Capacity to work in multicultural and multidisciplinary environments.
- Resilience to face challenges and difficulties.

#### **Supervisor team**

Dr. [Felisa Rey](#); Dr. [Paulo Cartaxana](#)

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#### **Research Group description**

**Website of the Marine Biotechnology & Aquaculture (MBA) research group:** <https://www.cesam-la.pt/sobre/grupos-de-investigacao/mba/>

**Website of the Lipidomics laboratory:** <http://lipidomics.web.ua.pt>

**Website of the Marine Photophysiology & Phycotechnology lab:** <https://mplab-kleptoslug.com>

#### **Additional information**

**Website of CESAM:** [www.cesam-la.pt](http://www.cesam-la.pt)

**Website of the University of Aveiro, Portugal:** <https://www.ua.pt/en/>