Research Internship
Modeling the Interaction Between Microalgae and Bacteria

Topic profile

math

coding

biology

Tags

#bioproduction

#coculturing

#mathematical modeling

#interdisciplinary research

Supervision

Matthias Fuegger

CNRS Researcher at ENS Paris-Saclay

Thomas Nowak

Professor at ENS Paris-Saclay

Mélanie Pietri

PhD student at ENS Paris-Saclay

Why would we model that?

Culturing microalgae together with bacteria can have a positive effect on their growth [1]. This observation has the potential to transform various industrial processes, like the production of biofuels. The mechanisms of the positive impact on growth and production is not yet fully understood, however. To be able to fully harness the potential of this co-culturing paradigm in a range of industrial-scale environments, a predictive model that allows simulation of envisioned setups is needed.

What we are looking for

We value a curious and driven attitude. An ideal candidate is inclined to mathematical modeling, microbiology, and coding (in Python).

The team

You will be part of an interdisciplinary research team at ENS Paris-Saclay near Paris, working on different aspects of synthetic biology, distributed computing, and circuit design.

Research

The goal of this internship is to build a mechanistic model of the changes of growth and lipid production rate in microalgae–bacteria cocultures. A possible way of tackling the problem is:

- Starting from data produced in the lab and published articles, identify a list of likely interactions (e.g., CO_2 produced by bacteria and used by microalgae).
- Build models that contain these interactions using the Biochemical Reaction Network (BCRN) formalism. This allows to focus on the relevant timescale for growth and production while providing mechanistic explanations.
- Calibrate the models with experimental data and produce predictions that can be tested in the lab.
- Use the models to optimize a sample bioproduction process.

References

[1] Yamada et al. *Biotechnol. J.* **18**(2), 2023. URL

You are interested or would like to join us?

Please send us your questions or, in case you would like to apply, a short statement of interest and a curriculum vitae, to Matthias Fuegger (mfuegger@lmf.cnrs.fr) and Thomas Nowak (thomas@thomasnowak.net). Applications received until December 15, 2023 will receive full consideration. The start date of the internship is flexible, but the goal is to start in spring or summer 2024.