Research Internship
Formal Rules for Plasmid Design

Topic profile

math

coding

biology

Tags

#synthetic biology

#DNA design

#formal methods

#interdisciplinary research

Supervision

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Why so formal?

Plasmid design is a fundamental and recurring task in synthetic biology. There is a large body of knowledge available to help the designer. There are even software tools that give some predictive information about the current design. However, much of the art of plasmid design is based on non-formalized knowledge and the widely-available software tools are narrowly focused on a single aspect. The ultimate solution would be of course to have an automated compiler [1] from a desired behavior to a plasmid. Towards this goal, it is necessary to formalize the various design heuristics that exist.

What we are looking for

We value a curious and driven attitude. An ideal candidate is inclined to microbiology, formal methods, 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 develop a coherent and sufficiently complete set of formal rules for plasmid design, and to implement them in a web-based software tool. A possible way of tackling the problem is:

- Gather the existing widely-used design heuristics from lecture notes, books, and instructional web resources.
- Formalize a subset of these heuristics by programming them in Python using the Biopython library.
- Integrate the formal rules into a plasmid-design checker.
- Develop methods to automatically fill in parts of the design that are necessary for the plasmid, but which were not specified by the user.
- Use the developed software in a plasmid-design task in the team. This will show any weaknesses of the set of rules.

References

[1] Nielsen et al. *Science* **352**(6281), 2016. 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.