



Offer #2025-08783

Post-Doctoral Research Visit F/M
Postdoctoral position – Systems biology
and metabolic modelling of uncultured
bacteria

Contract type : Fixed-term contract

Renewable contract : Yes

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

About the research centre or Inria department

The Inria center at the University of Bordeaux is one of the nine Inria centers in France and has about twenty research teams.. The Inria centre is a major and recognized player in the field of digital sciences. It is at the heart of a rich R&D and innovation ecosystem: highly innovative SMEs, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute...

Context

The postdoctoral position is offered as part of a **partnership between [INRAE](#)** (the French National Research Institute for Agriculture, Food, and the Environment) **and [Inria](#)** (the French National Institute for Research in Digital Science and Technology). It is **funded by the TARGET project, promoted by [INRAE's EXPLOR'AE](#)** "high-risk research" programme.

The TARGET project is an **interdisciplinary initiative combining microbiology, culturomics, genetic engineering, systems biology, and modelling**. It is a four-year research project. The postdoctoral position offered within this project is for an **initial two-year period, with the possibility of renewal for an additional two years**.

Context of the project:

Since the late 19th century, microbiologists have been developing culture media and techniques to study microorganisms such as bacteria, archaea, yeasts, and filamentous fungi. However, **only a small fraction of bacterial species are currently cultivable**, severely limiting their study. While advances in metagenomics have highlighted this limitation, genome sequencing alone has not provided sufficient explanations for why many bacterial species remain unculturable. This lack of cultivability remains a scientific enigma and a major barrier to applications in fields such as disease control, antibiotic discovery, biomolecule production, microbiome management, and bioremediation. In bacteria that live in association with eukaryotic hosts, understanding metabolic interactions with their partners opens new possibilities for developing tailored culture media, thereby facilitating their study. **Using grapevine Flavescence Dorée phytoplasma as a proof of concept, the TARGET project aims to demonstrate that integrating systems biology, genome engineering, and culturomics can help overcome the challenge of bacterial non-cultivability.**

This postdoctoral position is part of the project's **metabolic modelling work package**, with objectives including the **development of numerical models for the metabolism of minimal bacteria and Flavescence Dorée phytoplasma**. These models will be used to predict suitable culture media. The project involves close collaboration between modellers and microbiologists to bridge computational and experimental approaches.

The recruited researcher will work in collaboration between [Inria Pleiade](#) team in Talence and [INRAE BFP](#) (Fruit biology and Pathology) unit at Villenave d'Ornon. At Inria, the work will be carried under the supervision of [Clémence Frioux](#). Pleiade hosts researchers in mathematics, computer science and computational biology working on developing approaches for microbial community characterisation. Two teams are involved at INRAE: MOLLI (Pascal Sirand Pugnet) where most of the experimentations will be carried out, and META specialised in metabolic modelling. The co-supervisor of the position is [Sylvain Prigent](#), researcher in the META team.

Assignment

The recruited postdoctoral researcher will be the **main modeller of the systems biology work package**.

The work focuses on **constructing metabolic models of Mollicutes and Flavescence Dorée phytoplasma (FDp) to better understand their metabolic functions and predict suitable growth media**. Initially, the work will apply proven strategies to well-studied Mollicutes, refining models and predicting culture conditions, followed by validation experiments carried out by collaborators. A similar approach will then be used to develop and validate models for *Spiroplasma citri* and FDp. Comparative metabolic network analysis across Mollicutes will help generate functional insights, while further efforts will explore dynamic models of FDp metabolism within its hosts. Ultimately, the project aims to integrate symbiotic interactions into these models to enhance understanding of FDp physiology in insect vectors.

Strong collaborations are planned with the TARGET consortium in order to provide hypotheses for new experimentations and to integrate into models experimental results.

See the following references for details on the team activities and approaches used in the project:

- Belcour, A., Got, J., Aite, M., Delage, L., Collén, J., Frioux, C., Leblanc, C., Dittami, S. M., Blanquart, S., Markov, G. V., and Siegel, A. (2023). Inferring and comparing metabolism across heterogeneous sets of annotated genomes using AuCoMe. *Genome Research*. <https://doi.org/10.1101/gr.277056.122>
- Cerk, K., Ugalde-Salas, P., Nedjad, C. G., Lecomte, M., Muller, C., Sherman, D. J., Hildebrand, F., Labarthe, S., and Frioux, C. (2024). Community-scale models of microbiomes: Articulating metabolic modelling and metagenome sequencing. *Microbial Biotechnology*, 17(1), e14396. <https://doi.org/10.1111/1751-7915.14396>
- Ghassemi-Nedjad, C., Bolteau, M., Bourneuf, L., Paulevé, L., and Frioux, C. (2024). Seed2LP: seed inference in metabolic networks for reverse ecology applications. *BioRxiv*. <https://doi.org/10.1101/2024.09.26.615309>

Main activities

- Reconstruction, curation, and comparison of metabolic networks from genomic data.
- Use and development of various metabolic models: individual-scale models, dynamic models, and community models.
- Writing scientific articles.
- Collaborating with microbiologists to refine models and guide experiments.

Skills

Technical Skills and Required Level:

- Experience in modelling and systems biology
- Good programming skills, preferably in Python
- Good practices in software development

Languages:

- Proficiency in English is expected for disseminating results through research papers and in conferences

Interpersonal Skills:

- Ability to work collaboratively in an interdisciplinary environment
- Strong analytical and problem-solving skills
- Good communication and teamwork abilities

Additional Desirable Skills:

- Knowledge of metabolic modelling techniques
- Experience in bioinformatics and data analysis
- Familiarity with high-performance computing environments
- Experience in collaborating with experimental biologists

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Remuneration

The gross monthly salary will be 2788€ (Before social security contributions and monthly withholding tax).

General Information

- **Theme/Domain :** Computational Biology
Biologie et santé, Sciences de la vie et de la terre (BAP A)
- **Town/city :** Talence
- **Inria Center :** [Centre Inria de l'université de Bordeaux](#)
- **Starting date :** 2025-09-01
- **Duration of contract :** 2 years
- **Deadline to apply :** 2025-04-30

Contacts

- **Inria Team :** [PLEIADE](#)
- **Recruiter :**
Frioux Clemence / clemence.frioux@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

The keys to success

- **Experience in modelling / systems biology** – Prior experience in computational modelling, particularly in the context of biological systems, is highly desirable.
- **Bioinformatics skills** – Proficiency in handling genomic and metabolic data, with experience in relevant bioinformatics tools and pipelines.
- **Metabolic modelling** – Ideally, familiarity with metabolic network reconstruction, constraint-based modelling, and dynamic models.
- **Autonomy and strong analytical and writing skills** – Ability to work independently, synthesise complex information, and contribute to scientific publications.
- **Interest in interdisciplinary research and collaborative work** – Willingness to engage with microbiologists and experimentalists to refine models and guide laboratory experiments.

Warning : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

If you are interested by thi sjob, please could you apply on website jobs.inria with the following documents :

- cv
- cover letter
- recommendation letters

Defence Security :

This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :

As part of its diversity policy, all Inria positions are accessible to people with disabilities.