PhD studentship: Design of Cross- and Multi-species Genetic Circuits

We are looking for a PhD candidate to develop cross- and multi-species genetic circuits.

Background. Bioengineering of genetic and metabolic circuits has a wide range of applications. However, most efforts in circuit design are currently limited to a small subset of laboratory model organisms used in monocultures, many of which may be incompatible for their target applications. Expanding circuit design to a novel organism remains an uphill task that requires characterisation of new genetic parts and re-construction of the circuit for each new organism of interest. This doctoral project aims to develop tools and strategies for building cross-species compatible genetic circuits. We expect the results of the work to facilitate rapid implementation of circuits in non-model organisms, while preserving their function, and enabling their deployment in multi-species communities. The tools developed here will help expedite the design and implementation of synthetic genetic and metabolic circuits in new chassis organisms suited for diverse biotechnology applications.

Position. The 3-year doctoral position will be hosted in the Cellular Computing and the COSYNUS teams at the Micalis Institute (INRAE Jouy-en-Josas, University of Paris-Saclay). The expected start date is September 2025.

Funding. The PhD position is funded by the Tbox4BioProd project, as part of the French government's Priority Research Programmes and Equipment (PEPR) action B-BEST. The project is a collaboration between several leading French research labs: Micalis Institute, CBS Montpellier, and Genoscope.

Applicant profile. We are looking for a highly motivated candidate with experience in experimental synthetic biology, including microbiology and molecular biology techniques. Although not essential, some background in programming, bioinformatics, or computational modelling would be an added advantage. They should have strong communication skills and the willingness to work collaboratively with other members of the team and project collaborators, including biologists, engineers, mathematicians, and computer scientists. A Master's degree or equivalent is required for PhD registration at the *Structure et dynamique des systèmes vivants* (SDSV) doctoral school of the University of Paris-Saclay.

Application process. For questions regarding the position and/ or the application process, please contact manish.kushwaha@inrae.fr and youngkyoung.park@inrae.fr. To apply, pleae send a cover letter and a CV (with contact details of at least two referees).

Application deadline. 10 June 2025. Applications will be considered as they are received.

Selected References:

1. Kushwaha, M. & Salis, H. M. A portable expression resource for engineering cross-species genetic circuits and pathways. *Nat. Commun.* **6**, 7832 (2015).
2. Adams, B. L. The Next Generation of Synthetic Biology Chassis: Moving Synthetic Biology from the Laboratory to the Field. *ACS Synth. Biol.* **5**, 1328–1330 (2016).
3. Nevozhay, D., Zal, T., & Balázsi, G. Transferring a synthetic gene circuit from yeast to mammalian cells. *Nat. Commun.* **4**, 1451 (2013).
4. An, W., & Chin, J. W. Synthesis of orthogonal transcription-translation networks. *Proceedings of the National Academy of Sciences of the United States of America* **106**, 8477–8482 (2009).
5. Patel, J. R., Oh, J., Wang, S., Crawford, J. M. & Isaacs, F. J. Cross-kingdom expression of synthetic genetic elements promotes discovery of metabolites in the human microbiome. *Cell* **185**, 1487–1505.e14 (2022).