Job offer –Post-doctorate in Biochemical Engineering-Fermentation
(*For non-French scientists only*)

Research Project Short Title as Submitted to CEFIPRA: "MELANGE**"**
Principal Investigator contact (Name and email id): "Stéphane GUILLOUET, UMR 5504 (INSA-CNRS-INRAe), TBI, "guillouet@insa-toulouse.fr"
Reference Number of the Job Offer: IFI_CEF_25_05

Project description

- **Keywords**: Synthetic consortia, Fermentation, Flavonoids, Single cell analysis

- **Context:** The goal of the MELANGE project is to develop a microbial platform for the synthesis and production of a glycosylated flavonoids in bioreactors. The production of these molecules from natural sources includes an extended treatment of the plant extract with polar organic solvents followed by chromatographic procedures to obtain a pure compound. Apart from the environmental consequences, these processes are not suited for large-scale production. A more environment friendly and economical production strategy for glycosylated flavonoids is thus clearly necessary given the utility of these phytochemicals as nutraceutical supplements, cosmetics and potential applications in therapeutic strategies.

- **Abstract of the Research Project:** We propose to develop a mixed-culture cohort of engineered microbes for the production of glycosylated flavonoids. This process involves metabolically expensive biosynthetic pathways that affect microbial cell fitness alongside sub-optimal bioconversion. We propose to address this problem by dissecting the pathway into four components each performed by specialist microbial cells. We seek to exploit synthetic transcription initiation factors for bespoke microbial gene expression for optimized bioconversion by each microbial compartment. A co-culture of these specialist microbial cells would then lead to the glycosylated flavanoid. Evaluation and optimization of microbial co-cultures will be performed in lab bioreactors. Mixed culture fermentation containing specialist microbes with synchronized growth by quorum sensing would provide a microbial cohort that can self-govern gene expression and production of the desired phytochemical.

- **Scientific Objectives of the Project:** The project combines aspects of synthetic microbiology with co-culture fermentation strategies for scale up to large scale industrial production. The project thus incorporates three distinctive components – each with their own scientific and technological niche. The first is the aspect of utilizing the bacterial stress response genes to achieve synchronized cohesive expression of target genes in a bacterial cell. The synthetic strains incorporating diverse inducible plasmids will be screened for their functional role. This second step provides a unique route to strain selection and co-culture cohort optimization. This step would be coordinated with the academic laboratory in France where we seek to apply modelling strategies and experimentally validate some of the large scale fermentation of the selected microbial cohort.

- **Methodology and Timeline of the Project:** Robustness on the engineered strains will be evaluated by cultivating each of them in lab-scale bioreactor and quantifying their kinetic properties such growth and viability. This will be performed using flow cytometry using specific fluorescent markers. Plasmid stability of each strain will be also evaluated by the means of classical cell counting methods and/or by the means of expressing fluorescent proteins on the plasmid. The stability could be then measured as the single cell level via flow cytometry. The kinetic properties of each individual strain will be then inserted in a phenomenological model which will be usefull to define optimal fermentation strategy with synthetic consortium. Differen mode of cultivation (fed-batch, chemostat,..) will be envisaged based on the strain characteristics.

Candidate profile

- Indian candidates or candidates with a research experience in India are eligible; French candidates are not eligible
- Applicants for post-doctorate must have a PhD degree (or be in the process of obtaining one)
- No competences in French language is required
- Candidate competences in Biochemical Engineering, Microbial Physiology and Modelling
- Candidate know-how : running fermentation in bioreactors, kinetic analysis and modelling of microbial processes, skills in team working and communication
- Expected starting date: 01-12-2025
- Expected duration: 12 months

How to candidate ?

Documents to be provided :

i. A cover letter (reasons for the candidature, professional project …) max 2 pages
ii. A copy of the master's degree or a proof of the program followed (and expected date of end) OR A copy of the PhD degree or a proof of the PhD program followed (and expected date of defense) max 1 page
iii. A copy of results for previous scholarship (max 3 pages)
iv. International curriculum vitae (max 2 pages)
v. Two letters of recommendation: one from any Indian institution and one from the French institution planned to host the candidate –mandatory- (max 2 pages)
vi. All should be submitted within 1 pdf file of no more than 10 pages.

Applications should be submitted to the following email address: msi@ifindia.in mentioning the reference number of the Job offer clearly.

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Candidates are requested to contact the French scientific principal investigator of the project before submission. A recommendation letter from the scientific principal investigator is mandatory.

Benefits:

- Monthly allowance of 2400 euros for Post-Doc
- Travel allowance
- University fee
- Carte de séjour fee
- Campus France management fee
- Registration to the French social security scheme

Selection process:

Selection is made by a dedicated selection committee of at least 4 persons. Decisions will be transmitted by the Embassy of France to CEFIPRA. **No consideration will be given for candidates with no recommendation letter from the French institution.**

Criteria for applicants' selection:

Academic excellence

- Excellence of the Academic background, Academic records, Honors, Letters of support, Participation to international research projects, exchange programmes and conferences.

Motivation and qualities

- Academic maturity: appropriation of the thesis project (stakes and contexts) • Quality of the presentation (oral expression, skills for synthesis, English level) • Maturity of the professional project: capacity to project her/himself within five years in terms of career development.

About CEFIPRA:
Indo-French Center for the Promotion of Advanced Research (CEFIPRA/IFCPAR) is an Indian body which promotes scientific cooperation between France and India in advanced fields of Science and Technology. It is supported by the Department of Science and Technology, Government of India and the Ministry of Europe and Foreign Affairs of the French government