Master 2 internship: Propionate-sensing bacteria for nutritional state recording

Description

We are looking for a Master 2 student (M/F) for a 6-month internship within the ProbiHôte and Cellular Computing Teams at the MICALIS Institute (INRAE UMR1319) located in Jouy-en-Josas.

The student will participate in a project funded by the MICA department on the development and optimization of a propionate monitoring system using genetically modified bacteria.

Summary:

Malnutrition is a state of altered body composition and body cell mass leading to reduced physical and mental functions, which results from the lack of intake or uptake of nutrition (Cederholm et al. 2017). Evidence increasingly points to complex relationships between malnutrition, food intake, and microbiota composition that are reflected in the microbial composition and the small molecule signatures found in the mammalian gut (Saint-Criq, Lugo-Villarino, and Thomas 2021). For example, we have evidenced that restricting food access to older animals induces a decrease in short chain fatty acid, in particular propionate. Yet, faecal samples only represent the end snapshot of the complex digestive and assimilative process, with little information about molecules and microbes in the proximal part of the mammalian gut, which is also relatively inaccessible for sampling. The ability to non-invasively sample molecular signatures throughout the gut length would facilitate better observation and understanding of the kinetics of nutrient metabolism in the mammalian gut, helping devise more effective strategies for nutritional interventions. The Cellular Computing Team has engineered genetically modified bacteria as sensors of propionate concentration. Therefore, we now aim to develop multiple co-culture models ranging from simple dual to complex community-based culture conditions to establish the sensitivity of the reporter bacteria. In this context, the Master's student will be involved in:

1 – Culturing propionate-producing bacterial strains in multiple conditions to modulate propionate production
2 – Measuring SCFA concentrations in single culture supernatants
3 – Establishing dual co-culture methods with the propionate sensors
4 – Designing a complex community to optimize propionate production and sensing
If time allows:
5 – Assessment of sensor localization and propionate sensing in the mouse gut

Expected skills:
- Organizational skills and thoroughness
- Curiosity and high motivation
- Communication and interpersonal skills (teamwork)
- Knowledge of molecular biology and cell biology

Start date: around Jan, 12th 2026.

Stipend: €4.35/heure (35 heures/semaine)

Application process: CV, cover letter, grades, and recommendation letter to Manish.Kushwaha@inrae.fr and vinciane.saint-criq@inrae.fr