

JOB POSITION

PhD: Design and characterisation of synthetic microbial communities to explore interspecies hydrogen transfer

The French National Research Institute for Agriculture, Food, and the Environment (INRAE) is a public research establishment. It is a community of 12,000 people with 272 research, experimental research, and support units located in 18 regional centres throughout France. Internationally, INRAE is among the top research organisations in the agricultural and food sciences, plant and animal sciences, as well as in ecology and environmental science. It is the world's leading research organisation specialising in agriculture, food and the environment. INRAE's goal is to be a key player in the transitions necessary to address major global challenges. Faced with a growing world population, climate change, resource scarcity, and declining biodiversity, the Institute has a major role to play in building solutions and supporting the necessary acceleration of agricultural, food and environmental transitions.

WORKING ENVIRONMENT AND ACTIVITIES

■ You will work in the Herbivores joint research unit (UMR Herbivores). This unit conducts research for a multi-performing herbivore breeding, mobilizing the levers of agroecology. This involves research to better understand animal functions and the impacts of breeding practices on the animal and the environment. The UMR Herbivores has 120 permanent staff, including 74 researchers and engineers, and welcomes about 60 non-permanent staff each year (including about 20 PhD students and post-doctoral positions). It is organized into 5 research teams, a support team and a management team.

You will work in the Dinamic (Digestion, Nutrition, Food, Metabolism, Microbes) team, whose research includes characterising the ruminal microbial ecosystem in order to understand and manipulate methane emissions from ruminants. Ruminant agriculture is currently under intense social pressure for its contribution to global warming. Ruminants are responsible for around a third of anthropogenic methane production, which is linked to microbial activity in the rumen, the first and largest compartment of their digestive system. Here, large plant polymers are broken down into volatile fatty acids (energy sources for the animal), CO₂ and H₂. Most of the H₂ is captured by methanogenic archaea and used to reduce CO₂ to CH₄. The aim of this thesis is therefore to investigate the syntrophic relationships and interspecies H₂ transfer that play a key role in methanogenesis. The work is part of the ANR H2RUMEN project, in which the UMRH, MoSAR (INRAE Paris Saclay) and PLEIADE (INRAE - INRIA Bordeaux) are collaborating. The first steps will be the characterisation and precise quantification of H₂ transfers in simple co-cultures of rumen microbes of particular interest (hydrogenotrophs, including methanogenic archaea and certain bacteria, and hydrogenogens, mainly fibrolytic bacteria). The simple co-cultures will be made progressively more complex to achieve stable microbial consortia in which the fibrolytic function is maintained or even improved despite methane production. Quantitative data on substrate consumption and the appearance of products (including H₂) will form the basis of collaborations with MoSAR, which will use them to improve existing models of rumen function. Genomic and transcriptomic data will be used in collaboration with PLEIADE for genome-scale modelling (GSM) of rumen fermentation. In parallel, simplified microbial consortia will be constructed using a top-down approach, starting with complex rumen contents simplified by successive enrichments. This approach will allow to construct consortia without preconceptions and to identify and isolate new potentially interesting species.

■ You will be in charge of:

- Anaerobic culture of micro-organisms, identification of species of interest, design and execution of experiments in consortia.

- Collecting, storing, processing and analysing the bioinformatic and statistical data obtained (independently or as part of a team)
- Synthesis, reporting, publication and dissemination of results

TRAINING AND SKILLS REQUIRED

- Recommended training: Master 2 Research Microbiology / Microbial Ecology
- Knowledge required: Excellent theoretical knowledge of microbial metabolism and interactions
- Appreciated experience: Bioinformatics, statistics, R
- Skills sought: Curiosity, initiative, autonomy, teamwork

INRAE'S LIFE QUALITY

By joining our teams, you benefit from (depending on the type of contract):

- until 30 days of annual leave + 15 days "Reduction of Working Time" (for a full time);
- [parenting support](#): CESU childcare, leisure services;
- skills development systems: [training](#), [career advise](#);
- [social support](#): advice and listening, social assistance and loans;
- [holiday and leisure services](#): holiday vouchers, accommodation at preferential rates;
- [sports and cultural activities](#);
- a dedicated and free public transport service;
- collective catering.

↘ Reception modalities

- Unit: **UMR Herbivores**
- Postal code + city: **63122 St Genès Champanelle**
- Type of contract: **Doctoral position**
- Duration of the contract: **36 months**
- Starting date: **01/01/2025**
- Remuneration: **2 200€ gross salary**

↘ How to apply

Send a motivation letter and a CV by e-mail to:

Milka POPOVA – milka.popova@inrae.fr

AND

Diego MORGAVI – diego.morgavi@inrae.fr

✘ Deadline for applications: **15/09/2024**

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