Unravelling the molecular basis of metabolic interactions in synthetic consortia dedicated for bio-H2 production.

Keywords

Consortium, metabolic interactions, quorum sensing, transcriptome, biohydrogen

Summary

In nature, bacteria usually exist within taxonomically and genotypically diverse communities. Moreover, it is now well appreciated that the capabilities of microbes in their natural environment cannot be predicted by the sum of their parts. Rather, synergistic interactions between microbes within the environment often result in better overall performance of these bacteria and allow them to occupy ecological niches otherwise inaccessible to the isolated species. Given the importance of microbial communities to many ecosystems, like health, or in various industries, they represent an important new frontier for modern microbiology. Nevertheless, there is today a significant gap of knowledge between behaviour and functioning of microbes in monoculture and within complex microbial communities. Nutrient status and metabolic interactions play a key role in driving ecological interactions in microbial communities. Furthermore, it is crucial to understand how the different community members communicate with each other, how this communication is regulated and impacts the metabolism of each species. Very little is known about the molecular basis of interactions between species, as this is difficult to investigate, especially in Nature, on account of community complexity. Therefore, gaining a better insight into the behaviours of microbial communities required to develop simplified models[1]. Using synthetic microbial ecosystems, here we explore this new idea that more than the intrinsic properties of a microorganism, it is the interactions that exist between these living objects that induce emergent properties. Focusing on 2 synthetic consortia constituted of 2 bacteria that are physiologically involved in the anaerobic digestion of organic matter and bio-H2 production[2,3], this project aims at (i) deciphering the metabolic interactions within the consortium; (ii) unravelling the molecular basis of interspecies bacterial communication, (iii) investigating the link between bacterial communication and metabolic coupling.

[1] Song, H. *et al*. Synthetic microbial consortia: from systematic analysis to construction and applications. *Chem. Soc. Rev* **43**, 6954 (2014). [2] Benomar, S. *et al.* Nutritional stress induces exchange of cell material and energetic coupling between bacterial species. *Nature Communications* **6**, 6283 (2015). [3] Ranava, D. *et al.* Metabolic exchange and energetic coupling between nutritionally stressed bacterial species: Role of quorum-sensing molecules. *mBio* **12**, 1–20 (2021).

The co-supervisors

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Locations

Laboratories BIP et LISM, Campus Joseph Aiguier, Marseille, France

Doctoral school

Life and Health Sciences (ED 62), Aix-Marseille université (https://ecole-doctorale-62.univ-amu.fr/)

Expected profile of the candidate

Master or engineer'degree in microbiology. The applicant must have strong background in bacterial metabolism or genomics. The applicant must have a deep interest in this area of research, excellent oral and written communication skills, skills in analysis and problem solving as well as demonstrate critical thinking.