PhD Position: Polymer-based nanodiscs to study membrane protein interactions in *Bacillus cereus*

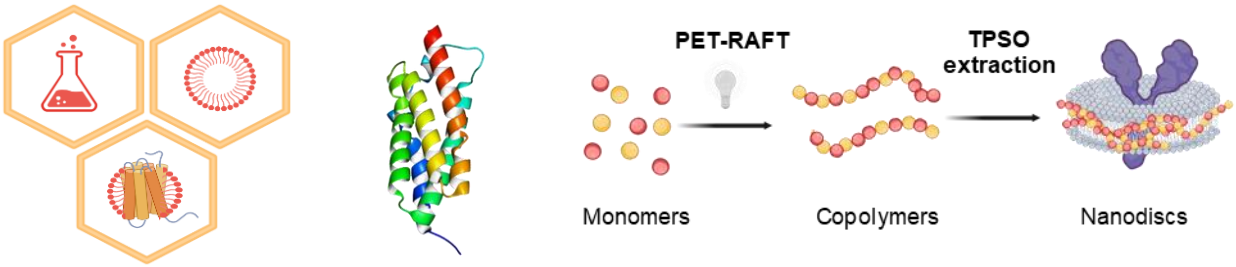
A PhD position is available at Avignon University within the **Graduate School Implanteus** PhD program (https://implanteus.univ-avignon.fr/en/), in close partnership between the Synthèse et Systèmes Colloïdaux Bioorganiques team (https://s2cb.univ-avignon.fr) and the UMR *Safety and Quality of Products of Plant Origin* (https://sqpov.paca.hub.inrae.fr/).

Context and scientific background. Membrane proteins play a central role in cellular signaling, stress adaptation and metabolism. However, their study remains particularly challenging due to their strong dependence on a native lipid environment. Conventional detergent-based approaches often disrupt membrane organization and alter protein–protein interactions, thereby limiting our ability to investigate these systems under physiological conditions.

This PhD project focuses on the Translocator Protein (TSPO), a highly conserved membrane protein involved in oxidative stress responses. In the foodborne pathogen *Bacillus cereus*, TSPO is increasingly recognized as a membrane platform coordinating interactions with soluble partners, particularly under photo-oxidative stress conditions.

In parallel, there is a growing need to develop sustainable alternatives to petroleum-based amphiphiles used in membrane protein research. Polymer–lipid nanodiscs have emerged as a promising solution, enabling the extraction and stabilization of membrane proteins in a near-native lipid environment.

This project lies at the interface of polymer chemistry, membrane biophysics, and molecular microbiology, with both fundamental and applied objectives.



Objectives of the PhD project. The main objectives are to:

- ❖ Develop bio-based amphiphilic polymers as sustainable alternatives to conventional systems
- ❖ Use these polymers to extract and stabilize TSPO in its native lipid environment
- ❖ Identify and characterize TSPO interacting partners involved in stress response
- ❖ Elucidate the functional role of these interactions in bacterial resistance to photo-oxidative stress

Candidate profile. We are looking for a highly motivated candidate with:

- An excellent academic record and a Master's degree or Engineering degree in chemistry and/or biochemistry
- A strong interest in research and significant hands-on experience in experimental laboratory work
- A willingness to engage in an interdisciplinary project
- The ability to work effectively in two teams, along with good communication skills (oral and written)

Experience in one or more of the following areas will be considered an asset:

- protein biochemistry
- molecular microbiology
- biophysical techniques

Fluency in either English or French is required (minimum C1 level), with at least a B1 level in the other language.

Application details. Applications must be submitted as a PDF file including:

- ❖ A cover letter outlining your motivation and suitability for the project
- ❖ A detailed Curriculum Vitae
- ❖ Academic transcripts of the Master and Bachelor degrees (or equivalent)
- ❖ Contact details of at least two referees (name, institution/company, email address, and phone number)

Application procedure. Application must be submitted via the ADUM website only at:

- ❖ http://adum.fr/as/ed/propositionFR.pl?sit_e=adumR
  - Doctoral School (Ecole doctorale): **Agrosciences et Sciences - ED 536**
  - Laboratory (Laboratoire): **UMR SQPOV**
  - Deadline for the application: **May 15th 2026**
- ❖ Selection process:
  - **Step 1**: Pre-selection of maximum three candidates based on the submitted application documents
  - **Step 2**: Shortlisted candidates will be interviewed by the EUR selection committee June 3rd, 2026
- ❖ Starting date: **October 1st, 2026** (36-month contract)
- ❖ Salary: **Approximately €2,200 gross per month** (with the possibility of additional teaching duties)

Important information: The SPORALIM team is located within a restricted access area (ZRR – Zone à Régime Restrictif). Access is subject to authorization by French authorities, which will be required prior to recruitment.

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More information on the laboratories:

The selected candidate will join dynamic research teams based at Avignon University (https://univ-avignon.fr) and INRAE (https://sqpov.paca.hub.inrae.fr/), benefiting from state-of-the-art Technology Facilities. The team Synthèse et Systèmes Colloïdaux Bioorganiques (S2CB, https://s2cb.univ-avignon.fr) is specialized in the synthesis of amphiphilic molecules and has developed strong expertise in the ligation of polar and apolar moieties using various chemical approaches. Since April 2015, the team S2CB has led the joint laboratory Chem2staB (www.chem2stab.org) in partnership with the company CALIXAR. The team has also contributed to the development and commercialization of non-ionic amphipols (NAPols) in collaboration with the company ANATRACE (USA). Within the joint research unit *Safety and Quality of Products of Plant Origin* (UMR SQPOV, https://sqpov.paca.hub.inrae.fr/), the PhD candidate will be affiliated with the SPORALIM team (*Sporulating Bacteria in the Food Chain*). This team focuses on spore-forming bacteria, which are ubiquitous in the environment and frequently contaminate food products, particularly plant-based foods. These bacteria are highly resistant to physical and chemical stresses, as well as to thermal processing, and display a wide range of adaptive mechanisms along the food chain. Among them, *Bacillus cereus* is considered a key model organism. The team aims to characterize and assess the risks posed by these bacteria to consumer health. It also develops innovative strategies to control food contamination by *B. cereus* and other spore-forming species, using emerging technologies that preserve both food quality and nutritional value. A major research focus is the investigation of the physiological and molecular mechanisms underlying the adaptation of *B. cereus* to its environment.

References

- Duport, C., Armengaud, J., Schmitt, C., Morin, D. & Lacapère, J.-J. Elucidating the pivotal role of TSPO in porphyrin-related cellular processes, in *Bacillus cereus*. *Biochimie* (2024) doi:10.1016/j.biochi.2024.02.008.
- Duport, C. & Armengaud, J. Exoproteomic Evidence for BcTSPO-Mediated Regulation of Virulence Factors in Bacillus cereus. *Proteomics* e202400293 (2025) doi:10.1002/pmic.202400293.
- Monjal et al, Photo-induced polymerization of styrene-maleic acid copolymers for the extraction of membrane proteins. *J. Polym. Sci.* (2024) 1–12. DOI: 10.1002/pol.20240295
- Gomes *et al*, Biotinylated RAFT Styrene/Maleic Acid Copolymers for Biosensor Applications of Membrane Proteins. *ACS Applied Polymer Materials* (2025) DOI: 10.1021/acsapm.5c02955.