PROPOSAL OF RESEARCH INTERNSHIP (M2 LEVEL)

Title*: platform protein, phosphorylation and sporulation in *Bacillus cereus

***Host*: SporAlim Team, SQPOV Research Unit, INRAE Avignon**

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Bacillus cereus is a Gram+, sporulating bacteria belonging to the phylum of firmicutes. Due to its abundance in the soil and the resistance of spores, *B. cereus* contaminates virtually all categories of food. This contamination can also occur during the processing of food matrices, due to the persistence of spores on the surfaces of equipment and their adhesion capacity leading to the formation of biofilms. Spore germination can cause product alterations, sources of food loss and waste, or after ingestion can cause food poisoning. Sporulation is a complex, rigorously controlled program of differentiation, both in time and in space, via the cascade activation of specific transcriptional sigma factors. Several successive steps will allow the formation of the pre-spore and lead to release, after lysis of the mother cell, of a mature spore: encompassing the pre-spore, synthesis of cortex and spore coats which give the spore its extreme resistance. In *B. cereus*, the spore is protected by an outer fibrous protein coat, the exosporium. The transition between the dividing vegetative cell and the entry in sporulation or alternatively in biofilm formation is controlled by the major transcriptional regulator Spo0A. In *Bacillus subtilis*, the model bacteria of sporulating firmicutes, Spo0A controls the expression of more than 500 genes (Molle *et al*, 2003). The Spo0M protein is a sporulation regulator that controls Spo0A via an unclear mechanism in *B. subtilis*. Spo0M exhibits a 3D structure highly similar to that of arrestins, which are mammalian platform proteins involved in many signaling pathways (Sonoda *et al.*, 2015). Spo0M would also play a multifunctional role and would be capable of interacting with several protein partners (Vega-Cabrera *et al*, 2018).

We identified in *B. cereus* a eukaryote-like serine/threonine kinase, YbdM (Hanks, S. K. & Hunter, 1995). Genes encoding Spo0M and YbdM are concomitantly expressed in the early phase of sporulation. We also demonstrated that YbdM phosphorylates Spo0M *in vitro*.

The selected candidate will be responsible for determining proteins in interaction with Spo0M via the development of different biochemical approaches.

Keywords

Bacillus cereus, regulation, phosphorylation, sporulation, protein/protein interactions, biochemistry.

Methodology

The selected candidate will use different biochemical techniques (Protein purification, pull-down, co-immuno-precipitation, far Western-blot, etc…). He (she) will also become familiar with the physiology of *B. cereus*, in particular the production of spores, the major form of contamination.