M2 student internship

Revealing S-layer function in the food-borne pathogen *Bacillus cereus*

Global warning affects the diversity and population of bacteria in soil. In the case of *Bacillus cereus*, it could increase the population of mesophilic pathogenic strains, and consequently the contamination of plants by pathogenic strains. The health risk associated with *B. cereus* would thus be increased with global warming.

B. cereus is a common cause of food-borne gastrointestinal illness. The most serious cases are caused by mesophilic emetic strains. In their natural habitat, emetic strains colonize roots and tubers of plants, either as endophytic symbionts or as biofilms. Aerial parts of the plants are contaminated by these strains, upon harvest or by small animals. In non-natural environment such as contaminated food-matrices, emetic strains produce human toxin cereulide, which is considered as the key factor of their pathogenicity. However, we noticed that, in contrast to other strains of *B. cereus*, emetic strains have an S-layer on their surface.

An S-layer is a protein assembly that forms a two-dimensional crystal lattice on the bacterial surface. Despite the apparently conserved function of providing a 2D network surrounding the cell, the genetic and functional studies described in the literature show that there is a great diversity in the structures and roles of S-layers. The ability to form a 2D network could be the result of a convergent evolution to fulfill a multitude of functions, some of which are essential to the physiology of the cell and others facilitate survival in specific niches. Although the function of many S layers is not known, it appears clearly that they play an important role in the bacteria producing them.

The observation that *B. cereus* emetic strains harbor an S-layer leads to some interrogation: Are S-layer determinants of the pathogenicity of emetic strains? Are S-layer a characteristic of adaptation to an ecological niche? What selective benefits does S-layer provide?

We are currently characterizing S-layer mutants of the emetic reference strain by using different approaches: morphological characterization by microscopy, metabolomic studies to determine how the presence of an S-layer affects the bacterial metabolism, growth and adaptation to different environments as well as virulence studies. The internship student will complement and develop some of these aspects to help to understand the role and function of S-layer in *B. cereus*, learning skills in microbiology, microscopy and cellular biology.

The internship student will also learn to elaborate lab experiment, position its research activity and results in the existing literature, analyze the data and write reports.

Team: SporAlim, SQPOV (Sécurité et qualité des produits d'origine végétale, https://www6.paca.inrae.fr/sqpov/Equipes-Personnes/SporAlim), INRAE Avignon Centre PACA, route de l'Aérodrome, CS 40509, 84914 Avignon Cedex 9

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