Regulation of a two-component system involved in *Bacillus cereus* cold adaptation

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Bacillus cereus is a spore-forming bacterium, responsible for foodborne poisoning and some fatal infections. This bacterium is ubiquitous and able to adapt to a wide range of environmental fluctuations. *B. cereus* owns fifty two-component systems (TCS), which represent major elements in bacterial environmental adaptation. We showed that one of these TCS, CasK/R plays a role in the optimal unsaturation of fatty acids (FAs) necessary for *B. cereus* cold adaptation and we investigated the regulation of this sensor system as a function of growth temperature.

RT-PCR experiments performed at optimal and low growth temperatures showed that *casK* and *casR* are co-transcribed with a gene encoding a RpiR-like regulator protein, forming the *casK-casR-rpiR* operon. The *lacZ* transcriptional fusions demonstrated that the promoter activity of this operon was repressed in the stationary phase during growth at low temperature in the WT strain compared to the Δ*casK/R* strain, suggesting that CasR negatively regulates the activity of its own promoter in cold conditions, something original for a TCS. A second individual promoter was identified upstream of the *rpiR* gene and we showed that CasK/R also repressed the expression of this second *rpiR* promoter, not only at 12°C but also at 37°C, suggesting a role of CasK/R also during growth in optimal conditions. We studied the promoter activity of the *desA* gene, encoding a FA desaturase, presumably providing unsaturated fatty acids (UFAs) required for cold adaptation. Our data suggest that CasK/R activates *desA* expression for the optimal unsaturation of the FAs during *B. cereus* growth at low temperature, expression which was however lowered when a UFAs source was provided in the growth medium. This work will help in deciphering the whole mechanism involving CasKR for *B. cereus* cold adaptation.