The everchanging nature of bacterial environment requires adaptation to emerging novel conditions. One proposed way of adaptation involves increased generation of genetic variability in response to harmful conditions – a phenomenon called adaptive mutagenesis. However, the details of mechanisms of adaptive mutagenesis, and even its very existence, are far from clear.
Our goal was to subject the Gram-positive model bacterium Bacillus subtilis to variety of environmental stresses, examine the rate of mutagenesis occuring and compare it to unstressed conditions. Next we wondered if there was a role for mismatch-repair system (MMR), the major pathway for mutation avoidance, in these processes.
To accomplish this, we constructed systems to monitor the expression of MMR components both on transcription and translation level. We also developed a mathematical model for precise mutation rate determination in order to quantify the intensity of mutagenic processes.
The monitoring of MMR proteins translation failed due to high background endogenous fluorescence present in B. subtilis cells. However, we found out, using transcription reporter system, that the expression of MMR is not influenced by imposition of harsh hyperosmotic shock upon cells. The expression of MMR was also barely influenced by nutrient limitation in stationary phase of growth. Conversely, we did not detect any significant increase of mutation rate on these and several other conditions.
We conclude that B. subtilis does not experience obvious stress-directed adaptive mutagesis. Our findings also add support to the notion of substantial differences between dynamics of MMR on stress condition in B. subtilis and Escherichia coli. These might be attributed to strikingly different lifestyles of both prokaryotic models, i.a. existence of sporulation in B. subtilis.