„The influence of strigent response on bacterial adaptability to different environmental conditions"

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One of the basic processes in bacterial cell, with crucial influence on the survival of the organism, is regulation of gene expression. As an effect of occurrence of unfavorable environmental conditions, in order to survive, bacteria employ the stringent response, one of the mechanisms responsible for regulation of global metabolism changes. Bacterial existence depends on whether they are able to quickly and effectively adapt to environmental challenges, often associated with deficiency of nutrients, to which they are particularly susceptible as unicellular organisms. Despite the fact that marine bacteria are well adapted to the environment with limited nutrients, only quite sparse information exist about the molecular mechanisms allowing them to survive in these unfavorable conditions. To reveal the mechanisms of the adaptation of marine bacteria to stress conditions, three species isolated from the Baltic Sea were employed in my research: *Shewanella baltica*, *Acinteobacter johnsonii* and *Vibrio harveyi*. The analysis proved that these bacteria harbor genes and relevant proteins necessary for the synthesis of the stringent response alarmone, guanosine tetraphosphate (ppGpp) and are able to induce alarmone synthesis under various stress conditions. The environmental factors that induce ppGpp accumulation include: amino acid, carbon and nitrogen starvation, temperature shock, osmotic stress and pH changes as well as agents causing DNA damage. My results show that the stringent response is induced to a various extent in different bacterial species, depending on environmental conditions. Stringent response factors, which are ppGpp and DksA protein, lead to severe repression of e.g. stable RNA synthesis, including transcription from tRNA promoters in order to conserve energy in unfavorable conditions. As demonstrated by our research, pArgX promoter can be inhibited by ppGpp and stimulated by DksA *in vivo* and *in vitro* while its activity is inhibited when both regulators are present. Importantly, this is a first example of a promoter being differentially regulated by DksA and ppGpp. The important role in transcription regulation is ascribed also to a specific sequence located in a promoter region between -10 box and +1, called discriminator. Results presented in this work show antagonistic effect of ppGpp (inhibitory effect) and DksA (activation) on transcription from all analyzed tRNA promoters, except serU. However, the increase in the concentration of ppGpp in the cell in most cases completely eliminates the effect of DksA, and in some cases reduces the effectiveness of its action. Both stringent response factors influence

the process of transcription initiation at various stages. Moreover, the discriminator sequence has a significant impact on this regulation. The results of my analysis indicate that the stringent response factors, ppGpp and DksA, have significant influence on the regulation of transcription of tRNA promoters and this regulation is dependent on the discriminator sequence. The results presented in my thesis provide new set of data about complex regulation by the stringent response factors, also in poorly investigated marine bacteria.