Minimal transcriptional regulation of horizontally transferred photosynthesis genes in phototrophic bacterium *Gemmatimonas phototrophica*

RNDr. Karel Kopejtka. Ph.D.
Laboratory of Anoxygenic Phototrophs

Abstract:
The first discovered phototrophic member of the bacterial phylum *Gemmatimonadota*, *Gemmatimonas phototrophica* AP64^T, received all its photosynthesis genes via a distant horizontal gene transfer from purple bacteria. Here, we have investigated how the acquired genes, which in the ancestor are tightly controlled by oxygen and light, are integrated into the regulatory system of its new host. *G. phototrophica* grew well under aerobic and semi-aerobic conditions, with almost no difference in gene expression. Under aerobic conditions, the growth of *G. phototrophica* was optimal at 80 µmol photon m-2 s-1, while higher light intensities had an inhibitory effect. The transcriptome showed only a minimal response to the dark-light shift at optimal light intensity, while the exposure to a higher light intensity (200 µmol photon m^{-2} s^{-1}) induced already stronger, but still transient changes in gene expression. Interestingly, a singlet oxygen defence was not activated under any conditions tested. Our results indicate that *G. phototrophica* possesses neither the oxygen-dependent repression of photosynthesis genes known from purple bacteria, nor the light-dependent repression described in aerobic anoxygenic phototrophs. Instead, G. phototrophica has evolved as a low light species preferring reduced oxygen concentrations. Under these conditions the bacterium can safely employ its photoheterotrophic metabolism without the need of complex regulatory mechanisms.