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Metabolic homeostasis of Phosphate and Nitrogen in *Streptomyces*

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In different *Streptomyces* species it is well known that the biosynthetic pathways of distinct types of secondary metabolites are regulated negatively by high-phosphate concentrations. Apart from that, it was found that under nitrogen starvation, GlnR controls the transcription of multiple genes associated with nitrogen metabolism. One of the approach for *Streptomyces* to survive during phosphate starvation is to interact with nitrogen metabolism. Phosphate control of nitrogen metabolism is achieved by the binding of PhoP to the promoters of nitrogen metabolism, most importantly: *glnR* (the global regulator). Here, the authors show the competition of PhoP and GlnR to the promoters of nitrogen metabolism genes showing the interesting example of non reciprocal regulation of the GlnR-regulated glnA model promoter by the master protein PhoP.

紹介論文

Competition between the GlnR and PhoP regulators for the *glnA* and *amtB* promoters in *Streptomyces coelicolor.* Alberto Sola-Landa, Antonio Rodríguez-García, Rafat Amin, Wolfgang Wohlleben and Juan F. Martín Nucl. Acids Res. (2012) doi: 10.1093/nar/gks1203

要旨

Interaction of regulatory networks is a subject of great interest in systems biology of bacteria. Phosphate control of metabolism in *Streptomyces* is mediated by the two-component system PhoR–PhoP. Similarly, the utilization of different nitrogen sources is controlled by the regulator GlnR. Transcriptomic and biochemical analysis revealed that *glnA*(encoding a glutamine synthetase), *glnR* and other nitrogen metabolism genes are under PhoP control. DNA-binding experiments showed that PhoP binds to other nitrogen-regulated genes (SCO0255, SCO01863 and*ureA*). Using the *glnA* promoter as model, we observed that PhoP and GlnR compete for binding to the same promoter region, showing GlnR a higher affinity. Using a total of 14 GlnR-binding sites (50 direct repeat units) we established two information-based models that describe the GlnR box as consisting of two 11-nt direct repeats each with clear differences to PHO box. DNA-binding studies with different mutant sequences of *glnA* promoter revealed that the sequence recognized by GlnR is found in the coding strand whereas that recognized by PhoP is overlapping in the non-coding strand. In *amtB* promoter PhoP and GlnR boxes are not totally overlapping and both proteins bind simultaneously. PhoP control of nitrogen metabolism genes helps to balance the cellular P/N equilibrium.

References:

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