# Cyanobacteria's Specific Features: A Circadian Clock and many Antisense RNAs

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Abstract:

Many organisms coordinate their activities into daily cycles metering an inner clock. Among prokaryotes, only cyanobacteria are known to harbour such a circadian clock. It consists of just three proteins, KaiA, KaiB, and KaiC that produce 24-hour oscillations of KaiC phosphorylation, even in a test tube. Our analyses revealed that complex formation between Kai proteins and, therefore, their stoichiometry is essential in maintaining robust circadian oscillations (Brettschneider et al., 2010). Thus, it is puzzling that several cyanobacterial species contain multiple *kai*-gene copies; others harbour only a reduced *kaiBC* system, thus, lacking the *kaiA* gene. We are investigating the phenomenon in a combined *in vitro*, *in silico* and *in vivo* approach. Kai proteins from diverse cyanobacteria have been purified from *E. coli* for biochemical assays. In parallel, mathematical models aid in evaluating experimental results and predicting the circadian clock mechanism for diverse systems. Finally, global transcriptomic analyses of light-dark synchronised cyanobacterial cultures will clarify intertwining of clock and gene regulation.
Further, small RNAs involved in the bacterial gene regulation are analysed which have been detected antisense to circadian (*kai*) genes as well. For a first example, the small regulatory RNA, IsrR, we showed that antisense RNA is responsible for a pronounced delay in the induction of an accumulation of the target mRNA and that it ensures rapid termination of the target expression once external stress triggers are removed (Dühring et al, 2006; Legewie et al. 2008). Moreover, recent global screenings in a cyanobacterium (Georg et al. 2009) as well as our own expression data have identified a large number of antisense RNAs suggesting that about 10% of all genes are influenced. Thus, regulation by antisense RNA seems to be a fundamental mechanism in cyanobacterial gene expression.

## Friday, June 10th, 2011 13:00

## Room PH 127

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