UNIVERSITY OF TURKU

Supervisor's contact details

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Title of the project

Analysis of a growth regulating signalling cascade in cyanobacteria

MSCA-PF Research Panel

☐ Chemistry (CHE)

☐ Social Sciences and Humanities (SOC)

☐ Economic Sciences (ECO)

☐ Information Science and Engineering (ENG)

☐ Environment and Geosciences (ENV)

☒ Life Sciences (LIF)

☐ Mathematics (MAT)

☐ Physics (PHY)

Description of the project

Cyanobacteria are extremely important primary producers being responsible for at least one-fourth of carbon fixation on Earth. However, our current knowledge on how cyanobacteria adjust their growth according to environmental cues is limited. We have discovered of a novel signalling cascade in the model cyanobacterium Synechocystis sp. PCC 6803. The novel signalling cascade regulates the growth of cells according to environmental cues including the amount of available inorganic carbon. The signalling cascade comprises the SigC sigma factor, an anti-SigC factor and an anti-SigC antagonist. Furthermore, the non-essential tiny ω subunit of the RNA polymerase is also involved in the growth regulation by influencing which sigma factors the RNA polymerase core recruits to form the transcription initiation competent RNA polymerase holoenzyme.

Recruitment of the SigC sigma factor by the RNA polymerase core results in cessation of growth. Our results suggest that the recruitment of the SigC factor is regulated by the anti-SigC factor and by the anti-SigC antagonist. The regulation may utilize a partner switch model. The anti-SigC factor either interacts with the SigC factor or with the anti-SigC factor antagonist; if the anti-SigC factor interacts with the anti-SigC antagonist then the free SigC factor can be recruited by the RNA polymerase core, and growth is arrested whereas formation of SigC/anti-SigC complex prevents formation of the RNAP-SigC holoenzyme allowing growth. The anti-SigC antagonist is a phosphoprotein and phosphorylation may

regulate the signalling cascade. The role of the Marie Curie PostDoc in the project is to study the interactions between the signalling cascade components and how they are regulated.

Research objectives or research questions of the project

The research aims at discovering at the molecular level how the novel signalling cascade functions. To that end, the 3D structures of the SigC sigma factor, the anti-SigC factor and anti-SigC antagonist and their complexes will be determined and interactions between signalling cascade components will be studied using standard biochemical methods. The regulatory role of phosphorylation of two serine residues of the anti-SigC antagonist will be tested in vitro and in vivo.