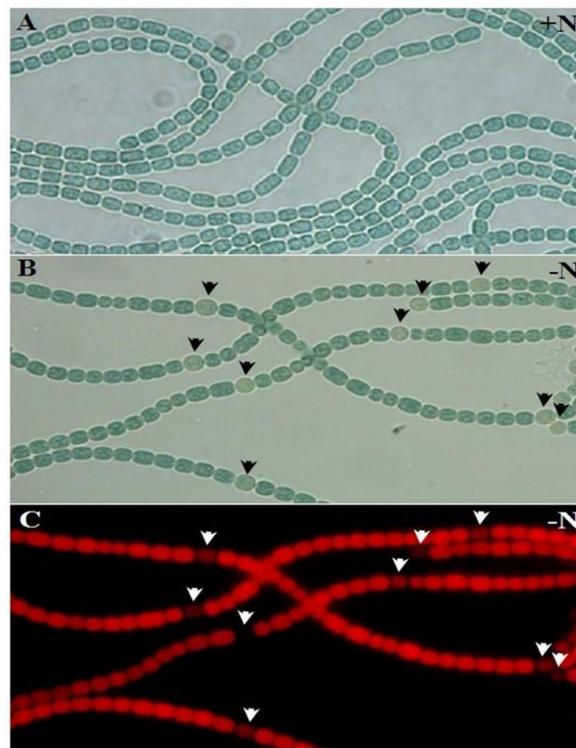


## Role of the Master regulator HetR in the cellular differentiation process in the cyanobacterium *Nostoc* PCC 7120

### Project aim and description:

We study the filamentous and diazotrophic cyanobacterium *Nostoc* PCC 7120. When the fixed nitrogen is abundant, *Nostoc* grows in long filaments of vegetative cells but if the combined nitrogen becomes limiting, 5-10% of the vegetative cells are induced to differentiate into micro-oxic cells (heterocysts), which are semi-regularly distributed along the filament (Figure 1). Our research is focused on understanding how signaling pathways are integrated to control heterocyst differentiation and how the behavior of cells dictates the developmental pattern.



**Figure 1: Heterocyst differentiation in *Nostoc* PCC 7120**

**A:** *Nostoc* grown in the presence of combined nitrogen: the filaments are only composed of vegetative cells performing oxygenic photosynthesis. **B:** in response to combined nitrogen starvation, 1 every 10/15 vegetative cell differentiate into a heterocyst specialized in atmospheric nitrogen fixation. **C:** Heterocysts (dark cells) are micro-oxic cells where photosynthesis is inhibited.

The signaling cascade initiating the differentiation process involves the HetR protein which is the specific and master regulator of this cellular process. We have recently shown that HetR is

a phosphoprotein whose phosphorylation on three conserved Serine residues is essential for the differentiation process.

**The aim of the project** is to better understand the role of HetR phosphorylation in the control of cellular differentiation. The questions that we address is which kinase phosphorylates HetR? Is HetR phosphorylation needed for the establishment of the pattern? What are the mechanism underlying the temporal dynamic of HetR transcriptional control through the differentiation process?

**To answer these questions**, the phosphorylation of HetR during the course of the differentiation will be addressed by studying the phenotype(s) of phosphoablative and phosphomimetic *hetR* mutants. Proteins able to interact with HetR during the differentiation process will also be searched, which will allow to identify HetR kinase, phosphatase and potentially proteins that allow HetR to recognize various promoters along the process. The function of the identified interactants will be studied by assessing the phosphorylation/dephosphorylation of HetR and by studying the control it undergoes on target genes.

**Key words:** *Nostoc* – Cyanobacteria – Cellular differentiation – Nitrogen fixation-  
Transcriptional regulator Serine/threonine Phosphorylation

**Application will be through the Doctoral School Exam on June 2017 at Aix-Marseille University.**

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