SCIENCES & BIOENGINEERING SCIENCES

The Research Group of

Microbiology

has the honor to invite you to the public defense of the PhD thesis of

Liesbeth Lemmens

to obtain the degree of Doctor of Bio-Engineering Sciences

Title of the PhD thesis:

Molecular mechanisms of heat-shock induced transcription factors in the thermoacidophilic crenarchaeon *Sulfolobus acidocaldarius*

Promotor:

Prof. dr. ir. Eveline Peeters

The defence will take place on

Thursday January 9, 2020 at 17h00

in Auditorium D.2.01 at the Campus Humanities, Sciences and Engineering of the Vrije Universiteit Brussel, Pleinlaan 2 - 1050 Elsene, and will be followed by a reception.

Members of the jury:

Prof. dr. Gert Desmet (voorzitter)
Prof. dr. Stefan Weckx (secretaris)
Prof. dr. Luc Leyns
Dr. Alexandre Wohlkönig
Prof. dr. Remus Dame (Universiteit Leiden)
Prof. dr. Laurence Van Melderen (ULB)

Curriculum vitae

Liesbeth Lemmens (°1988) obtained a Master degree in Biology in 2012 at the Katholieke Universiteit Leuven (KULeuven). In 2013 she started her PhD research in the Research Group of Microbiology at the Vrije Universiteit Brussel, focused on gene regulation in response to heat shock in the thermoacidophilic crenarchaeon *Sulfolobus acidocaldarius*. Her research results were presented at several international conferences. Liesbeth is first author of three peer-reviewed publications, of which one research paper and two reviews. Besides her research was Liesbeth actively involved in the educational program by teaching practical courses at Bachelor and Master level. She was representative of the PhD community in the department and faculty board and NSE doctoral school.

Abstract of the PhD research

Archaea, regularly referred to as the “third domain” of life, are microorganisms characterized by several extremophilic species, living for example in hot springs and salt lakes. However, they are also found in mainstream habitats. *Sulfolobus acidocaldarius,* an aerobic thermoacidophilic crenarchaeon isolated from solfataras, sulfur-rich hot springs characterized by a high temperature and low pH, is an important archaeal model organism. Living in a dynamic ecosystem with strongly fluctuating environmental conditions, such as temperature, it is clear that *S. acidocaldarius* is subjected to high levels of stress. Therefore, an adequate gene regulation in response to stress conditions, such as heat shock, is crucial for the fitness and survival of these microorganisms. Only little information is available on the physiological function of transcription factors in *S. acidocaldarius* and moreover, although it can be postulated that a heat-shock response is transcriptionally regulated as in bacterial and eukaryal microorganisms, none of the transcription factors have been linked to heat shock response. This work focuses on heat-shock induced transcriptional regulation and aims to characterize induced transcription factors. In a first part, I aim to define heat-shock stress for *S. acidocaldarius* by describing physiological effects on cells, focusing on growth rate and survival. Gene expression analysis revealed differential expression of six genes encoding transcriptional regulators upon subjecting the cells to a 10°C heat shock. Based on these results, a subset of these regulators were molecularly characterized in a second part of the work: a GntR-family transcription factor, a TetR-family transcription factor and a small DNA-binding protein. Detailed studies were performed to unravel DNA-binding mode, regulon, regulatory mechanism and protein structure. Although none of the identified and studied transcription factors were shown to be directly involved in heat shock response, this work provides new insights into the molecular functioning of transcription factors in *S. acidocaldarius*.