

The Research Group of
Microbiology (MICR)

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

HASSAN RAMADAN MAKLAD

to obtain the degree of Doctor of Bioengineering Sciences

Title of the PhD thesis:

Phosphorylation of transcription factors as a signal transduction mechanism in the thermoacidophilic crenarchaeon *Sulfolobus acidocaldarius*

Promotor: Prof. dr. ir. Eveline Peeters

The defense will take place on

Saturday, September 5 2020 at 11h00

at the Campus Etterbeek of the Vrije Universiteit Brussel, Pleinlaan 2 - 1050 Elsene (limited capacity) and can be followed through a live stream. Contact Eveline.Peeters@vub.be for more information and in case you would like to attend.

Members of the jury

Prof. dr. Dominique Maes (VUB, chairman)
Prof. dr. ir. Remy Loris (VUB, secretary)
Prof. dr. ir. Eveline Peeters (VUB, promotor)
Prof. dr. Gustavo Gutierrez (VUB)
Dr. Martine Roovers (Institut de Recherche LABIRIS)
Prof. dr. Tessa Quax (University of Freiburg, Germany)

Curriculum vitae

Hassan Ramadan Maklad (°1988) has obtained a BSc and MSc of Science in Microbiology at the Department of Botany and Microbiology at Alexandria University in Egypt in 2009 and 2015, respectively. He joined the VUB Research Group of Microbiology in July 2015 to initiate his PhD research. His work resulted in four peer-reviewed journal articles and he delivered three poster presentations and one oral presentation at (inter-)national conferences. During his PhD, he guided three MSc students for a master thesis project.

Abstract of the PhD research

Protein phosphorylation is an essential and efficient mechanism by which cells can transduce signals and regulate different processes. Its existence in the three domains of life is well-established and the process is thoroughly studied in *Eucarya* and *Bacteria*. However, in *Archaea* little is still known about the process of protein phosphorylation.

A phosphoproteomic study revealed that protein phosphorylation occurs widely in the model archaeon *Sulfolobus acidocaldarius*, of which numerous targeted proteins are involved in central cellular processes including respiration, motility and transcription regulation. Intriguingly, tyrosine was the most targeted residue for phosphorylation. The prominent abundance of phosphorylation in *Sulfolobus* is associated with a lack of reliable information about it. More specifically, very little is known about the cognate kinases and/or phosphatases responsible for specific phosphorylation events and the effects on cellular processes in which they are involved.

In this work, the role of phosphorylation for the functioning of two transcription regulators was studied in *S. acidocaldarius*: one involved in cellular motility (AbfR1) and one in fatty acid metabolism (FadR_{sa}). The effect of phosphorylation on DNA binding and ligand binding was studied. Moreover, I identified a novel protein kinase with tyrosine phosphorylation activity, which is the first of its type to be described in *Archaea*. The enzymatic activity of this representative of a novel archaeal family of kinases was analyzed in addition to the identification of protein substrates using a phosphoproteomic approach. In summary, this work contributes to a better understanding of signal transduction mechanisms in *S. acidocaldarius* by means of phosphorylation of transcription factors.