SCIENCES & BIOENGINEERING SCIENCES

The Research Group
Structural Biology Brussels

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

Manon Demulder

to obtain the degree of Doctor of Bioengineering Sciences

Joint PhD with Ghent University

Title of the PhD thesis:

Structure-function relationships of Arabidopsis thaliana SOG1, a master regulator in plant DNA damage control

Promotors:
Prof. dr. . ir. Remy Loris
Prof. dr. Lieven De Veylder

The defense will take place on

Thursday, October 15, 2020 at 17h00

at the Campus Etterbeek of the Vrije Universiteit Brussel, Pleinlaan 2 - 1050 Elsene, E.0.05
The defense can be followed through a live stream. Contact manon.demulder@vub.be for more information

Members of the jury

Prof. dr. Geert Angenon (VUB, chair)
Dr. Inge Van Molle (VUB, secretary)
Prof. dr. Luc Leyns (VUB)
Prof. dr. Daniel Van Damme (UGent)
Prof. dr. Frank Sobott (Universty of Leeds, UK)
Prof. dr. Julie Bouckaert (Université de Lille, FR)

Curriculum vitae

Manon Demulder (1992) obtained her B.Sc. and M Sc. in Bio-Engineering Sciences at the Vrije Universiteit Brussel. Her doctoral research was carried out within the context of the joint collaboration between the lab of Prof. Dr. ir. Remy Loris (VUB-VIB Structural Biology Centre) and the lab of Prof. Dr. Lieven De Veylder (UGent-VIB Plant Systems Biology). She started her Phd after obtaining a IWT-FWO personal grant with the aim to study DNA stress response in plants by combining biophysical methods and plant *in vivo* work.

Abstract of the PhD research

Due to their sessile lifestyle, plants evolved unique ways to cope with stress. Environmental stress can cause DNA damage and impede proper cell growth by arresting the cell cycle. A major cause of DNA stress is aluminium stress that occurs in acidic soils which make out 30% of arable soils worldwide. In mammals, DNA stress response has been well characterized and more than 25 years ago the “guardian of the genome” p53 was discovered. Strikingly, no p53 homologue is present in plant genomes. It was found that the plant specific transcription factor Suppressor of Gamma Response (SOG1) fulfils the same role in plants. As such SOG1 will activate genes, allowing the plant cell to respond appropriately to its environment. As of yet, the molecular details on SOG1 structure and function have not been studied so that it remains unexplored how SOG1 achieves its role at the molecular level. During this Phd thesis, SOG1 as well as its subdomain were heterologous expressed and purified. Structural analysis revealed that SOG1 is highly intrinsically disordered, preventing crystallization. We also show that SOG1 binds DNA *in vitro* in a highly non-specific manner and that SOG1 contains two independent DNA binding domains. DNA specificity can be regulated by phosphorylation but, contrary to *in vivo* studies, no effect of SOG1 SQ motives phosphorylation was observed on DNA binding specificity. An additional level of regulation could occur by protein-protein interaction. We identified and confirmed that the closely related ANAC044 is a SOG1 interactor *in vivo* and *in vitro*. Lastly, in order to better map the *in vivo* role of SOG1, a chemical genetic screen was preformed to find small compounds that abate SOG1-dependent aluminium toxicity in *Arabidopsis thaliana*. This approach revealed an unmapped link between aluminium stress and phosphate starvation in plants through the CK2 kinase. This study is a first step towards integrating complementary structural and molecular data into a DNA-binding model of SOG1. As SOG1 is a central regulator of stress response in plants, this brings us a step closer to understanding how plants cope with their challenging environment.