SCIENCES & BIOENGINEERING SCIENCES

The Research Group

Structural Biology Brussels

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

Barbara DE SMET

to obtain the degree of Doctor of Bio-Engineering Sciences

Joint PhD with Universiteit Gent

Title of the PhD thesis:

Protein cysteine sulfenylation in plant stress responses: a journey through the organelles

Promotors:

Prof. dr. Joris Messens
prof. dr. Frank Van Breusegem (UGent)

The defence will take place on

Wednesday Feburary 12th 2019 at 17 h

in the seminar room of VIB-PSB-Ghent University, Technologiepark-Zwijnaarde 71 – 9052 Zwijnaarde, and will be followed by a reception.

Members of the jury:

Prof. dr. Wout Boerjan (chairperson, UGent)
Prof. dr. Ive De Smet (secretary, UGent)
Prof. dr. Geert Angenon
Dr. Inge Van Molle
Prof. dr. Alain Goosens (UGent)
Dr. Jingjing Huang (UGent)
Prof. dr. Philip Mullineaux (Univ. of Essex)
Dr. Didier Vertommen (UCL)

Curriculum vitae

Barbara De Smet obtained her Master in Biochemistry and Biotechnology at the University of Ghent in 2013. She started as a joined-PhD fellow with Frank Van Breusegem (UGent) and Joris Messens (VUB). In 2014, she acquired an IWT-grant to fund her research in plant biotechnology and redox biology. Her PhD research focuses on cysteine oxidation in plant stress responses, which led to six publications in international peer reviewed journals. She presented her results at several international conferences, and she also supervised 4 Bachelor and Master thesis projects.

Abstract of the PhD research

Plants are continuously exposed to fluctuating environmental conditions. In order to adapt to these conditions, plants possess an array of stress responses that are only activated when necessary. Important signaling molecules during these stress responses are reactive oxygen species (ROS), which are accumulating upon stress. Oxidation of crucial cysteines to sulfenic acid (-SOH), the initial oxidation product of cysteines, has emerged as a biologically relevant post-translational modification (PTM) with particular importance in redox-mediated signal transduction. Recently, we identified the H_2O_2-dependent sulfenome of Arabidopsis cell suspensions, using the YAP1C probe. Owing to its genetic nature, the YAP1C probe can be engineered for multiple uses. Aiming to explore the sulfenomes of different organelles, the YAP1C probe was fused to various organellar signaling peptides. The sulfenic acid trap was successfully targeted to the chloroplast and nucleus, but unfortunately targeting to the peroxisomes and mitochondria was not possible. It resulted in a compendium of redox sensitive proteins.
Further, I explored the role of these redox-sensitive proteins in plant defence mechanisms by monitoring the growth of plant mutants under oxidative and osmotic stress inducing conditions. One (nuclear) protein, COP9 SIGNALOSOME SUBUNIT 5a (CSN5a), gathered particular interest due to its role in plant development and stress response. The role of the two cysteine residues of CSN5a were evaluated by complementing a knock down line with the mature protein and with cysteine to serine substituted variants of the protein. Mutating both cysteines of CSN5a impaired plant growth, suggesting that the cysteines of CSN5a play an important functional and regulating role.

Overall, this thesis contributes to the compendium of S-sulfenylated proteins, with an emphasis on the subcellular localization of these proteins. It furthers delivers a handful of promising genes involved in plant stress responses.