SCIENCES & BIOENGINEERING SCIENCES

The Research Group

Structural Biology Brussels (SBB)

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

Nandita Bodra

to obtain the degree of Doctor of Bioengineering Sciences

and Doctor of Sciences in Biochemistry and Biotechnology

Title of the PhD thesis:

How *Arabidopsis thaliana* dehydroascorbate reductase 2 and mitogen activated kinase 4 cope with cysteine sulfur oxidation

Promotors:
Prof. Dr. Joris Messens (VUB)
Prof. Dr. Frank Van Breusegem (UGent)

The defense will take place on
Tuesday February 20 2018 at 16:00h

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. Geert Angenon (chairman)
Prof. Dr. Jean-Pierre Hernalsteens (secretary)
Prof. Dr. Jean Philippe Reichheld (Univ. Perpignan)
Prof. Dr. Ann Depicker (UGent)
Prof. Dr. Godelieve Gheysen (UGent)
Prof. Dr. Nathalie Verbruggen (ULB)

Curriculum vitae

Nandita Bodra graduated as a Master in Biotechnology at the Indian Institute of Technology (IIT) Roorkee, India in 2013. In 2014, she started her research as a joint PhD student of the VIB-VUB Center for Structural Biology and UGent Department of Plant Biotechnology and Bioinformatics. In 2015, she received an Indian council of agricultural research (ICAR) fellowship to continue her PhD research.
She worked on redox proteins involved in plant signalling and oxidative stress survival. She studied the mode of action of redox proteins. During her PhD studies, she contributed to three peer reviewed publications.
In addition, she presented her work in several oral and poster presentations at national and international scientific conferences. During this period, she also supervised master students practical courses.

Abstract of the PhD research

Reactive oxygen species (ROS) are unavoidable by-products of aerobic life. To prevent oxidative damage, cells maintain a dynamic balance between ROS production and removal by antioxidants. ROS also function as signalling molecules, and today, thiol oxidation of cysteines is a well-recognized posttranslational protein modification. However, the signal transduction processes steered by such oxidations remain poorly understood. To gain insight into the cysteine thiol-dependent ROS signalling in plants, we mapped out the hydrogen peroxide-dependent sulfenome of *Arabidopsis thaliana*: that is, proteins with at least one cysteine thiol (Cys-SH) oxidized to a sulfenic acid (Cys-SOH).

The main goal of my research was to characterize proteins of the sulfenome to understand their role in oxidative stress signalling. We studied dehydroascorbate reductase 2 (DHAR2) and mitogen activated kinase 4 (MPK4) which we identified as sulfenylated proteins. DHAR2 regenerates the pool of ascorbate in a glutathione-dependent manner for the reduction of ROS. DHAR2 catalysis was shown to be driven by conformational flexibility with sulfenic acid formation and S-glutathionylation on its active site cysteine as part of its catalytic cycle. For cytosolic MPK4, an enzyme induced under oxidative stress, the situation is different. Here, sulfenylation of one of its conserved cysteines significantly slows down its substrate phosphorylation activity.

In conclusion, it becomes clear that understanding the role of sulfur oxidation of proteins from the sulfenome requires a detailed case-by-case biochemical approach. Ultimately, the molecular understanding of these oxidative stress induced protein modifications in plants might help to conceive new biotechnological approaches to improve performance of crops under stressful growth conditions.