

DOTTORATO DI RICERCA IN BIOLOGIA CELLULARE E DELLO SVILUPPO

XXXVII Cycle

Project proposal for a Sapienza PhD scholarship

The Arabidopsis Berberine Bridge Enzyme-like family in the homeostasis of cell-wall derived DAMPs during immunity and development

Giulia De Lorenzo, giulia.delorenzo@uniroma1.it

Web Page and CV: https://phd.uniroma1.it/web/GIULIA-DE-LORENZO_nC95_EN.aspx

Google Scholar Page:

https://scholar.google.it/citations?hl=it&user=eUlhXXUAAAAJ&view_op=list_works&sortby=pubdate

Plant immunity can be activated by endogenous elicitors referred to as damage-associated molecular patterns (DAMPs). Typical DAMPs are the oligogalacturonides (OGs), the cellodextrins (CDs) and the recently discovered mixed-linked beta-1,3/1,4-glucans (MLGs). These oligosaccharides are released from the cell wall pectin, cellulose, and hemicellulose respectively, upon pathogen infection or mechanical injury or during the physiological cell wall remodelling. It has been shown that, like OGs, CDs influence the action of auxin (unpublished) and are therefore potential players affecting development. Notably, the effect OGs and CDs on auxin signalling are different; nothing instead is known about the effects of MLGs on hormone responses. The homeostasis of OGs and CDs is maintained by specific oxidases (OGOXS and CELLOX, respectively), belonging to the berberine-bridge enzyme-like (BBE-like) family. BBE-I enzymes play a role in immunity, likely preventing over-accumulation of DAMPs and consequent deleterious effects (hyper-immunity). We have recently found that there are at least two CELLOXs in Arabidopsis, sharing a very similar enzymatic activity and both capable of oxidizing MLGs, but showing a different regulation at the level of gene expression. By reverse genetics, the role of OGOXS and CELLOXs in immunity and development is being elucidated. Moreover, other BBE-like members, the expression of which is induced during immunity, will be characterized by heterologous expression and biochemical analyses. We aim at demonstrating that the BBE-I family comprises members devoted to the maintenance of the homeostasis of cell wall-derived DAMPs in general.

Pertinent publications of the proponent (last 5 years)

1. Giovannoni M, Marti L, Ferrari S, Tanaka-Takada N, Maeshima M, Ott T, **De Lorenzo G**, Mattei B. (2021). The plasma membrane-associated Ca²⁺ - binding protein PCaP1 is required for oligogalacturonide and flagellin-induced priming and immunity. *Plant Cell Environ.* doi: 10.1111/pce.14118. Online ahead of print.
2. Gamir J, Minchev Z, Berrio E, Garcia JM, **De Lorenzo G**, Pozo MJ (2021) Roots drive oligogalacturonide-induced systemic immunity in tomato. *Plant, Cell & Environment* 44 (1), 275-289
3. L Marti, DV Savatin, N Gigli-Bisceglia, V de Turris, F Cervone, **De Lorenzo G**. (2021) The intracellular ROS accumulation in elicitor-induced immunity requires the multiple organelle-targeted Arabidopsis NPK1-related protein kinases *Plant, Cell & Environment*
4. D Pontiggia, M Benedetti, S Costantini, **G De Lorenzo**, F Cervone (2020) Dampening the DAMPs: How Plants Maintain the Homeostasis of Cell Wall Molecular Patterns and Avoid Hyper-Immunity. *Frontiers in Plant Science* 11:613259. doi: 10.3389/fpls.2020.613259.
5. Locci F, Benedetti M, Pontiggia D, Citterico M, Caprari C, Mattei B, Cervone F, **De Lorenzo G** (2019) An Arabidopsis berberine bridge enzyme-like protein specifically oxidizes cellulose oligomers and plays a role in immunity. *Plant J.* 2019 98(3):540-554. doi: 10.1111/tbj.14237
6. **De Lorenzo G**, Ferrari S, Giovannoni M, Mattei B, Cervone F. (2019) Cell wall traits that influence plant development, immunity, and bioconversion. *Plant J.* 97(1):134-147. doi: 10.1111/tbj.14196

7. **De Lorenzo G**, Ferrari S, Cervone F, Okun E. (2018) Extracellular DAMPs in Plants and Mammals: Immunity, Tissue Damage and Repair. *Trends Immunol.* 2018 Oct 4. doi: 10.1016/j.it.2018.09.006.
8. Benedetti M, Verrascina I, Pontiggia D, Locci F, Mattei B, **De Lorenzo G**, Cervone F (2018). Four Arabidopsis berberine-bridge enzyme-like proteins are specific oxidases that inactivate the elicitor-active oligogalacturonides. *Plant J.* 2018 Feb 3. doi: 10.1111/tpj.13852
9. Gigli Bisceglia N, Savatin DV, Cervone F, Engelsdorf T, **De Lorenzo G** (2018). Loss of the Arabidopsis protein kinases ANPs affects root cell wall composition, and triggers the cell wall damage syndrome. *Front Plant Sci.* 2018. doi: 10.3389/fpls.2017.02234
10. Mattei B, Spinelli F, Pontiggia D, **De Lorenzo G**. (2016) Comprehensive analysis of the membrane phosphoproteome regulated by oligogalacturonides in *Arabidopsis thaliana*. *Front Plant Sci.* 2;7:1107. doi: 10.3389/fpls.2016.01107.
11. Gravino M, Locci F, Tundo S, Cervone F, Valentin Savatin D, **De Lorenzo G**. (2016). Immune responses induced by oligogalacturonides are differentially affected by AvrPto and loss of BAK1/BKK1 and PEPR1/PEPR2. *Mol Plant Pathol* 2016 doi: 10.1111/mpp.12419.