

Supervisor(s):

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Host laboratory: Lab : LPCV

Host group/team: LIPID

Title of the M2 research internship:

Characterization of proteins involved in lipid remodelling during phosphate starvation in *Arabidopsis thaliana*.

Project summary:

Phosphate (Pi) deficiency is a common nutrient stress affecting plant growth and crop yield. Plants respond to low Pi by several mechanisms, including increased extracellular Pi uptake and the remobilization of intracellular reserves. In the plant cell, one third of the Pi content is stored in phospholipids, the major components of the extraplastidial membranes. Under low Pi conditions, phospholipids are partially degraded to release Pi and are replaced by galactolipids coming from the chloroplasts. This massive lipid remodelling occurs in the membrane of several organelles including, mitochondria, tonoplast and the plasma membrane. To date, the enzymes involved in Pi starvation are well characterized whereas only a few proteins involved in the transport of lipids between membranes have been characterized. In our team, we have recently identified a lipid transporter, AtVPSM13M1, which plays a role in phospholipid degradation in low Pi. AtVPS13M1 is located on the surface of mitochondria suggesting a potential role in the regulation of mitochondrial lipid homeostasis. The aim of this project is to characterize the role of AtVPS13M2, the closest paralog of AtVPS13M1, in lipid remodelling in response to Pi starvation. To this end, we will take the advantage of the single *atvps13m2* and double *atvps13m1/m2* mutants recently generated by our team using CRISPR/Cas9 technology. The intern will be in charge of characterizing the phenotypes of these lines at the lipidomic and developmental level, both under standard growth conditions and in response to Pi starvation. This work will highlight the key role of VPS13 proteins in plant development and acclimation to low Pi.

Keywords:

Plant, phosphate starvation, lipid transport

Relevant publications of the team:

Leterme, S., Albrieux C., Brugière S., Couté Y., Dellinger J., Gillet B., Hughes S., Castet J., Bernard A., Scheuring D., Schilling M., Jouhet J., and **Michaud M.*** (2024). AtVPS13M1 is involved in lipid remodeling in low phosphate and is located at the mitochondria surface in plants. *BioRxiv*. doi:10.1101/2024.05.22.594332.

Salomon, S., Schilling M., Albrieux C., Si Larbi G., Jouneau P.-H., Roy S., Falconet D., **Michaud M.***, and Jouhet J.*. (2024). Betaine lipids overproduced in seed plants are excluded from plastid membranes and promote endomembrane expansion. *Journal of Experimental Botany*. erae458. doi:10.1093/jxb/erae458.

Leterme, S., Bastien, O., Aiese Cigliano, R. A., Amato, A., and **Michaud, M.*** (2023) Phylogenetic and structural analyses of VPS13 proteins in Archaeplastida reveal their complex evolutionary history in Viridiplantae. *Contact* (Thousand Oaks). doi:10.1177/25152564231211976.

Leterme, S., and **Michaud, M.*** (2022) Non-vesicular glycerolipids transport in plant cells. *Lipids in Plants and Algae: From Fundamental Science to Industrial Applications*. 101, 121–189. doi:10.1016/bs.abr.2021.07.001

Michaud, M.*, V. Gros, M. Tardif, S. Brugière, M. Ferro, W.A. Prinz, A. Toulmay, J. Mathur, M. Wozny, D. Falconet, E. Maréchal, M.A. Block, and J. Jouhet*. (2016). AtMic60 Is Involved in Plant Mitochondria Lipid Trafficking and Is Part of a Large Complex. *Current Biology*. 26:627–639. doi:10.1016/j.cub.2016.01.011.