

**Master 2 internship project  
Year 2025-2026**

**Laboratory/Institute:** LPCV  
**Team:** Lipid  
Maréchal

**Director:** Eric Maréchal  
**Head of the team:** Juliette Jouhet/Eric

**Name and status of the scientist in charge of the project:** Morgane Michaud

**HDR:** yes ☒ no ☐

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**Program of the Master's degree in Biology:**

- ☐ Microbiology, Infectious Diseases and Immunology      ☒ Biochemistry & Structure  
☐ Physiology, Epigenetics, Differentiation, Cancer      ☐ Neurosciences and Neurobiology

**Title of the project:** Understanding how the subcellular localization of the lipid transfer protein VPS13M1 is regulating in cells.

Objectives (up to 3 lines):

- Determining/analyzing the protein partners of VPS13M1
- Analyzing *in vitro* the capacity of VPS13M1 to bind lipids and membranes

Abstract (up to 10 lines):

Lipid transport between organelles is an essential process in eukaryotic cells that ensures growth and signaling, as well as the ability to respond to stress. VPS13 family proteins are lipid transporters that play a role in non-vesicular lipid transport and are involved in processes requiring massive membrane transport. Recently, we demonstrated that VPS13M1 plays a pivotal role in the model plant *Arabidopsis thaliana* in response to nutrient stress triggered by phosphate starvation, which frequently impacts plant growth and crop yield. We demonstrated that the protein is primarily localized on the surface of mitochondria, as well as on other membranes of the endomembrane system. Our current goal is to understand how the protein's localization is regulated in cells, particularly with regard to mitochondria. Because VPS13M1 has several lipid-binding domains, we hypothesize that its localization is regulated by protein-protein and protein-lipid interactions. The objective of this internship is to investigate these possibilities.

Methods (up to 3 lines):

- Co-immunoprecipitation, protein pull down, western blots
- Protein production and purification
- In vitro lipid binding assays

Up to 3 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.

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

Requested domains of expertise (up to 5 keywords):

Biochemistry, protein-protein interaction analysis, protein expression, protein purification, lipid binding assays