

**Master 2 internship project
Year 2026-2027**

Laboratory/Institute: LPCV/IRIG

Team: Lipid

Director: Eric Maréchal

Head of the team: Alberto Amato

Name and status of the scientist in charge of the project: Morgane Michaud Chargée de Recherche CNRS

HDR: yes ☒ no ☐

Address: 17 avenue des Martyrs 38000 Grenoble

Phone: 0438782908

e-mail: morgane.michaud@cea.fr

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:

Objectives (up to 3 lines):

- Expressing and producing in different systems VPS13M1 domains
- Analyzing *in vitro* the capacity of VPS13M1 domains to bind lipids and/or to transport lipids between 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 and can transport lipids. Our current goal is to understand how the protein can bind to membranes in cells, particularly with regard to mitochondria, and its lipid transport specificity. Because VPS13M1 has several lipid-binding domains, we hypothesize that its localization can be mediated by multiple domains. The objective of this internship is to investigate the lipid binding and transfer capacity of different VPS13M1 domains *in vitro*.

Methods (up to 3 lines):

- Molecular biology: PCR, cloning, sequencing.
- Biochemistry: Protein expression in bacteria, cell free, insect cells; protein purification by affinity and size exclusion chromatography, protein characterization on gel, lipid binding and transfer assays.

Up to 3 relevant publications of the team:

Leterme, S., C. Albrieux, S. Brugière, Y. Couté, J. Dellinger, B. Gillet, S. Hughes, J. Castet, A. Bernard, D. Scheuring, M. Schilling, J. Jouhet, and M. Michaud. AtVPS13M1 is involved in lipid remodeling in low

phosphate and is located at the mitochondria surface in plants. 2024. BioRxiv.
doi:10.1101/2024.05.22.594332.

Leterme S, Bastien O, Cigliano RA, Amato A, Michaud M. Phylogenetic and Structural Analyses of VPS13 Proteins in Archaeplastida Reveal Their Complex Evolutionary History in Viridiplantae. 2023. Contact (Thousand Oaks);6:1-23. doi:10.1177/25152564231211976

Leterme S*, Michaud M. # Standardization of VPS13 proteins description in Viridiplantae to facilitate their characterization. 2025. New Phytologist;248(3):1123-1125. doi:10.1111/nph.70558

Requested domains of expertise (up to 5 keywords): Biochemistry, Cloning, Protein expression, Protein purification, Lipids