# THERMIT

Project title: Building subcellular thermometers to study plant mitochondria self-warming in the context of cold tolerance

Acronym: **THERMIT**

Project duration: 18 months - Start date: 01/10/2019 End date: 30/04/2021

Key-words: mitochondria, cold tolerance, freezing tolerance, thermosensor

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**Summary:**

**Context**
Plants are considered as ectotherms because their temperature is dictated by their environment. However, the existence of some cases of thermogenic flowers indicates that plant mitochondria have the potential to heat tissues. We demonstrated earlier that isolated pea seed mitochondria were able to perform oxidative phosphorylation at negative temperature, which strongly suggests internal heat generation by the organelles in such freezing conditions. The recent discovery that mitochondria in mammalian cells could reach temperature around 48-50°C, i.e. they are 10°C warmer than their surroundings, reinforces the hypothesis of increased temperature in plant mitochondria. We therefore postulate that mitochondrion self-warming could have an important role in cold tolerance of plants by preserving the bioenergetics functions of the organelle under cold crisis.

***Goal:***
The goal of the THERMIT project is to construct subcellular thermosensors to indirectly estimate heat production and regulation by mitochondria in plant tissues. The main objective is to prove that plant mitochondria can be warmer than their cellular surroundings, which would contribute to maintain temperature locally, allowing the organelles to maintain a higher level of energy production under cold conditions.

**Methodology**
We will build genetic constructs encoding a couple of GFP variants that will be used as a ratiometric thermosensor and that will be transiently expressed in the cytosol and in mitochondria of Arabidopsis leaf protoplasts. This will allow to visualize by fluorescence microscopy a temperature difference between the two compartments, in particular at low temperature.