SQPOV UMR408	***Implanteus* Graduate School** Academic Year 2020 - 2021 **Proposal of** **Master 2 Internship**	

Title: *Acylated anthocyanins from edible sources as natural food colorings*

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Context
Artificial food colorings have a tainted image that turns consumers away. Replacing them with plant-based colorants would have a huge net-positive socio-economic impact. Anthocyanins are natural pigments abundantly found in fruit and vegetables, where they express as deep reds, purples and even blues depending on pH. However, they tend to lose color stability once extracted from their natural sources, which makes it a priority to find more sophisticated anthocyanins that can confer attractive time-stable colors. Several deeply colored vegetables, such as red cabbage and purple sweet potato, are naturally rich in anthocyanins that are acylated by 1 or 2 residue(s) of *p*-hydroxycinnamic acid. Our recent work (within an international network of academic and industrial partners) has shown that acylated anthocyanins and their metal complexes express a variety of stable colors owing to the strong molecular interactions (« π-stacking ») taking place between the anthocyanidin chromophore and the HCA residue(s).

Objectives
Three topics will be addressed during this internship:

- For obvious economic reasons, whole extracts are better candidates than pure isolated pigments for development as colorings. Hence, it is important to adapt to mixtures of pigments the kinetic models and analytical methods required for a rigorous evaluation of color stability (rate constants of water addition and oxidative degradation, identification and titration of degradation products…).
- Oxidative degradation (autoxidation) operates through complex mechanisms involving O_2 and transition metal traces (*e.g.*, iron, copper). Hence, metal – anthocyanin interactions can be color-promoting (formation of stable metal complexes) or color-damaging (initiation of autoxidation). Clarifying these relationships as a function of anthocyanin structure, pH, presence of chelating agents and antioxidants is critical to expanding anthocyanins' shelf life.
- Further improvement in color stability can be achieved through appropriate formulation of anthocyanins, typically within biopolymer matrices, *i.e.* food proteins, pectins and other polysaccharides. Some trials will be carried out in the course of the internship.

Prerequisite skills: Sound foundation in chemistry (organic, physical, analytical).

Main competences: Mechanisms of color expression and color stabilization in plant and food, a range of analytical methods, including UV-visible spectroscopy, a luminescence method for O_2 titration, analysis of mixtures by UPLC coupled to UV-visible and mass spectrometry detectors.