**IMAS MASTER Academic Year 2024 - 2025**

**Proposal of M2 Internship**

**PROJECT TITLE AND SUMMARY:**

**Title:** Study of the effect of phytochemicals on carotenoid bioaccessibility and intestinal cell uptake efficiency

**Summary:** Carotenoids are fat-soluble pigments synthesized by all photosynthetic organisms, responsible for colors ranging from red to yellow. Humans cannot synthesize carotenoids and primarily obtain them from fruits and vegetables. These compounds have antioxidant properties, and their dietary intake and plasma concentrations are associated with a decreased risk of several chronic diseases. Some carotenoids, such as β-carotene, α-carotene, and β-cryptoxanthin, also exhibit provitamin A properties. To exert their biological effects, carotenoids must first be extracted from the food matrix and incorporated into mixed micelles for absorption by enterocytes. The bioavailability of carotenoids can be low and is strongly influenced by several factors, with the food matrix being particularly crucial [1].

We have recently shown that peeling carrots significantly affects β-carotene bioaccessibility, defined as the relative amount of β-carotene recovered in mixed micelles following digestion, as well as intestinal cell uptake efficiency, using in vitro models. The goal of this project is to identify the effects of major compounds in carrot epidermis on β-carotene bioavailability. We will use an in vitro digestion model to measure β-carotene bioaccessibility and Caco-2 cells to assess intestinal cell uptake efficiency. Pure epidermis compounds will be added to in vitro digestions of a complex meal containing carrot cortex to evaluate their effects on β-carotene bioaccessibility. The micellar phase of these digestions will then be incubated with Caco-2 cells to examine how pure epidermis compounds affect β-carotene uptake efficiency. Additionally, we will conduct competitions between pure β-carotene and pure epidermis compounds for their incorporation into synthetic mixed micelles.

[1] Desmarchelier & Borel - Overview of carotenoid bioavailability determinants: From dietary factors to host genetic variations – Trends in Food Science and Technology, 2017 - <https://doi.org/10.1016/j.tifs.2017.03.002>

**Activities:**

The student will carry out in vitro digestion, Ccao-2 cell uptake experiments and synthesis of mixed midelles. The student will carry out liquid-liquid extraction of the carotenoids from the collected samples and measure their concentration using high performance liquid chromatography (HPLC). Finally, the trainee will be involved in data analysis.

**HOST UNIT:**

Centre de recherche en CardioVasculaire et Nutrition (C2VN) - https://c2vn.univ-amu.fr/

Aix-Marseille University - INSERM – INRAE

Campus Santé Timone

Marseille

**MAIN ACTIVITIES:**

The work carried out by the group “Bioavailability” of the “Human micronutrion” team of the Center for CardioVascular and Nutrition Research explores the different stages (from digestion to the production of chylomicrons) and the different factors (lipid and non-lipid food intake, food matrix, hormones, factors circulating as free fatty acids, genetic variations, circadian rhythms, drug treatments and bariatric surgery) that govern the absorption and postprandial metabolism of lipids, glucose and lipid micronutrients. It is a world leading team in the field of fat-soluble vitamin and carotenoid absorption and it has a long-standing expertise in in vitro digestions and chemical analysis of lipid micronutrients.

**EXPECTED SKILLS:**

Skills: basic biochemistry lab skills, knowledge in nutrition and in physiology of digestion. Knowledge in analytical chemistry and data analysis would be appreciated. Competence acquired: critical analysis of the bibliography, design and implementation of experiments, *in vitro* digestions, high performance liquid chromatography, statistics, scientific writing methods in English.

**INDEMNISATION:**

- about 600 € / month

**CONTACT:**

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Organization: Centre de recherche en CardioVasculaire et Nutrition, UMR 1263 INSERM/1260 INRAE/Université d'Aix-Marseille

Location: Campus Santé Timone, Marseille

Duration: 6 months

Dates: 2025

Level: Master 2

Internship profile: Research