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## M2 student internship - 2020



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Team II : Thrombosis, platelets  
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cells and vascular diseases  
F. Dignat-George, C. Dubois

Team IV : New endothelial  
molecular targets  
M. Blot-Chabaud, S. Burtey

Team V : Adenosinergic system  
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### **Title:**

Effect of different protein food sources on the *in vitro* bioaccessibility of carotenoids.

### **Contacts:**

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### **Context:**

Carotenoids are fat-soluble pigments synthesized by many photosynthetic organisms and responsible for colours ranging from red to yellow. Humans cannot synthesize these molecules and as a consequence, they primarily obtain them from vegetables and fruits in their diets as well as from a few animal products (e.g. eggs, salmon, and milk). The most abundant carotenoids found in the human diets and in their blood and tissues are  $\beta$ -carotene, lycopene, lutein,  $\beta$ -cryptoxanthin,  $\alpha$ -carotene, and zeaxanthin. Carotenoids are compounds with antioxidant properties and their dietary intake and plasma levels have been associated with a decreased risk of chronic diseases, including type-2 diabetes, cardiovascular diseases, age-related macular degeneration and several types of cancer, while some, namely  $\beta$ - and  $\alpha$ -carotene and  $\beta$ -cryptoxanthin, also exhibit provitamin A properties. In order to exert their biological/health effects, carotenoids must first reach systemic circulation. The absorption process of these molecules includes several steps (extraction from the food matrix, incorporation into mixed micelles, uptake by enterocytes...) whose efficiencies are strongly influenced by the characteristics of the matrix of the food source or co-ingested foods. Although the effect of some nutrients, e.g. triglycerides, fibres, on carotenoid bioaccessibility is relatively well characterized, that of proteins and protein food sources remains largely unexplored.

### **Objectives:**

The goal of the project will be to characterize the effect of protein food sources on the *in vitro* bioaccessibility of carotenoids from their main dietary sources. The specific objectives of the internship will be: (1) to design several model meals comprising typical protein food sources but also vegetable protein food sources in order to follow the current recommendation for more sustainable diets, (2) to implement the static INFOGEST *in vitro* digestion method, which is a newly published gold standard for *in vitro* digestions and (3) to generate new data regarding the effect of protein food sources, including vegetable protein food sources, on the bioaccessibility of carotenoids from their main food sources.

### **Activities:**

This work will involve a critical analysis of the scientific literature regarding *in vitro* digestion methods and protein food sources, realization of biological experiments, pre-analytical and analytical processing of generated samples and statistical analyses of data. The student will first carry out a literature search to identify common protein food sources, both from animal and vegetable origin, as well as possible foods that would agree with recommendations for more sustainable diets. The student will be involved in the implementation and validation of the INFOGEST protocol (<https://pubmed.ncbi.nlm.nih.gov/30886367/>) in the lab. The student will then carry out *in vitro* digestions using the different protein food sources together with food sources of carotenoids. The student will then carry out liquid-liquid extraction of the carotenoids from the collected samples and measure their concentration using high performance liquid chromatography. Finally, the trainee will be involved in data analysis and interpretation.

### **Lab description:**

The work carried out by the group "Bioavailability" of the "Human micronutrition" 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.

### **Prerequisite skills and main competence acquired:**

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.

### **Application form:**

Please send a CV and a letter of motivation to charles.desmarchelier@univ-amu.fr and patrick.borel@univ-amu.fr