Internship Proposal

Nutritional transitions to more plant proteins and less animal proteins: understanding the induced metabolic reorientations and searching for proteomics-based biomarkers

Context and aims of the internship

In a context where different food transitions are affecting or will affect populations in emerging and developed countries, promoting healthy and sustainable food is a key objective to ensure both public health and sustainable agri-food development. These nutritional transitions include changes in animal and plant protein sources, the metabolic implications of which are poorly understood. Indeed, due to their different amino acid profiles, these proteins are used differently by the body and guide endogenous metabolism differently. This results in differential effects on the metabolism that are still poorly characterized and whose physiological and health implications are largely unknown.

This project aims to characterize and understand the metabolic orientations specifically induced by animal and vegetable sources of dietary protein, in order to better analyze the metabolic reorientations that would result from the expected increase in the share of plant proteins in different dietary contexts, especially those of the Western type, often associated with the development of metabolic deregulations (obesity and cardiometabolic risk).

The investigations are carried out in Wistar rats fed on regular or high fat diets where the protein is provided by a 100% animal (milk) or vegetal (legumes and cereals) sources. The specific aim of the Master project is to perform proteomics analyses on rat tissues (already available) after 4 months of diets consumption. Tissues include liver, skeletal muscle, adipose tissue and intestine. The student is expected to handle the whole proteomics workflow: sample preparation, analysis, protein identification and biological interpretation. The endpoint is to provide new insights on metabolic adaptations to plant-based protein sources in the context of Westernized diets. Protein identified as discriminant will be integrated with other available data from the study as plasma metabolomics or tissue transcriptomics in order to obtain novel biomarkers of the metabolic reorientations induced by the diets.

Techniques used during the internship:

- Spectrometry analysis (Q-Exactive-HF-X, (ThermoScientific))
- Mass spectrometry-based differential label-free quantification (LCProgenesis (Waters)) and statistical analysis,
- Bioinformatic analysis for data treatment and data mining.

Candidate skills:

-background on biology is of upmost importance. Notions in nutrition will be highly appreciated.
-ability to communicate in French will be beneficial.

Teams and supervisors:

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Selected publications of the team on this topic:

Polakof S, Remond D, David J, Dardevet D, Savary-Auzeloux I. Time-course changes in circulating branched-chain amino acid levels and metabolism in obese Yucatan minipig. Nutrition. 2018;50:66-73.

Polakof S, Remond D, Bernalier-Donadille A, Rambeau M, Pujos-Guillot E, Comte B, Dardevet D, Savary-Auzeloux I. Metabolic adaptations to HFHS overfeeding: how whole body and tissues postprandial metabolic flexibility adapt in Yucatan mini-pigs. Eur J Nutr. 2018;57(1):119-135.

Jarzaguet M, Polakof S, David J, Migne C, Joubrel G, Efstathiou T, Remond D, Mosoni L, Dardevet D. A meal with mixed soy/whey proteins is as efficient as a whey meal in counteracting the age-related muscle anabolic resistance only if the protein content and leucine levels are increased. Food Funct. 2018;9(12):6526-6534.

David J, Dardevet D, Mosoni L, Savary-Auzeloux I, Polakof S. Impaired skeletal muscle branched-chain amino acids catabolism contributes to their increased circulating levels in a non-obese insulin-resistant fructose-fed rat model. Nutrients. 2019;11(2):355.

Jeanne Bazile; Brigitte Picard; Christophe Chambon; Alberic Valais; Muriel Bonnet.
Pathways and biomarkers of marbling and carcass fat deposition in bovine revealed by a combination of gel-based and gel-free proteomic analyses. Meat science. 2019 (56) ;146-155.

Karol Pawłowski; José A.A Pires; Yannick Faulconnier; Christophe Chambon; Pierre Germon; Céline Boby; Christine Leroux. Mammary Gland Transcriptome and Proteome Modifications by Nutrient Restriction in Early Lactation Holstein Cows Challenged with Intra-Mammary Lipopolysaccharide. International journal of molecular sciences. 2019; *20*(5), 1156.

Laëtitia Théron; Marine Gueugneau; Cécile Coudy; Didier Viala; Astrid Bijlsma; Gillian Butler-Browne; Andrea Maier; Daniel Béchet; Christophe Chambon. Label-free quantitative protein profiling of vastus lateralis muscle during human aging. Molecular Cellular Proteomics. 2014, 13 (1) 283-294