WWTF Project LS19-046

Tracking Nutrient Metabolism and Cellular Partitioning by Multimodal Molecular Imaging

Abstract

The partitioning of nutrients under conditions of energy oversupply is the starting point of many metabolic pathologies associated with a sedentary lifestyle. In this context obesity, where energy influx exceeds energy expenditure, drives the prevalence of type 2 diabetes, fatty liver and cardiovascular disease. However, the metabolic fate of excess nutrients in the body and their contribution to metabolic disease are not well understood. This project uses a unique combination of imaging modalities and tracer techniques to investigate tissue biochemistry and sub-cellular partitioning of fuel metabolites in animal models of metabolic health and disease. In vivo positron emission tomography (PET) and magnetic resonance (MR) based deuterium molecular imaging (DMI) are used to assess glucose and fatty acid fluxes on the organ-/tissue level and are complemented with correlative transmission electron microscopy (TEM) and nanometer-scale secondary ion mass spectrometry (NanoSIMS) for visualization of metabolite distribution patterns within single cells. We apply these high-end imaging techniques to study physiologic states (fasting/refeeding) and metabolic disease (fat vs carbohydrate-rich diet; obesity). In combination with metabolic experiments, our multimodal imaging-setup paves the way towards a more comprehensive understanding of the physiology and pathophysiology of fuel metabolism and shows great potential for broader application in preclinical and translational research.

Scientific disciplines:
302043 - Magnetic resonance imaging [MRI] (40%) | 302054 - Nuclear medicine (30%) | 104002 - Analytical chemistry (30%)

Keywords:
positron emission tomography, magnetic resonance, NanoSIMS, deuterium molecular imaging, glucose, fatty acids, metabolism

Principal Investigator:	Martin Krssak
Institution:	Medical University of Vienna
Collaborators:	Cecile Philippe (Medical University of Vienna) (Co-Principal Investigator) Arno Schintlmeister (University of Vienna) (Co-Principal Investigator)

Status: Ongoing (01.05.2020 - 31.10.2023) 42 months

Funding volume: EUR 699,980

Further links about the involved persons and regarding the project you can find at
https://archiv.wwtf.at/programmes/life_sciences/LS19-046