ABSTRACT FOR THE GENERAL PUBLIC

The growing interest in adipose tissue biology is correlated with health problems connected with lifestyle diseases, including obesity. Associated with obesity hypertrophy of the adipose tissue has a drastically harmful effect on whole-body functions, leading to the development of insulin resistance, metabolic syndrome, type 2 diabetes, and elevated blood pressure, which are among the major risk factors for cardiovascular diseases (CVDs). The development of CVDs strongly influences pathological changes within the blood vessels, having a negative impact on the protective function of the perivascular adipose tissue (PVAT). PVAT, like other types of AT, contains various cell types that actively produce and secrete a number of factors that can locally modulate blood vessel metabolism. Interestingly, these factors can also interact with the resident endothelial cells (ECs).

The role of PVAT in the development of vascular pathology, including endothelial dysfunction, is not yet well understood. Hence the overarching goal of this research is to understand the interaction of ECs and PVAT, under normal cell development as well as under pathological conditions caused by high-fat diet (HFD, obesity model) and pro-inflammatory factors connected with obesity. Due to the lack of commercial PVAT cell lines, this project will be the first to identify new *in vitro* models to study this tissue in described below conditions, which will contribute to the field of vascular biology and a better understanding of related diseases.

The project will focus on two models of cell co-cultures based on direct or indirect interactions between PVAT adipocytes and ECs *in vitro*. PVAT progenitor cells from healthy and obese mice (fed with HFD) will be differentiated into mature adipocytes to analyze the effects of obesity on PVAT chemical composition and its impact on ECs. Additionally, the cell line of ECs will be exposed to pro-inflammatory agents related to obesity to examine how inflamed ECs impact the regulation of PVAT. To assess the involvement of PVAT in vascular metabolism, several methods will be used, including high-spatial resolution Raman microscopy. It has been used in recent years to observe changes in PVAT in obesity states, including the progression of atherosclerosis. Being a non-invasive method without the need for cell labeling, Raman imaging is a cheaper and faster tool for determining the chemical composition of adipocytes compared to other methods. Moreover, it can uncover markers of inflammation resulting from changes in the biomolecular composition of lipid droplets. Due to the complexity of the project, a variety of biochemical and functional techniques will be additionally used, such as immunocytochemistry, gene expression studies using real-time quantitative polymerase chain reaction (RT qPCR), and lipidomics, which allows for detailed quantitative analysis of lipids.

In summary, this project is one of the first to evaluate the interaction between vascular metabolism and PVAT/ECs dysfunction *in vitro*. Importantly, the chemical composition of cells in both tissues will be determined. The main hypothesis of the research is that, depending on the PVAT condition, adipocytes will have a key effect on changes in ECs depending on the co-culture model. Since cardiovascular alterations are the leading cause of death worldwide, therefore the goals of the project, will shed new light on the interaction between studied tissues, which may contribute to the treatment of obesity and to the development of dedicated therapies.