For many years, perivascular adipose tissue (PVAT) has been overlooked by scientists studying human anatomy. Until the 1990s, PVAT was routinely removed during the preparation of blood vessels for their further examination. However, scientists proved the effect of PVAT on blood vessels and thus ushered in a new direction of research in 1991. Nowadays it is known that PVAT as a paracrine tissue actively participates in vascular homeostasis and its dysfunctions are inherent in atherosclerosis, obesity and insulin resistance, i.e. reduced insulin sensitivity of peripheral tissues. Gut microbiota has also become a top of the top topic among scientists dealing with cardiometabolic diseases. It is estimated that 40,000 different species of bacteria live in the human intestine, which absorb about 10% of daily nutrients. Indigestible carbohydrates, such as fiber or starch, are used by gut microbiota to produce short chain fatty acids (SCFA, up to 6 carbons). Metabolites of the gut microbiota, including most often acetic, propionic and butyric acid, affect, among others functioning of the liver, pancreas or adipose tissue by improving lipid and glucose metabolism, thus protecting against obesity and insulin resistance. Although this knowledge, there is still a lack of research on the influence of gut microbiota on the perivascular adipose tissue that is an extremely important tissue from the point of view of the development of cardiometabolic diseases.

The aim of the project is to investigate the effect of gut microbiota on perivascular adipose tissue. In our multifaceted research, both murine models and the *in situ* functional PVAT model (isolated, control adipose tissue introduced into the medium and stimulated by various factors) will be used. In order to study the indirect effect of microbiota on the adipose tissue, including perivascular, mice will be fed a fiber-rich diet that is included in SCFA production. The direct impact of the three most common metabolites of gut microbiota on PVAT will be explored through two approaches: murine model (fodder enriched in SCFA) and *in situ* model (functional PVAT stimulated with SCFA). The main research technique used in the study will be Raman spectroscopy. This technique is based on inelastic light scattering and is more and more often applied in biochemical studies. Its main advantages are the lack of the need to prepare a sample, significant chemical specificity, in addition, this method is non-invasive and it is label-free. Fluorescence microscopy with nuclear, lipid droplets and mitochondria staining will also be used to visualize structural changes. The study of inflammation is planned using ELISA (kit 6-keto-PGF1α). An additional goal of the project is to study the effect of gut microbiota on the dysfunctional adipose tissue. A murine model of insulin resistance caused by diet-induced obesity will be provided by a high-fat diet enriched in various SCFA. The state of the gut microbiota will be investigated using Next Generation Sequencing (NGS). We suppose that gut microbiota *via* SCFA will impact on PVAT and will (at least partially) reverse negative influence of obesity and insulin resistance caused by a HFD diet.

Comprehensive analysis of chemical changes taking place in the perivascular adipose tissue during the development of obesity and treatment of insulin resistance induced by obesity will enable a closer look at metabolic diseases. The results of these studies may also be relevant for new therapies for these pathologies.