Diagnostics of the progression of diabetic complications consists mainly in observing atherosclerotic lesions using imaging techniques and clinical evaluation of the emerging changes of types of the micro- (retinopathy, nephropathy, polyneuropathy) and macroangiopathy (infarction, stroke, diabetic foot). The concentration of glucose, insulin and glycated hemoglobin determined in basic diagnostics allows, above all, to monitor the carbohydrate metabolism, but it is not possible to determine the progression of diabetic complications. The incidence of type 2 diabetes (T2DM), a diesease called the epidemic of the 21st century, increases every year. Reports indicating an increased risk of developing diabetes caused by infection with the SARS-CoV-2 virus are also alarming. T2DM is the second most common comorbid disease with COVID-19, and people with T2DM are more susceptible to SARS-CoV-2 infection. Increased release of inflammatory cytokines (often cytokine storm syndrome) is observed in patients with COVID-19 with hyperglycemia or with T2DM, leading to immunosuppression and multi-organ failure. However, the cellular mechanisms responsible for these phenomena are not known. The appearance of the COVID-19 pandemic has clearly highlighted the need to designate new biomarkers to monitor both the progression of micro- and macroangiopathic complications in diabetes and the effectiveness of therapies used to treat them.

The aim of the project is to test whether some of the compounds belonging to advanced glycation end-products (AGEs) are potential markers of diabetic complications. Due to their properties, AGEs are considered to be potential biomarkers; it is a large group of various compounds that are persistent, resistant to enzymes and non-degradable. Several different AGEs will be tagged in the project, including the one our team discovered, AGE10. These compounds will be measured in the plasmas of patients with T2DM and those with end-stage renal disease due to T2DM.

Material collected from volunteers, honorary blood donors, will be considered as control group material (collected from potentially healthy people). The added value of the project is that the biological material was collected just before the COVID-19 pandemic, at the turn of 2019/2020 (diabetic complications in this patient population are therefore not related to infection with the SARS-CoV-2 virus). The performed statistical analysis will allow to check the relationship between the occurrence of a given AGE and various diabetic and vascular complications and the concentrations of biochemical markers determined in basic diagnostics. The impact of the therapies used will also be taken into account. A second series of blood donations from the same patients will be performed during the COVID-19 pandemic. It will therefore be possible to compare the levels of individual AGEs in people before and after contracting COVID-19. Statistical analysis will allow to check the influence of SARS-CoV-2 virus infection on the progression of diabetes, atherosclerosis and complications of these diseases. The analysis will also take into account the impact of vaccination against COVID-19 (taking into account the type of vaccine) on the course of diabetes.

In addition, the project planned to determine the concentrations of scavenger receptors, receptors for AGEs, i.e. compounds which, by reacting with AGEs, increase the inflammatory response. Determination of factors of inflammation, immune factors, cardiovascular diseases, cell signaling, metabolic changes will be performed. These compounds will be measured using the multiplex bead array assay (MBAA) technique, which allows the simultaneous determination of various compounds. Compare the concentrations of these factors with the concentrations of the tested AGEs and AGE receptors, it may be possible to understand the mechanisms causing cellular changes by individual AGEs.

The presented project will allow to assess the impact of the glycation process on vascular complications of diabetes and their severity, and will also contribute to deepening the knowledge about the impact of infection SARS-CoV-2 for the progression of diabetic changes.