Nowadays, organ transplantation is a highly effective way to treat various forms of end-stage organ failure. Due to improved surgical techniques, immunosuppressive strategies, and patient management improvements, the number of candidates has dramatically grown in the last decades. However, the number of patients waiting for liver transplantation exceeds the number of available donors, and the use of poor-quality grafts is associated with a higher risk of transplant failure. Hence, the greatest challenge of modern transplantation is increasing the number of transplants through the use of marginal (suboptimal) organs. An additional problem is a lack of reliable methods of organ quality assessment before transplantation. Currently, the surgeon decides to accept or decline a potential liver based on the interpretation of the donor's recent laboratory tests and the visual evaluation of the organ. Therefore, there is still a need to develop and improve organ preservation methods and new analytical solutions leading to the finding of parameters or compounds that would allow a more efficient assessment of organ quality.

The proposed research project aims to use an innovative method of perfusion of livers intended for transplantation under normothermic conditions with oxygen delivery on an animal model (porcine). This method, combined with solid phase microextraction (SPME), allows the assessment of liver function directly after its harvesting and subsequently during the period of its preservation and immediately before transplantation, due to the non-invasive way of sample collection. Bile, being a direct product of the liver activity, seems to be a promising biological fluid reflecting metabolic processes taking place in this organ. Analysis of metabolites that correlate with changes in the perfused organ may help to find a panel of potential biological markers of organ quality and indicators of the possible development of early liver dysfunction.

The project will consist of an analytical and medical part. Regarding the former, new, more ecological analytical methods will be developed in line with the trend of "green chemistry", which will allow the selection of a panel of potential biomarkers of liver transplant injury. Next, a method of direct determination of selected biliary low-molecular compounds with clinical potential will be proposed. The medical part will focus on comparing normothermic perfusion with oxygen delivery with the routine method of static cold storage and the assessment of changes taking place in the organ depending on the time of its ischemia. The innovative method allows for extending the time of preservation while maintaining the appropriate quality of the organ.

Finding a panel of metabolites that act as determinants of organ quality may become the basis for expanding the pool of currently used analytical tools. Comprehensive analysis of bile samples will provide a much deeper insight into the biochemistry of liver transplants depending on their initial state and method of preservation. It is assumed that the proposed solutions will improve the results of marginal organ transplantation in the future by offering clinicians a reliable tool for organ assessment and early identification of complications after transplantation.