Within the last decade there has been significant and dynamic development of the animal and human assisted reproductive techniques. One of them is in vitro fertilization and embryo culture, which, despite forceful progress, have still many restrictions. Among them is lower quality of the embryos obtained in vitro, and for that reason selection of the highest quality oocytes is essential for acquiring embryos with high developmental competence. The information about quality of the oocytes, implantation ability and developmental competence of the embryos is provided by molecular markers. One of the groups with potentially significant importance in early embryo development, are prostanoids.

The prostanoids represent the group of biologically active lipids, containing prostaglandins, prostacyclins and thromboxans, which act through binding to their G-protein-coupled receptors. They are well-known primary mediators of the pathological conditions such as inflammation and cancer but are also essential for the physiology of the female reproduction. The last data show also their contribution in preimplantation embryo development, oocyte maturation and implantation. The presence of the enzymes responsible for prostanoid synthesis in places of the embryo implantation in rodents and humans has been documented. What is more, the lack of the one of these enzymes in mice caused fertilization, implantation, and decidualization defects. In rodent's embryos without prostanoid's receptors, failures with the blastocyst formation, hatching and embryo adhesion were also proved. One of the pivotal stages of the bovine embryos cultured in vitro is successful oocyte in vitro maturation and the expansion of the cells surrounding the oocyte, called cumulus cells. It was documented, that appropriate oocyte maturation depends on proper synthesis and secretion of the prostanoids and their receptors, mainly prostaglandins E2 and F2α. The factors mentioned above are also expressed in different developmental stages of the bovine embryos, indicating correlation between prostanoid signaling pathway and developmental competences of the bovine embryos.

Although, the above mentioned data account for prostanoid involvement in the process of embryo implantation in rodents and humans, there is little data in the literature on prostanoid mediated bovine embryo implantation. Taking above into consideration, the scientific objective of the proposed project is to investigate whether prostanoid signaling in the in vitro cultured bovine embryos reflects the quality of oocytes and embryos. In our study we suspect that the time-dependent expression of the factors participating in PGE2, PGI2 and PGF2a synthesis and their receptors in the preimplantation embryos account for the quality of oocytes and embryos. Additionally, the synthesis and action of PGs during oocyte maturation and embryo culture in vitro during early embryo development will be examined.

Three tasks were planned in this project. The first of them will evaluate the correlation between oocyte quality and prostaglandin (PG) production and their receptors expression in bovine embryos, on different stages of their preimplantation development. To accomplish above task, the expression profile of the PGI2, PGE2 and PGF2α synthetizing enzymes and their receptors in embryos derived from good and poor quality oocytes, on different stages of their early development, will be evaluated. The expression of the markers of implantation ability and developmental competence in blastocysts obtained from good and poor quality oocytes will be also examined. Additionally, concentration of PGI2, PGE2 and PGF2α in medium used for in vitro culture will be determined. The aim of the second task is to evaluate the action of prostanoids during oocyte maturation in vitro. To execute this task, the influence of the selected prostanoids on oocyte maturation accomplishment, expression of factors involved in oocyte developmental competence, cumulus expansion, apoptosis level of cumulus cells and glucose metabolism in oocyte – cumulus cells complexes during in vitro maturation will be established. In the last, third task, we will examine the prostanoid influence on the quality and developmental competence of the blastocysts, derived from good and poor quality oocytes. For this purpose, prostanoids will be added to in vitro culture medium, in concentration chosen in previous experiments. The developmental competence and implantation abilities of the blastocysts will be determined by examining adeuquate gene expression.