Early pregnancy in mammals including pigs is the critical period during which the highest mortality of embryos is observed. Developing embryos signalize their presence to the maternal organism by secretion of multiple factors such as hormones, cytokines which are then recognized by specialized receptors being expressed in the uterine environment. In the pig, the main embryonic signals are estrogens, mainly estradiol (E2). Porcine conceptuses secrete elevated amounts of estradiol on days 11-12 and after day 15 of pregnancy. This enhanced synthesis and secretion of E2 on days 11-12 of pregnancy is defined as the maternal recognition of pregnancy. During this time embryos of many species synthesize estrogens, but only in the pig estradiol of conceptus origin prevents regression of corpora lutea (transient endocrine organ formed in ovulatory place in ovaries) against detrimental factors. Progesterone secreted by corpora lutea is the main hormone responsible for preparing the uterine environment for embryo implantation. Estradiol exerts its action through estrogen receptors localized inside the endometrial cells. Interestingly, the changes of estrogen receptors abundance in the porcine endometrium coincides with estrogen secretion by embryos. It should be emphasized that estradiol is the major and highly important embryonic signal as its impaired secretion leads to pregnancy loss. Too small number of embryos followed by insufficient amount of estrogens in uterine lumen leads to corpora lutea regression resulting in pregnancy termination.

So far in our research we evidenced that the presence of conceptuses (embryos with associated membranes) as well as their signal – estradiol induce significant changes in the whole endometrial transcriptome characteristic for pregnancy. We showed that these differentially expressed genes were related to the processes involved in mechanisms ensuring successful implantation and development of pregnancy. We also identified particular factors regulated by E2 vital for pregnancy establishment. However, the mechanisms by which E2 regulates the expression of particular genes is not fully elucidated. Scientific reports and our preliminary studies revealed differences in local methylation of DNA sequences localized in selected pregnancy-related genes in the porcine endometrium during early pregnancy and in response to E2 treatment *in vivo*.

Thus, the aim of current project is to determine the changes in the porcine endometrial methylome during early pregnancy and these evoked by E2 action and finding the answer whether these changes may affect the expression of particular genes. Because endometrium is a complex tissue, some changes could be characteristic only for specific type of cells. Thus, in our approach we are going to determine spatial and temporal profiles of porcine endometrial methylome during early pregnancy and in response to E2 treatment *in vitro* and *in vivo*. To reach our goal we are going to use *ex vivo* approach together with advanced *in vitro* models and also innovative *in vivo* model in which the estradiol was administered locally into uterine lumen to mimic conceptus signaling. The next aim of proposed project is to determine the effect of DNA methylation on endometrial secretory function and adhesion, proliferation and migration of endometrial cells. Our research will be conducted in the well-equipped and modern laboratories (laboratory of *in vitro* techniques and laboratory of molecular biology) of the Institute of Animal Reproduction and Food Research of PAS in Olsztyn and in the top international research units collaborating with our team. Although, the embryonic signals are species-specific, the molecular processes triggered by their action are universal for most mammals. Therefore, the realization of our research will increase the knowledge in the field of biology of reproduction and will be helpful in reducing the embryonic mortality rate during such a critical steps as early pregnancy, implantation and increasing changes of healthy offspring.