

SUMMARY

Expression profile of selected aquaporins in the oviduct and uterus of domestic pig (*Sus scrofa domestica* L.)

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Doctoral thesis was carried out in the Department of Animal Anatomy and Physiology, Faculty of Biology and Biotechnology, University of Warmia and Mazury in Olsztyn under the guidance of prof. dr hab. Mariusz Skowroński.

The doctoral thesis comprises two papers published in 2020 and 2021 (1 – *International Journal of Molecular Sciences* 2020; 21(8), 2777 <https://doi.org/10.3390/ijms21082777>; 2 – *Cells* 2021, 10(4), 832; <https://doi.org/10.3390/cells10040832>), focused on expression of aquaporins (AQPs) in the reproductive system of the domestic pig.

AQPs are integral membrane proteins, which play an important role in water homeostasis in whole body. According to the literature, the expression of aquaporins in reproductive structures depends on the local hormonal milieu. These proteins form a system for controlling water movement in ovaries, oviducts, uterus, placenta and fetal membranes to maintain normal reproductive function, embryo implantation, fetal growth and development. Furthermore, expression of AQPs in the porcine oviduct and luminal epithelial cells of the uterus may provide the physiological medium that sustains and enhances fertilization and early cleavage-stage embryonic development. Overall, studies provide a characterization of the reproductive system AQPs, increasing our understanding of fluid homeostasis in the porcine oviduct and luminal epithelial cells of the uterus.

The aim of this study was to determine the expression of AQPs in individual sections of the pig's oviduct in the oestrus cycle and early pregnancy, as well as the influence of certain hormones and signalling pathways on the expression of aquaporins in uterine epithelial cells during the periovulatory period. The goals of research were accomplished by the following tasks:

- 1) investigation of *AQP1*, *5* and *9* genes expression in individual sections of the pig's oviduct (infundibulum, ampulla, isthmus) in the oestrus cycle, in the early luteal phase (day 2–4), the mid-luteal phase (day 10–12), and the luteal phase (day 14–16) and in the follicular phase (day 18–20) as well as on days 14–16 and 30–32 of pregnancy (Real Time PCR).
- 2) investigation of the effect of estradiol (E_2), progesterone (P_4) and arachidonic acid (AA) as well as inhibitors of protein kinase A (PKA) (H89) and mitogen activated protein kinases

(MAPK) (PD98059) signalling pathways on the *AQP1*, 2, 5 and 7 genes expression in porcine uterine epithelium *in vitro* cultures: during the periovulatory period on day 18–20 and in the early luteal phase, day 2–4 (*in vitro* cultures and Real Time PCR).

The studies enabled to verify the research hypotheses and broadened the understanding role of aquaporins in the reproductive system of domestic pigs. On the basis of the obtained results the following conclusions were drawn:

- 1) *AQP1*, 5 and 9 mRNAs are expressed in oviduct tissues, while *AQP1*, 2, 5 and 7 mRNAs are expressed in porcine uterine epithelial cells in *in vitro* cultures,
- 2) changes in the expression levels of *AQP1*, 5 and 9 genes in the parts of oviduct observed during the oestrus cycle suggest that the expression of these genes may depend on the hormonal status of the animal,
- 3) changes in the expression levels of *AQP1*, 5 and 9 genes in the parts of oviduct during implantation and the post-implantation period suggest that the expression of aquaporins depends on the course of pregnancy,
- 4) estradiol, progesterone, arachidonic acid and inhibitors of PKA and MAPK signal transduction pathways cause changes in the expression of *AQP1*, 2, 5 and 7 genes in the pig endometrial epithelial cells during periovulatory period, which may affect the proper water homeostasis of the cell during this period.