



Dummerstorf, 21 March 2017

Novel cell culture model is aimed at avoiding animal experiments and solving reproductive problems

Long-term cooperation with the Teterow abattoir helps scientists

The Reproductive Cell Biology Unit at the Leibniz Institute for Farm Animal Biology (FBN) in Dummerstorf has succeeded for the first time in establishing realistic 3D cell culture models of the animal Fallopian tubes that embryos can even develop in their "tubal fluid". The model is particularly suitable for the animal-free investigation of early interactions between embryo and mother animal. Fallopian tubes from cows and pigs from the regional abattoir in Teterow were used as starting material. The results have now been published in the renowned scientific journal *Scientific Reports**. The improved knowledge about early embryonic processes is also of great interest for human reproductive medicine.

Early embryonic losses are one of the most common reproductive disorders in humans and animals. The Fallopian tube is one of the central reproductive organs in which highly sensitive reproduction steps take place in the maternal organism. In addition to the final maturation and selection of the germ cells and fertilisation, early embryonic development also takes place in the Fallopian tube. At the same time, the Fallopian tube acts as a "pipeline" for the transport of the offspring in the embryo stage into the uterus. Although the Fallopian tube plays a central role within reproductive biology processes, basic mechanisms of Fallopian tube function are still unresolved and are the focus of fundamental research.

Why life fails early

"Since it is extremely difficult, from practical and ethical points of view, to directly examine the interactions between early embryos and the female reproductive tract in humans or animals, in vitro (lat. "In glass") models that resemble this contact zone as realistically as possible are needed urgently," explained Dr. Jennifer Schön, Head of the Reproductive Cell Biology Unit at the FBN Institute of Reproductive Biology. The veterinarian, with her team, developed a novel cell culture model in which processes in the Fallopian tube can be simulated realistically outside the animal organism.

"The model is so close to reality because the long-term cultured cells form a kind of tubal fluid in which embryos can develop independently of other influences such as, for example, artificial cell culture media," the scientist said. "Our new 3D cell culture model, in contrast to classical cell culture systems, allows us to perform long-term trials over a number of weeks, thus enabling realistic simulation of the hormonal changes during the female cycle. We hope to understand the highly dynamic and complex cellular processes in the female reproductive tract, which are essential for the initiation and maintenance of early pregnancy, better. And, of course, we want to find answers to the question of why newly emerging life often fails so early on, and how we can prevent it."

Avoiding animal experiments and providing answers for other species

Another aspect of this research is the avoidance of animal experiments. In addition to the improved possibilities for observing biological processes, the in vitro model also helps to avoid animal experiments. For many years the scientists of the FBN have been gaining tissues and organs for experiments from animals used for food production at the abattoir in Teterow. Special

rooms have even been set up on site, in which the tissue samples from abattoir material can be prepared for the research projects.

"We are currently mainly investigating the Fallopian tubes of cattle and pigs, which are sufficiently available byproducts otherwise not used for food production. Our goal is to further develop and optimise the cell culture model so that we can replace more and more animal experiments", Schön explained. "In addition, the methodology is being extended to other species and thus also to be used for species conservation. For example, we are cooperating with the Berlin Leibniz Institute for Zoo and Wildlife Research (IZW), which is committed to the preservation of endangered animal species, which are also often affected by reproductive problems."

Photos: FBN

PD Dr. Jennifer Schön came from FU Berlin to the Dummerstorfer Leibniz Institute because the FBN has excellent research facilities. Here, the Luebeck native examines Fallopian cells with the laser scanning microscope.

Microscopic picture of Fallopian cells cultured over several weeks.

Veterinarian Inga Weiß is using the novel culture model in studies for her PhD Thesis.

*Scientific reports (see Appendix)

An air-liquid interphase approach for modeling the early embryo-maternal contact zone

www.nature.com/scientificreports, Published: 09 February 2017

Scientific Reports | 7:42298 | DOI: 10.1038/srep42298

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