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Press release
For immediate release

Influence of sperm on successful embryo implantation
Embryonic development: a new perspective on human reproduction

Graz, 3 March 2025: In a study of early embryonic development in primates, an international research team under the leadership of Berthold Huppertz and Thomas Kroneis from Med Uni Graz has shown for the first time that sperm can penetrate the outer layer of five- to seven-day-old embryos (blastocysts). This development during a critical phase before implantation in the uterus could have far-reaching consequences for our understanding of reproduction, sperm competition and pregnancy success and in the long term provide important indications for infertility therapy.

Sperm and its influence on pregnancy success

The international research team is documenting the interaction of sperm with embryos that are preparing to implant, specifically showing the early biological process of reproduction in rhesus monkeys. Blastocysts are normally protected from external influences by a coat, the zona pellucida; before the embryo implants in the uterus, the young embryo "hatches" from this protective cover. "During this critical time window, extra sperm can intrude into the blastocyst. This might be an evolutionary feature that influences the developmental fate of the blastocysts," explains Thomas Kroneis from the Med Uni Graz Division of Cell Biology, Histology and Embryology at the Gottfried Schatz Research Center for Cell Signaling, Metabolism and Aging. The study indicates that between 200 and 5,000 sperm can reach the blastocyst during the implantation stage. The researchers were even able to provide visual evidence that intact sperm heads entered the outer cell layer, or trophectoderm. "Such an intervention could have far-reaching consequences for pregnancy success because sperm—regardless of their origin—might impact the implantation behavior of the blastocyst. Blastocysts that have difficulty in dealing with the intruding sperm could be more susceptible to failed implantation," says chair Berthold Huppertz.

New perspectives on reproductive competition and health

Such a phenomenon could also lead to an evolutionary "conflict" between sperm. Rival sperm could promote failed implantation in order to favor the genes of the more successful male. This may represent another example of reproductive competition in the early stage of embryonic development that has already been observed in other animal species.
The research team is also considering whether the time of coitus and the intrusion of additional sperm into the blastocyst might have a decisive influence on pregnancy success. More frequent

coitus around the time of implantation could potentially lower the probability of a successful pregnancy by disturbing the development and implantation of the blastocyst. "In the past, studies with contradictory findings have pursued this hypothesis, which is why more investigations would be of interest here," says Thomas Kroneis concerning further research questions.

Future research questions with potential relevance for family planning

The study is also working on the question of whether sperm that intrude into the blastocyst may potentially influence embryonic development or even result in a type of microchimerism—a phenomenon in which foreign cells remain in the body of the embryo and influence development. The development provides a variety of questions for future research. The scientists suggest performing DNA typing of sperm to clarify their origin and find out whether intruded sperm remain in the trophectoderm and can influence the fate of the embryo. These questions play a key role in understanding the mechanisms that influence the success of a pregnancy. Furthermore, research on the interaction of sperm and blastocysts may also have a far-reaching significance for human health and the development of new reproductive treatments.

To the publication:
Sperm intrusion into the implantation-stage blastocyst and its potential biological significance
https://academic.oup.com/emph/article/12/1/1/7492705

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