Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)

Assisted Reproductive Technology (ART) and Women's Health

Promoting Healthy Pregnancies and Healthy Families

What is ART?

ART refers to treatments and procedures that aim to achieve pregnancy. One of the most widely used ART methods, *in vitro* fertilization (IVF), involves collecting eggs and sperm, fertilizing the eggs in a lab, and transferring the resulting embryos into the uterus. Other ART techniques include intracytoplasmic sperm injection (sperm cell is injected directly into an egg), frozen embryo transfer (embryos frozen for short- or long-term storage are thawed and transferred into the uterus), and intrauterine insemination (sperm are placed into the uterus using a long, narrow tube). Some people may opt for ART with third-party involvement, such as donated sperm, eggs, embryos, and/or a surrogate or gestational carrier.

How does NICHD support research on ART?

Studies of fertility and infertility, including methods that allow more people to get pregnant and have a family, are central to NICHD's mission of improving reproductive health. ART-specific research includes understanding and achieving optimal conditions for IVF and other ART methods, improving the safety and success of ART procedures, and making ART more accessible. NICHD-supported researchers also study the effects of ART on pregnancy and future fertility, and on the long-term health of offspring.

Success Snapshots

Reducing the Number of Extra Embryos

ART methods often generate more embryos than are needed for a successful pregnancy. Extra embryos pose emotional challenges for ART users, as well as logistical strains for clinics. These challeges and strains can increase overall costs and decrease access to the technology. By analyzing data from more than 400,000 ART cycles, researchers created a prediction tool to determine the number of eggs that maximizes probability of a live birth, while limiting production of extra embryos. Once clinic-ready, the tool can help improve decision making for ART users and providers.

Detecting Extra or Missing Chromosomes

Current IVF pre-implantation evaluation methods require that embryos be frozen, and then thawed. Freezing, thawing, and the passage of time can increase the risk of implantation failure and other problems. An NICHD-funded team of scientists developed STORK, a same-day test to detect extra or missing chromosomes in embryos. In initial studies, STORK's accuracy was comparable to standard clinical tests, but it was significantly faster. Although more work is needed to validate STORK, providing results within hours could eliminate freezing/thawing, save time and costs, and mitigate risks.

Selected NICHD-Funded Projects on Assisted Reproductive Technology (ART)

Long-Term Health Outcomes Advances

Defining Health Effects of ART
Previous research has linked conception with ART to greater risk of childhood obesity and cancer, yet the nature of these links is unclear. One large study of children born in Denmark found no overall differences in Body Mass Index at age 5 to 8 years among those conceived with ART, other treatments, or no treatments. It also found that those conceived by frozen embryo transfer ART were 1.5 times more likely to have obesity than those conceived by fresh embryo transfer ART (2.7% vs. 1.8%). Another large NICHD-funded study found that children conceived by ART were at higher risk for non-chromosomal congenital anomalies, which are linked to a greater risk of certain cancers. Using these and other findings, families and providers can take preemptive steps to reduce health risks.

NICHD-supported researchers also examined outcomes of pre-implantation embryo evaluation (typically a biopsy of cells from the outside of the embryo). Unlike mice conceived without ART, adult mice conceived with IVF-plus-biopsy had metabolic changes, suggesting the need for continued research on how ART affects outcomes.

Investigating the Epigenetic Effects of IVF
Epigenetic changes, such as differences in DNA methylation (when a chemical group is added to DNA), affect how genes function. Unlike genetic changes to the DNA sequence, epigenetic changes are reversible. NICHD researchers noted minor DNA methylation differences in newborns conceived with IVF versus those conceived without IVF. However, these changes were not present in early childhood, providing reassurance for people who have conceived with IVF or who are considering the procedure.

Learn More About NICHD ART Projects

NICHD's ART Website: https://go.nih.gov/OoW0L9j

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Methods & Access Improvements

Optimizing the Chances of Success
Despite ART advances, knowledge about factors that affect success remains limited. Knowing which sperm are most likely to fertilize an egg could improve efficiency and healthy embryo production. NICHD-funded researchers are exploring the link between sperm's ability to change movement patterns, called motility, and its fertilization capabilities. Their work in mice suggests that motility changes are governed by measurable changes in sperm metabolism, opening a new avenue for evaluation.

Other NICHD-supported researchers are developing a computer-based tool to determine embryo viability. This work combines visual features of the embryo with data from electronic health records to better gauge embryo health before transfer to the uterus during ART.

Simplifying Egg Preparation
High costs, partly from the need for specialized labs and staff, are an obstacle to widespread use of IVF. Following egg retrieval, an embryologist manually separates each egg and removes surrounding tissue by hand using a glass straw. One small business is using NICHD funding to automate this process. The new device would handle egg preparation mechanically, making the process faster and more reliable. After promising experiments with mouse eggs, the company is working to optimize the technology for possible use with human eggs.