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The overarching goal of Dr. Block's research program is to improve the reproductive efficiency of livestock species, with a primary emphasis on cattle. The approach is to use both basic and applied methodologies to achieve the following objectives:

1) Identify strategies to improve the practical efficacy of assisted reproductive technologies for use in improving reproductive efficiency in livestock species

A limitation to the practical use of in-vitro embryo transfer in cattle production systems is that embryos produced in-vitro are more sensitive to cryopreservation. One reason is that the metabolic activity of in-vitro produced embryos is altered in such a way that lipid is accumulated in the cytoplasm. To help overcome this issue, Dr. Block's laboratory studies ways to modify embryo culture media to improve cryotolerance. Strategies include the use lipid metabolic regulators such as, L-carnitine, forskolin, phenazine eholsulfate and conjugated linoleic acid. .

2) Determine how preimplantation and post-implantation embryo development and survival are regulated by uterine-derived embryotrophic molecules

Bovine embryos produced in vitro have reduced competence to survive to term compared to their in vivo derived counterparts. The reduced post-transfer survival of bovine in vitro produced embryos is due in part to suboptimal culture conditions. In vivo, the growing embryo is exposed to several uterine-derived embryotrophic factors important for development, including growth factors, cytokines, amino acids and other macromolecules. In collaboration with Dr. Peter Hansen's laboratory at the University of Florida, Dr. Block's research has focused on studying how uterine-derived embryotrophic factors, such as IGF-1, CSF-2, DKK-1 and hyaluronan affect early embryonic development in vitro and post-transfer survival in vivo.

3) Determine the genetic and physiological regulation of FSH-independent follicular growth and its effects on oocyte developmental competence.

It is known that the number of follicles in the growing pool of a follicular wave is controlled, at least in part, by genetics. There is wide variation in follicle count between individual cows, as well as, between different breeds of cattle. Recent research indicates that antral follicle count is associated with fertility. In particular, cows with high follicle counts are more fertile than cows with low follicle counts. Moreover, cows with high follicle counts are more responsive to stimulation treatments for superovulation and ovum pick-up which makes these assisted reproductive technologies more efficient and practical. In collaboration with researchers in Brazil, Dr. Block's laboratory is working to identify the specific genes and single nucleotide polymorphisms associated with follicle count. Further understanding of the genes involved in regulating the size of the follicular growing pool could lead to tools for genetic selection of cows with high follicle count and, also, physiological treatments to increase the number of follicles in the growing pool.