This research has allowed us to better understand the mechanisms that govern maternal recognition of pregnancy. Increasing reproductive efficiency contributes to USDA priority number 2, *Animal Health and Production and Animal Products*, and NIFA challenge area number 5, enhancing *Global Food Security*.

Increasing the efficiency of artificial insemination and embryo transfer in Capra hircus

Who cares and why?

Profitability in livestock production is linked to reproductive success. For all mammalian pregnancies the first 30 days is the most critical stage for survival of the conceptus (i.e. the early embryo and associated fetal membranes). Fertilization rate of 90–95% are achieved normally in healthy, non-lactating goats. Studies on early embryonic losses are rare in goats. However, post-fertilization embryonic mortality rates for moderate-producing cows were estimated at 40%, with 70–80% of these losses occurring between days 8 and 16 after insemination. This suggests that of all domestic animal pregnancies that fail, the largest proportion is lost during the earliest stages of conceptus - uterine interactions. This number is likely magnified when estrus synchronization and artificial insemination or embryo transfer are used to improve genetic merit. Understanding these developmentally regulated events may lead to better treatment and diagnostic strategies for infertility, novel approaches to contraception and better methods for controlled breeding in livestock. Increasing reproductive efficiency contributes to USDA priority number 2, *Animal Health and Production and Animal Products*, and NIFA challenge area number 5, enhancing *Global Food Security*.

What has the project done so far?

Our long-term goal is to identify component regulators of pregnancy recognition and maintenance in mammals and use this information to control the reproductive process. We have shown that members of the histo-blood group and Lewis carbohydrate antigens are strongly expressed on the cells lining the female reproductive tract (i.e. uterine epithelial cells; Figure 1) during the critical period of pregnancy recognition. Receptors for one of these antigens, H-type 1 (HT1), are present on the conceptus. Our working hypothesis is expression of HT1 antigen by the apical plasma membrane of uterine epithelial cells, and binding to lectin-like receptors on embryonic trophectoderm, is an important component in the sequence of events that initiates formation of the placenta and results in maintenance of pregnancy. We have detected important changes in fucosyltransferases that controls synthesis of the Histo-Blood group and Lewis antigens may be regulate changes uterine receptivity to blastocyct attachment. Manipulating these enzymes may open the window of receptivity to blastocyst attachment and increase the success rates of embryo transfer.

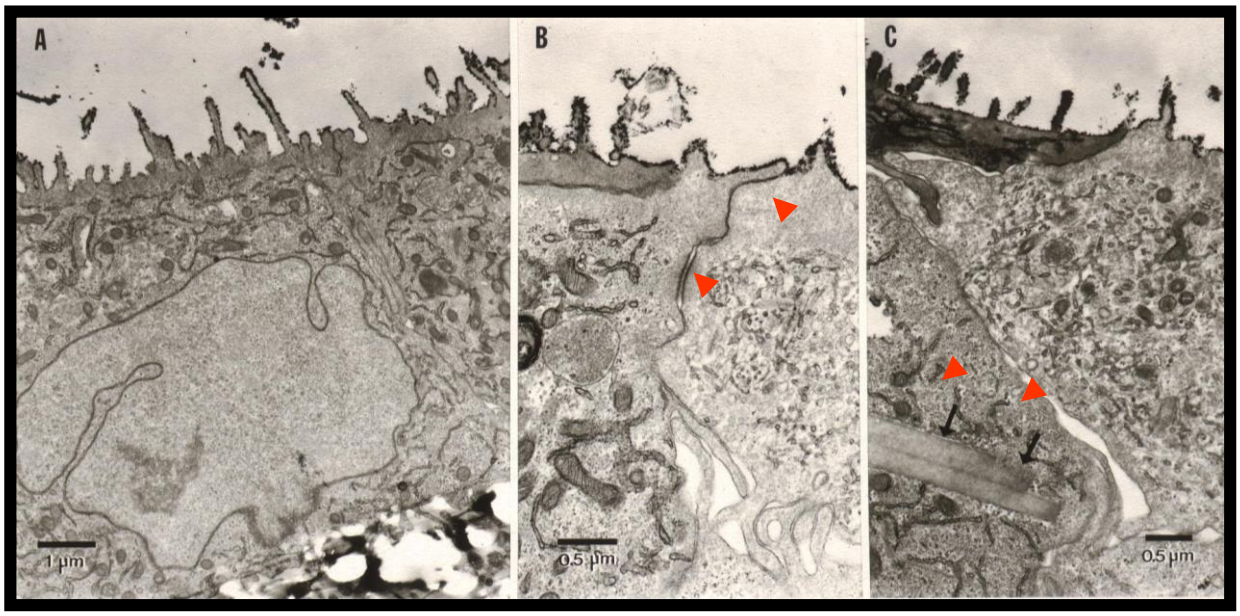

Figure 1. Transmission electron micrographs of polarized caprine UE cells grown on matrigel-coated filter inserts. Uterine epithelial cells are the first to come in contact with embryonic tissues during early pregnancy. When grown in culture they possess many characteristics of the uterine epithelium in utero. Notice the junctional complexes needed to maintain distinct apical and basal compartments (B, arrows), the basally located nucleus (A), prominent apical microvilli (A, arrow) and the presence of crystalline inclusions (C, arrows), which have been reported in the endometrium of several small ruminants, including the goat.

Impact Statement

Profitability in livestock production is linked to reproductive success. For all mammalian pregnancies the first 30 days is the most critical stage for survival of the conceptus (i.e. the early embryo and associated fetal membranes). We are conducting functional studies on key genes and pathways governing: 1) pregnancy recognition, 2) initiation of placentation, and 3) growth and development of the early embryo. Understanding these developmentally regulated events may lead to better treatment and diagnostic strategies for infertility, novel approaches to contraception and better methods for controlled breeding in livestock. Application of this research will enhance international competitiveness of American agriculture and enhance competitiveness and sustainability of rural and farm economies.

What research is needed?

We are currently using advances in genomic sequencing technology to evaluate what genes/gene networks are activated or suppressed during pregnancy recognition, with particular reference to factors controlling HT1 expression. Our objective is to characterize complex changes in the transcriptome that occur in the endometrium during the course of maternal recognition of pregnancy and initial placentation using deep sequencing of endometrial RNA samples obtained during the estrous cycle and early pregnancy. Deep sequencing of Day 17 conceptus tissue will also be performed. Collectively these experiments will provide the foundation needed to conduct functional studies on key genes and pathways governing: 1) pregnancy recognition, 2) initiation of placentation, and 3) growth and development of the early embryo. Application of this research will enhance

international competitiveness of American agriculture and enhance competitiveness and sustainability of rural and farm economies. This work also provides the foundation needed to develop critical University infrastructure and provide students with inquiry based research in the cellular and molecular aspects of animal reproduction.

Want to know more?

Gary R. Newton, Ph.D.
936-261-5036
grnewton@pvamu.edu

Additional links: http://www.umes.edu/ard/Default.aspx?id=46285

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