

## Interaction of Pre-implantation Embryo with Endometrial Cells

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The fertility of dairy animals has declined worldwide and this change is surprising given the importance of good fertility to the dairy industry. It is estimated that approximately 50% of the potential profitability from genetic selection for milk production is lost due to a reduction in fertility [1]. The reduction in fertility can be explained by managemental changes within the dairy industry and also negative genetic correlations between milk production and reproduction. There are four mechanisms that reduce fertility in lactating animals that are (i) failure to cycle and display estrus (an ovulatory and behavioral estrus), (ii) suboptimal and irregular estrous cyclicity, (iii) abnormal pre-implantation embryo development and, (iv) uterine/placental incompetence. Uterine disease is associated with lower conception rate, increased intervals from calving to first service or conception, and more dairy animals culled for failure to conceive (Azawi, *et al.* 2008). Pregnancy losses are thought to occur primarily during the pregnancy recognition/pre-implantation period, making studies of endometrial gene expression critical to further understanding of pregnancy establishment, recognition and maintenance within the animal reproductive cycle. The cause of fertilization failure can also lie with the bull and the technique and timing of insemination when using artificial insemination. Infectious agents like bacteria (*Streptococcus* spp., *Enterobacteriaceae* spp., *Proteus* spp., *Staphylococcus* spp., *Leptospira* and *Bacillus Licheiformis*) can also cause of the embryonic losses in dairy animals [2,3].

It has been observed that the successful implantation of the blastocyst depends on adequate interactions between the embryo and the uterus. Implantation means the first intimate relationship between maternal tissues and developing foetus. For proper implantation and the subsequent placentation formation many physiological events needs to be complete sequentially. After conception in the oviduct, a fertilized ovum passes through a number of developmental stages that begins with its cleavage and form morula. Morulacells converted into blastocyst and inner cell mass (ICM) during a period of compaction of its cells.

At the time of implantation, increased concentrations of ovarian steroid hormones initiated a complex signaling cascade that stimulates the differentiation of endometrial stromal cells to decidual cells, preparing the uterus to lodge the embryo. Studies in humans and in other mammals have shown that cytokines and growth factors are produced by the pre-implantation embryo and cells of the reproductive tract. The actions of interleukin-1, leukemia inhibitory factor, epidermal growth factor, heparin-binding epidermal growth factor, and vascular endothelial growth factor, and on the network of their interactions leading to early embryo development, pre-implantary endometrial changes, embryo implantation and trophoblast differentiation. The use of embryo co-culture systems using "helper" cells is one such approach that may afford benefit to certain animals, specifically those with history of poor embryo quality or repeated implantation failure. The initial studies of embryo co-culture took place in animals. In 1965, Cole and Paul demonstrated improved blastulation rates with culture of mouse embryos on a HeLa cell line. The use of such helper cell lines then gained popularity during the 1970s in the field of domestic animal biotechnology. Later on, several types of somatic cells were used to support mammalian pre-implantation embryo development *in vitro* [4]. This approach was again refined using trophoblastic vesicles and oviduct epithelial cells in ruminant embryo culture [5-8], and soon found applications in clinical practice [9]. Since then, embryo somatic co-culture has been applied to a broad spectrum of species, including cattle [5], rabbit [10], guinea pig [11], hamster [12], mink [13], cat [14], monkey [15], horse [16], goat [17], mouse [18], buffalo [19], camel [20], pig [21], rat [22], dog [23], and of course, human [24].

It has been suggested that the low rate of pregnancy result from implantation failure and therefore, the process and mechanism of normal implantation must be elucidated in order to increase the rate of successful pregnancy.

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