Improved Maturation of Oocytes for use in Animal Assisted Reproduction

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Technology description

Technology Overview

Bovine In Vitro Embryo Production is utilised in order to improve/manage multiple important aspects related to animal reproduction. This includes genetic selection, the application of novel manipulation procedures (such as sexing, PGD, somatic cell nuclear transfer and transgenic animal production), infertility treatment and ovarian or oocyte storage options for prized, rare or endangered animals. IVF vet solutions is a business unit of Adelaide University which specifically leverages the University' s core competence in oocyte biology. IVF vet solutions have developed improved media and process-driven change to enhance embryo production in animals, with particular emphasis on the bovine IVP market.

Market for bovine IVP embryos

The cattle IVP embryo market has grown consistently, relative to the established production and trade in embryos obtained via ovarian hyperstimulation (using gonadotrophins). Globally, production of IVF embryos has resulted in 546,628 transferrable embryos, as reported by the International Transfer Society. 517,587 of these embryos were OPU (ovum pick-up) derived embryos. This is an increase of 16% from 2012 and the first time bovine OPU IVF has exceeded 500,000 bovine embryos collected and over 400,000 embryos transferred. However, these estimates are expected to be grossly underestimated as the data collected is not complete for some countries and practitioners. Overall, it is estimated that embryo transfers in cattle are more likely to be above 1 million transfers world-wide. Most of this activity in IVP embryo production is based in South America, especially Brazil. As with South America, the industry in Australia is benefitting from several factors, especially the interest in applying IVP technology to genetic improvement in Bos indicus breeds. There are several reasons: 1) the high number of follicles in a follicular wave in indicus c.f. taurus , allowing high numbers of oocytes to be retrieved from an individual cow; 2) the greatly reduced management of animals for oocyte retrieval c.f. embryo retrieval using conventional gonadotrophin treatment (i.e., no injections vs. multiple injections, no heat detection vs. active heat detection and synchronisation); 3) the ability to recover oocytes from pregnant animals (as opposed to embryos). Additional to this is the improving yield of embryos from collected oocytes as a consequence of our technologies, thereby increasing the efficiency of embryo production.

IVF Vet Solutions' Products

IVF Vet Solutions has developed a complete series of oocyte maturation and embryo handling and culture media products to support the uptake and application of IVP in cattle (Figure 1). Coupled to this is the provision of knowledge for all laboratory aspects of IVP. Currently the factors which limit application have been: 1) skilled personnel for collection of oocytes and production of embryos within the laboratory environment 2) provision of the specific culture media requirements for IVP. Being associated with The University of Adelaide has allowed us to recruit and train cattle embryologists (two to date, both of which are, or have been working in the industry since training).

IVF Vet Solutions media performance

Development to blastocyst stage embryo (Day 7-8 of development, where Day 0 is day of fertilization in vitro) from collected oocytes is a key outcome measure to judge performance of an IVP system. A further key measure is pregnancy rate (as measured at post Day 35 of development, usually by ultrasonography) from embryos transferred. There are a number of factors which influence these figures: source of oocyte (whether from selected pools from abattoir-derived ovaries vs. unselected pools from individual donors recovered by transvaginal ovum recovery, TVOR); selection of sire; application of sexed semen; use of serum in media systems; fresh embryo transfer vs. frozen/vitrified embryo transfer. There are also a number of herd management factors, such as condition and nutrition of donors and recipients and management of oestrous detection prior to embryo transfer which also impact on outcomes. Therefore, the development of systems to maximise the performance level requires a multifactorial approach, some aspects of which cannot be controlled by any one operator. Nevertheless, the achievable industry standard using best practices regarding blastocyst embryo production from IVP is 30% of all oocytes recovered from TVOR, and 40% from abattoir recovered oocytes. We are currently working with technologies that can give 60% blastocysts from abattoir-recovered oocytes (70% from fertilized). This is a substantial increase and shifts the economic arguments for bovine IVP in application not only to Bos indicus , but taurus as well. Current pregnancy rates with our basic medium formulation under Northern Australian conditions are around 30% and although we expect improvement to occur from improved embryo development with our new IP developments, this will be less dramatic than the increase in blastocyst rate. Management of recipient health and nutrition is most critical here. Bos taurus breeds will have greater pregnancy rates.

IVF Vet Solutions requires further investment, partnering in a development programme with at least one of its collaborative industry partners, to resolve the final phase of product development. This could exist as a satellite of the current Adelaide laboratory established within one of the partner's embryo supply operation. An IP protection strategy is required for the new discoveries which have just emerged and are pivotal to successful product development.

About IVF Vet Solutions

IVF Vet Solutions is a Registered Business Name of Adelaide Research & Innovation Pty Ltd, the commercial development company of the University of Adelaide. IVF Vet Solutions provides consultancies, contract research and embryo in vitro production (IVP) media products. IVF Vet Solutions services cattle reproductive veterinarians and other specialists that seek support in the area of reproductive biotechnology, in particular the production of embryos using in vitro production (IVP) technologies. We can also provide support for other species including sheep and deer.

Institution

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