Global innovation in cattle IVF by British veterinary consortium

by **Dr Judith Roberts**, national veterinary manager, Zoetis

The time is coming when in-vitro fertilisation (IVF) will be commercially viable and affordable for mainstream UK dairy and beef herd owners, thanks largely to a small and dedicated group of vets in northern England.

According to Stuart Mullan from Paragon ET, IVF promises to accelerate the advancement of cattle performance by enabling multiple calves to be bred from genetically elite mothers, without the hormone injections required by the multiple ovulation and embryo transfer (MOET) technique.

The development of IVF in cattle is being led by Mr Mullan and colleagues at Paragon ET's base in Newbiggin near Penrith. The technique involves extraction of eggs directly from a cow's ovaries by keyhole aspiration, called ovum pick-up (OPU). This is followed by in-vitro 'test tube' fertilisation, then culture of the embryos for one week before transfer into recipient heifers or cows as surrogate mothers for a normal pregnancy and birth.

OPU collections can be performed weekly and eggs collected from juvenile heifers, non-pregnant cows, and pregnant donors during the first trimester. Typically, this produces many more potential embryos than the MOET process. This means IVF can offer a very effective choice if MOET has not been successful, or is not appropriate. Indeed, the IVF programme's inception came about as a way to continue breeding from elite cows that would not conceive normally or respond to the MOET techniques that the Paragon ET team has been performing for 30 years.

In particular, Stuart Mullan says ovum pick-up was initially developed so that high genetic merit "no hoper" cows could be brought back into their owners' herd breeding programmes. He explains it soon became clear that this technique could quickly become a mainstream component in the cattle breeder's toolbox.

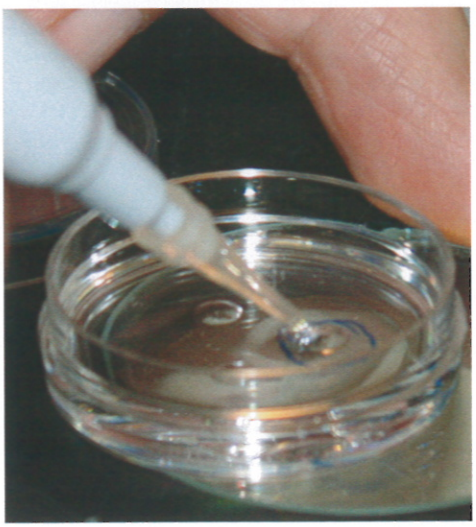
Stuart Mullan

> "Each OPU egg collection yields six to eight viable eggs"

SUCCESS STORY

One early success story involved the donor cow Applevue Rudy Mattia EX97(4) who stopped producing fertile embryos at the age of 12. Using the IVF process performed by Paragon ET's partner OPU team in Cheshire, Peter May and Mark Nutsford, she started producing pregnancies again at the remarkable age of 15. These calves are carried during pregnancy by recipient cows, whose breeding cycles are synchronised precisely with the timing of egg extraction and fertilisation.

In-vitro 'test tube' fertilisation follows ovum pick-up (OPU)



This part of the IVF process is the same as for MOET recipients and consequently well proven and understood by specialist cattle vets. At Paragon ET, it revolves around treating recipient females with a controlled intra-vaginal drug release device. This releases progesterone at a precise rate, which then passes through the vaginal wall into the blood stream. Progesterone suppresses the release of other reproductive hormones, thereby suspending the oestrous cycle temporarily.

After the prescribed number of days, removal of the device causes a sharp drop in blood levels of progesterone. This triggers resumption of the oestrus cycle, in preparation for transfer of IVF embryos into recipients at the optimum time. Compared with other devices for the same purpose, Stuart Mullan says the CIDR offers better cow comfort and optimal alignment of oestrus synchrony.

MAIN FOCUS OF RESEARCH

He reports acceptable pregnancy rates in the transfer of fresh IVF embryos to recipients. The main focus of the research team's work is now to concentrate on freezing embryos and to continue improving subsequent pregnancy rates.

Typically, he says each OPU egg collection yields six to eight viable eggs. Extracted eggs require a 24-hour period of maturation in a culture medium before fertilisation. Resulting embryos are cultured for six days in a nutrient medium and then ready for implantation in recipient females that have been synchronised in parallel.

Stuart Mullan reckons approximately 35% of extracted eggs are likely to make viable transferable embryos.

The project is about half way through a five-year Technology Strategy Board* programme, and the main goal is to make a commercial cattle IVF service available to owners of dairy and beef herds seeking accelerated advancement in cattle genetic merit.

He says the vision is to have five OPU/IVF teams around the UK within five years, with an associated network of XLVets practices implanting embryos into recipients.

Mr Mullan also suggests that IVF could largely replace MOET as first choice technique in accelerated genetic progress in cattle, and is resolute that the UK can become a global leader in this technology among a number of rival programmes in other countries.

• *Zoetis is sponsoring the Cream Awards Dairy Vet of the Year category.*

* The Technology Strategy Board is an executive non-departmental public body (NDPB), established by the Government in 2007 and sponsored by the Department for Business, Innovation and Skills (BIS). (Source: http://www.innovateuk.org/aboutus.ashx). The activities of the Technology Strategy Board are jointly supported and funded by BIS and other government departments, the devolved administrations and research councils.

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