



Bob Long

Imagine a two-year-old heifer with a natural calf at side and the dam of an additional 100 calves on the ground, alive and well. Sounds wild but reproductive physiologists say this is quite possible with in vitro fertilization and other recently developed techniques.

Embryo transfer is old hat in the cattle industry. First, cows were super ovulated through various hormone injections and those ova collected surgically in a veterinary hospital and transferred to recipient females for development. Next, nonsurgical, on the farm procedures were developed and embryo transfer was used extensively. More recently embryo splitting, embryo freezing, embryo sexing and cloning have become options.

Historically embryo transfer has required that a donor cow be inseminated during her heat and fertilized embryos collected from the reproductive tract six to eight days later and transferred to recipient females in the same stage of the reproductive cycle as the donor. The necessity for *in vivo*, in the living body, insemination was due to the inability of sperm to fertilize ova outside the reproductive tract. However, scientists

In Vitro Fertilization is Tool for the Future

have perfected a procedure which gives sperm the capacity to fertilize eggs *in vitro*, outside the living body. This development greatly expands the possibilities of embryo transfer.

A review of female reproductive physiology reveals that heifer calves produce viable oocytes, unfertilized eggs, long before puberty or a detectable heat period. Oocytes develop inside follicles which appear on the ovaries. Several follicles appear on each ovary at the beginning of the reproductive cycle which lasts 18 to 21 days. Normally, one of these follicles becomes dominant and the others subside. This dominant follicle continues to develop and after 18 to 21 days the cow comes in heat, the follicle ruptures and releases the egg. However, if early in the cycle the follicles are removed or ruptured mechanically the cycle starts over and several new follicles form.

The in vitro fertilization (IVF) procedure is nonsurgical, does not require any hormone injections and is said to not damage the female or her reproductive tract.

A technician places an ultrasound-guided needle into the cow's vagina. With his other hand in the rectum he holds the ovary against the ultrasound transducer and locates the follicles which contain oocytes. The needle is then passed through the vaginal wall and into the follicle. The contents of the follicle are aspirated, sucked out by vacuum, and the egg located microscopically in the laboratory.

This procedure is repeated for each follicle. Removal of the follicles causes a new set

of follicles to develop and the procedure can be repeated on a weekly basis. New follicles continue to develop for three to four months after pregnancy and oocytes can be collected weekly during this period without disturbing the pregnancy.

Once the oocytes are collected they must be cultured in a special media and incubated about 24 hours until mature. The mature eggs are then placed in a fertilization media along with capacitated sperm for approximately 18 hours. After this period a one-celled fertilized egg must be cultured for an additional seven or eight days to be suitable for transfer to the recipient cow which will carry it to term.

Currently, reproductive laboratories are reporting the ability to collect about six or seven oocytes per week with about 35 percent viability. The resulting pregnancy rate is approximately 50 percent which makes it possible for one pregnancy per week. However, as techniques improve IVF procedures will no doubt become more efficient resulting in a tremendous increase in female reproduction potential.

This increase in the number of offspring possible plus the elimination of the need for hormone injections suggests that IVF will replace conventional embryo transfer procedures.

IVF has the further advantage of being successful in obtaining embryos from cows where conventional techniques have failed. Problem cows due to advanced age, abnormal reproductive tracts, disease or failure to respond to hormone stimulation have produced viable embryos by IVF.

Keep in mind that all embryo transfer procedures are expensive and are probably not justified except with females that have demonstrated truly superior complete performance records. Likewise, even though IVF makes possible sizable numbers of offspring from very young heifers such females have not established superiority and are therefore questionable candidates for breed improvement.

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WE WELCOME YOUR INPUT!

Our Beef Improvement section has been expanded to include more information for today's performance-minded breeder. Both "Beef Logic" by Bob Long and the "What's Your Beef?" columns serve as a forum for Angus breeders and industry experts to express their opinions on current issues and topics of breed improvement and performance programs.

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