utilized in a practical manner to effectively inhibit rumen fermentation and formation of 3MI. It is anticipated that this approach might provide a practical method for controlling the natural disease.

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Ova Transfer in the Bovine Animal

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Although ova transfer in the cow was first successfully accomplished in the early 1950's, it took 20 years before it was used for commercial purposes on a practical basis. The early stimulus for the development of ova transfer in cattle was its value for research. Considerable information has been gained concerning reproductive physiology in other species in which ova transfer has been successful for many years; e.g. in the rabbit and swine. This research value may be genetically oriented as well as physiologically oriented. Presently cattle progeny testing is directed mostly at testing the transmitting ability of the male since insufficient offspring numbers limit such testing of the cow. With superovulation and ova transfer, selection based on the female transmitting ability may also be established.

The production of increased numbers of full sibs is obviously a tremendous asset for nutritional studies, for susceptibility to disease studies and for many other types of research.

The introduction of the so-called "exotic" breeds of cattle for cross-breeding purposes provides the greatest immediate stimulus for the commercial application of ova transfer. This is due to the fact that there are severe restrictions against importation of these breeds from foot-and-mouth disease countries. The limited numbers that can be brought in are, therefore, very valuable and the maximum number of offspring from these few is very important for the exotic cattle industry of this country.

In these breeds semen has been much more importable. Thus, the semen is used to produce F_1 half-bloods. These are bred back to the same breed giving ¾ bloods. The next generation (⅞ bloods) are considered to be full bloods. Ova transfer is used to increase the number of these percentage-blood animals and "up-blood" these as rapidly as possible. Instead of the traditional pyramid of diminishing numbers being produced as with single births in "breeding-up"

procedures, the process becomes inverted and the returns expand upward as each female produces several calves in her early lifetime. At the present time this is the most influential factor stimulating the commercial use of ova transfer in cattle.

The procedures employed for embryo transfer in cattle by most ova transfer units today might be outlined as follows:

In preparation for ova transfer, the donor cow is observed through two estrus cycles to establish her exact timing. Five days before her next heat period she is injected with PMS to induce superovulation. The donor is then allowed to come in heat and at that time is bred to the bull that has been previously selected. Prior to this breeding, she is examined to make sure she has been successfully superovulated. Generally, the cow would be bred two or three times during the heat period since the follicles would not all be ovulating at the same time. On the day that the donor animal is in heat, the recipient herd, which for a normal transfer operation must number at least 150 to 200 cows to provide adequate recipient numbers each day, is examined for cows showing estrus. It is critical for success that the donor and the recipient animals be synchronized. At the present time this is accomplished by selection and seldom by the use of drugs. Prostoglandin holds promise of being an adequate synchronizing agent, but is not approved for use in this country as yet.

The actual ova transfer is usually performed four or five days after the donor cow has been in estrus. The donor and recipients are taken off feed and water for 48 hours prior to surgery. Surgery is first performed on the donor animal. Various surgical approaches have been attempted and some variation presently employed in the field. However, the most common approach utilized is through the use of a mid-ventral incision just anterior to the udder. The donor is sedated, put on gas anesthesia and placed in dorsal recumbency on a table that can be used to elevate the rear quarters on the cow, approximately 70 cm. Following entry into the abdominal cavity, the uterus and ovaries are brought through the incision and the ovaries examined for ovulation points. Next a glass or plastic tube is passed into the infundibulum of the oviduct on one side and held in place by use of the thumb and forefinger. Then the tissue culture or flushing media is injected into the horn of the uterus on that same side, usually near the body of the uterus. The fluid is forced through the uterus and oviducts using a stripping motion with the hands being very careful not to traumatize the uterine tissue by exerting an undue amount of pressure. As the fluid is forced through the collecting tube, it is caught in a petri dish or a special dish designed for ova collection. Other methods of collecting ova may be used; this is a commonly employed method.

Following the flushing of both horns and oviducts of the uterus, the ova are located by using a dissecting microscope. As the fertilized eggs are found, they are withdrawn from this fluid and placed into holding vessels from which they will be taken when the recipient cows are ready to receive the eggs. As the eggs are found, they are evaluated and should be in the 16 to 32 cell stage.

As the first normal fertilized ovum is found, the supporting crew on the surgical team starts anesthetizing the first recipient animal. The recipient animals are anesthetized and the eggs are transferred using the same surgical approach as has been used for the donor animal. When the recipient is prepared and the abdomen entered, the uterine horn on the side of which ovulation has occurred is brought to the incision line and the fertilized egg is placed into the lumen of the uterus using a narrow bore glass pipette. Both donor and recipient animals are sutured in a routine manner. Antibiotics may or may not be utilized for a day or two following surgery.

The donor animal may be used two or three times as a donor. The decision as to whether or not she will be used a second or third time is based upon rectal examination findings. Particular attention is paid to the development of adhesions or abnormalities in the reproductive tract. Provided the surgery is completed with the least trauma possible and the corpora hemorrhagica do not bleed too profusely, the adhesion development will be minimal. Certainly, the aim is to superovulate and collect ova from the donor animals and to retain a reproductively sound animal.

The technique of ova transfer is constantly being improved through research efforts. Most research effort is presently being directed in the following areas: non-surgical collection of ova, ova culture, freezing of fertilized ova, non-surgical transfer and improvement of hormonal therapy for superovulation and synchronization of estrous. These efforts and problems associated with ova transfer will be discussed.

It is fortunate for ovum transfer that the "exotic breed boom" has come along for it is this boom that is serving to finance the development of ova transfer. It is an expensive procedure and the research for improving the field is also expensive. One must be dedicated to the fact that sufficient time, talent, money and attention to detail is necessary if embryo transfer is going to be successful in his hands. The temptation to dabble in ovum transfer on a part time but commercial basis has the potential of being as detrimental to the profession as beneficial. Ova transfer provides an excellent opportunity for the profession to become involved in a field of the reproduction that can have great impact on the cattle industry of the country. It is an exciting field with much challenge and opportunity. It does require good knowledge in reproductive physiology, good clinical talents in terms of diagnostic skills, surgical skills and laboratory techniques. Prior to offering the service on a commercial basis, many donor operations and transfers must be made on experimental animals for the development of the art as well as testing out

the efficacy of the hormones to be employed. Ova transfer is a procedure in the area of reproductive physiology which requires participation of veterinarians. We must use the opportunity wisely.