CORNELL

NYS Animal Health Diagnostic Laboratory
Cornell University
P.O. Box 5786
Ithaca, NY 14852-5786

Telephone 607 253-3900
Fax: 607253-3943

College of Veterinary Medicine

August 21, 2003

Mr. Edward Ludbrook
Marketing Director
Technotogies International Ltd.
P.O. Box 58460, Greenmount
Auckland 1730
New Zealand

Dear Mr. Ludbrook:

Please excuse the delay in responding to your letter of 11 June 2003. Since retiring last year from the Chair of Population Medicine and Diagnostic Science and Director of The New York State Diagnostic Laboratory at ihe College of Veterinary Medicine, I have been engaged in extensive travel to fulfill my added professional responsibilities.

Many years ago, what was then the United States Department of Health defined colostrum as the "milk" collected in the first six milkings after birth. This was done to keep milk intended for human consumption entirely free from colostrum since, at that time, it was believed that colostrum was only suitable for consumption by the calf. However, science has now significantly advanced our understanding of what colostrum really is, how it is formed and the many benefits that if can convey.

The formation of colostrum in the pregnant cow starts about 3-4 weeks before birth of the calf when a very small amount of fluid is released into the developing mammary tissues. This fluid contains tiny amounts of growih hormone, insulin-like growth factors and other tissue transforming substances. The presence of these substances in the mammary gland stimulates the appearance of special active sites on the surface of the cells in the interior of the mammary gland. These sites will be used to transfer the substances necessary for the development and survival of the calf from the mother's bloodstream into the mammary gland. About two weeks before birth, more fluid enters the gland and some of the sites on the surface of the cells become fully activated. Immunoglobulin molecules (lgG) from the mother's blood attach to the active sites and are transported by specialized units through the cells into the fluid in the mammary gland. At the same time, specialized white blood cells from the mother attach to different active sites and are also transferred info the mammary gland. These cells immediately begin to release other immunoglobulin molecules (IgM and lgA) into the mammary fluid. Additional sites become aciivated during the 3-5 day period before birth and serve to transport the other biologically active substances from the mother's bloodstream into lhe mammary gland fluid.

About two days before birth, the hormonal balance and control of the mammary gland by progesterone begins to change rapidly in the mother. The quantities of the hormone prolacfin and, to a lesser extent, other hormones increase sharply in the mother's bloodstream, removing some of the inhibitory effects of progesterone. This starts the production of large volumes of fluid that fills the mammary gland and also turns on the ability of cells in the mammary gland to make certain substances, like lactose. When birth occurs and the placenta is eliminated, the amount of progesterone in the blood of the mother drops dramatically and its control over the secretions in the mammary gland is completely removed. At the

same time, a unique protein develops inside the celts lining the mammary gland. This protein completely blocks the process by which biologically active substances were transferred from the mother's bloodstream into the mammary gland. Therefore, at this point, the composition of colostrum in the mammary gland represents true and complete colostrum that is maximally enriched with the biologically active substances required to support the development and welt being of the calf.

The process by which the cow begins to prepare to secrete the fluids developed in its mammary gland starts before colostrum formation finishes. When the level of progesterone in the mother's bloodstream begins to fall a few days before birth, significant volumes of fluid begin to enter the mammary gland, although the volumes that enter are not as great as will occur after birth. At this point in time, it is physically possible to remove some colostrum from the mammary gland, however, the colostrum usually is not fully formed and the removal has been shown to diminish the quantify and quality of fluid collected after birth. Fully functional lactation in the cow begins within moments after birth, when the placenta is eliminated and all inhibition of secretions by progesterone is removed.

After birth, one of the most influential factors on the composition of what will be secreted from the mammary gland is physical removal of the fluid within the gland. During the hours after birth, removal of even a small amount of fluid from the gland results in the production of very large amounts of fluid by cells in the gland itself. Since the transfer of biologically active substances from the mother's bloodstream was blocked at birth, all of the substances found in the added fluid will have been made by cells in the gland and the composition of the remaining fluid will change. This secondary fluid that is produced wholly by the mammary gland after birth, but may contain remnants of the original colostrum, is called "transitional milk". Thus, removing any quantity of original complete colostrum at the first milking after birth adulterates the remaining colostrum with transitional milk.

Another important characteristic that influences the composition of colostrum is the fact that, if the colostrum is not removed from the mammary gland within 6-8 hours after birth, the mother's system will begin to reabsorb many of the biologically active substances, including the hormones and immunoglobulins, back info her bloodstream from the mammary gland. Therefore, the composition of the secretions from the mammary gland changes rapidly during the hours and days after birth so that there is a continuous transition from complete colostrum to whole milk. Extensive scientific studies have demonstrated that complete colostrum is made up of about 27% solid material and 73% water at the time of birth. About 65% of the solids are proteins and approximately 40% of these proteins are immunoglobulins, mostly lgG. If no fluid is physically removed from the udder within 6 hours after birth, the amount of solids drops by about 25% the protein content is reduced by more than 40% and the total proteins now are only 50% of the total solids. Six hours later, at 12 hours after birth, the total solids are only about 55% of what they were at the time of birth and only 40% of the solids are proteins. This change is even more dramatic by 24 hours after birth and continues as the mother reabsorbs unutilized biologically active substances from her mammary gland. In addition to the loss of material due to reabsorption, the fluid in the mammary gland reflects other changes that are ongoing after birth, including the production of lactose by cells that line the mammary qqland and the slowing of fat production. (Fundamentals of Dairy Chemistry, 2nd Ed, B.H. Webb, A.H. Johnson, J.A. Alford eds; The AVI Publishing Co., Westport, CT, 1978.)

The above information represents the most recently available information from the scientific literature. I hope that it is useful and helps to clarify the rationale for the content of my memorandum to Mr. Kleinsmith.

Sincerely,

Donald H. Lein, DVM, Ph.D.
Professor Emeritus of
Pathology and Theriogenology