

CALVING EASE

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Maternal Immune Cells in Colostrum

Where do They Come From?

They come from the dam's blood. They are concentrated in the dam's udder during the last ten days before the calf is born. The common name for them is white blood cells. You may recognize their technical names. They are T and B-lymphocytes, macrophages, neutrophils and epithelial cells.

Are They the Same as Antibodies?

No, maternal immune cells are quite different from antibodies. Antibodies are large protein molecules, not whole cells. We hear a lot about antibodies when evaluating colostrum quality. High antibody concentrations are good. When colostrum like this is fed in adequate quantities soon after birth many antibodies move across the gut lining into the calf's blood. Research shows that freezing and thawing changes neither the rate at which antibodies are transferred from the gut into the blood nor the level of their effectiveness in preventing disease.

Maternal immune cells are also present in colostrum in large numbers. They are whole cells. Estimates suggest a concentration of about 1,000,000 of these cells per milliliter in fresh colostrum. Two quarts of fresh or refrigerated colostrum fed to a newborn provides around 3,500,000,000 of these cells. They migrate across the gut lining into a calf's blood if colostrum is fed soon after birth. However, research shows that freezing and thawing destroys most of the maternal immune cells in colostrum. Only fresh or refrigerated colostrum will provide extra immune protection in addition to antibody protection.

What Immune Protection do These Cells Provide?

The maternal immune cells' most important job is to help direct the rest of the calf's immune system (including antibodies) at the right enemies. Remember that a newborn calf's intestine hasn't had contact with the outside world. That world is full of pathogens. In order for the calf to remain healthy, individual parts of her immune system have to recognize pathogens as enemies. Initially special maternal immune cells from colostrum provide these directions. Sometimes this is called immunological memory. These messenger cells send out the word, "This object is harmful and should be destroyed."

Then, other parts of the immune system converge on the foreign object. They neutralize and absorb it. The calf's own lymphocytes take over this job by the time the calf is a couple of weeks old.

Another important job for maternal immune cells is to improve the calf's ability to destroy these foreign objects once they are identified. Some of the cells from colostrum migrate to the lymph nodes. Once there they are directly involved in absorbing and getting rid of pathogens. Other maternal cells go to the intestinal surfaces. They stimulate other cells located there to neutralize harmful pathogens as they attack the calf through the intestine.

The maturation of the calf's own immune system is stimulated by maternal immune cells. Some of these cells from the dam's colostrum stimulate the internal production of lymphocytes (special white blood cells). These lymphocytes in turn are stimulated to produce antibodies that also protect the calf against pathogens.

How Can I Help my Calves Get Lots of Maternal Immune Cells?

- Feed clean colostrum. Bacterial contamination will directly reduce the chances of maternal immune cells being transferred from the gut into the blood. In order to feed clean colostrum you have to collect it with sanitary equipment from clean cows. It needs to be fed within thirty minutes after collection from well-scrubbed nursing bottles or esophageal tube feeders. Or, if not fed immediately, colostrum needs to be refrigerated within thirty minutes after collection to prevent rapid growth of environmental bacteria.
- Feed plenty of colostrum as soon after birth as possible. The ability to absorb maternal immune cells from the gut to the blood declines rapidly. By six hours after birth only one-half of the calf's ability to absorb maternal immune cells remains. By twelve hours the gut's absorptive capacity has declined to about one-quarter of what it was at birth.
- **Feed fresh or refrigerated rather than frozen colostrum.** Freezing works fine for emergency supplies. Unfortunately, freezing and thawing essentially wipes out the maternal immune cells. If you can control bacterial contamination without freezing, fresh or refrigerated colostrum will deliver a bigger punch than frozen to promote immunity.

References: Le Jan, C. "Cellular components of mammary secretions and neonatal immunity: a review." Vet Res (1996) 27: 403-417. Davis, C. L. and J. K. Drackley 1998 The Development, Nutrition, and Management of the Young Calf. Iowa State University Press, Ames, IA, Part II Feeding and Management of the Young Calf.

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