# The Effect of Uterine Environment on Sperm Cells

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## Story in Brief

The problem is lack of knowledge as to the effects of uterine environment on sperm cell morphology and livability. In this study, several cows were inseminated with sperm cells with known characteristics. Then cells were recovered at various intervals after insemination and changes in their characteristics were determined. Results to date indicate that the cells die and age at a rapid rate in the uterus. The study is continuing in an effort to better define the effects of uterine environment on sperm cells.

It has been known for several years that optimum fertility is achieved when viable sperm cells are placed in the cow in the latter half of standing heat (Trimberger, 1944, 1948; Van Demark, 1952). This procedure assures that the sperm cells are in the cow's uterus several hours before fertilization occurs. The bovine sperm cell apparently has to undergo some changes, usually termed capacitation, before the cell can fertilize the egg cells. These changes occur within a few hours after being placed in the uterus and are a result of some property of the uterine environment.

All of the changes are not yet clear, however, the acrosome, the anterior cap-like structure on the sperm cell is apparently involved. At the present time, it is not clear whether the changes are in the shape of the cell, functional capability of the cell or both (Bedford, 1963, 1964). It is known that sperm cells undergo structural changes in the uterine environment (Bedford, 1970). This is an aging process and can be followed to a degree by determining the condition of the acrosome (Awa, 1970; Wells and Awa, 1970). Few researchers have undertaken to determine the effects of the cow's uterine environment on the sperm cell. The purpose of the work being reported was to obtain a clearer understanding of what happens to sperm cells after they are placed in the cow.

## Experimental Procedure

The effects of uterine environment on the percentage of live cells and the percentage of aged cells were measured using 9 cows from the Oklahoma State University herd. The percentages of live cells and aged cells were determined on ejaculates collected just prior to insemination. Each cow was inseminated with 1 ejaculate (approximately 5 cc). Sperm cells were recovered at 30 minutes, 1, 2 and 4 hours after insemination by inserting a stainless steel breeding catheter, with several openings in the anterior 1 inch, into the uterine chamber and, with gentle vacuum, removing a small sample of the cells.

Determinations of the percentages of live cells and aged cells were made on these samples within a few minutes after recovery from the cow. The cows were given routine herd rations and were housed and managed in conventional herd practices. Only 2 of the cows in this preliminary study were in heat on the day of insemination. Further trials will utilize cows that are in heat.

## Results and Discussion

The sperm retrieval process as described previously worked reasonably well. It was progressively more difficult to retrieve large numbers of cells at the later periods after insemination. Even though 5 cc. of semen, approximately 5 billion sperm cells, were placed in the cow, it was difficult to consistently secure large numbers of cells at the 4-hour retrieval period. Limited attempts were made to secure cells from 8 to 24 hours after insemination and rarely could sufficient numbers of cells be retrieved to make the desired determinations. This limitation did not allow us to gather any information on the effect of a 12 to 18 hour period in the uterus on sperm cell characteristics. Slaughter trials will likely have to be used to secure this needed information. This problem has been encountered by other researchers and likely explains why so little information is available on what happens to a population of sperm cells after they are placed in the uterus of the cow.

The changes in sperm cell characteristics in the first 4 hours in the uterus were striking. The average effect of the uterine environment on the percentage of live cells is shown in figure 1. The average percentage of live cells in the original ejaculates, just prior to being placed in the cow, was 73.4 percent. At the first retrieval period 30 minutes later, the percentage of live cells had dropped to 46.3 percent and remained at about the 50 percent level at both the 1 hour and 2 hour post-breeding samplings. At the 4 hour post-insemination samplings, the proportion of live cells had dropped to 24.1 percent, or, about one-third as many live

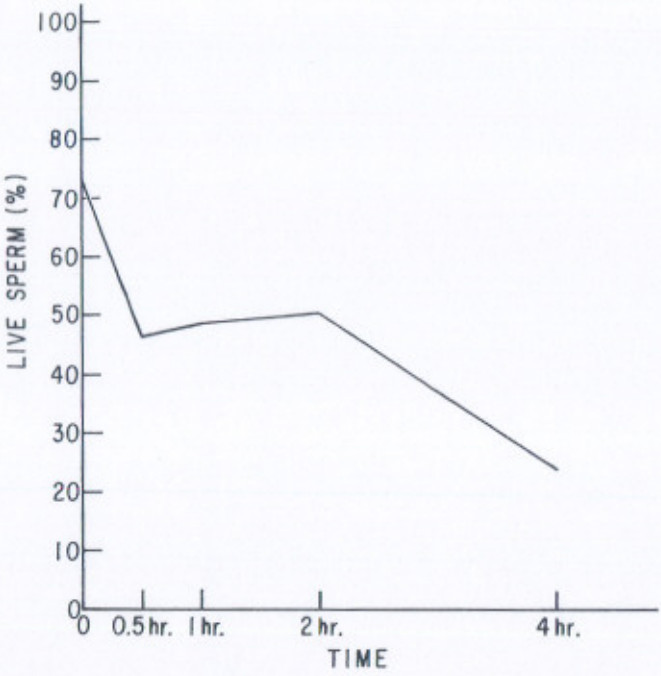


**Figure 1. The effect of uterine environment on the percentage of live sperm cells.**

cells were present at 4 hours post-insemination as was present at the time of insemination. These samplings were all taken from the uterine horns of the inseminated cows. Although the number of cows is small, the data suggests that sperm cells die rather rapidly after being placed in the uterus. Several factors could be responsible. Most of these cows were not in heat and there was no indication of infection in any of the cows. It should be stated that it may be normal to have this type of sperm cell loss. No data exists to give a good basis for comparison. The next phase of this study will involve a group of cows in standing heat and an attempt will be made to determine if the uterus is a more favorable environment during heat and if various sections of the reproductive system can maintain viability better than others.

The average effect of the uterine environment on the percentage of aged cells is presented in Figure 2. It is normal for all cells to go through the aging process. It is not known at this time at what point in the aging process the fertility of a sperm cell is affected. Our investigations are pointed toward gathering information on this problem. The average per-

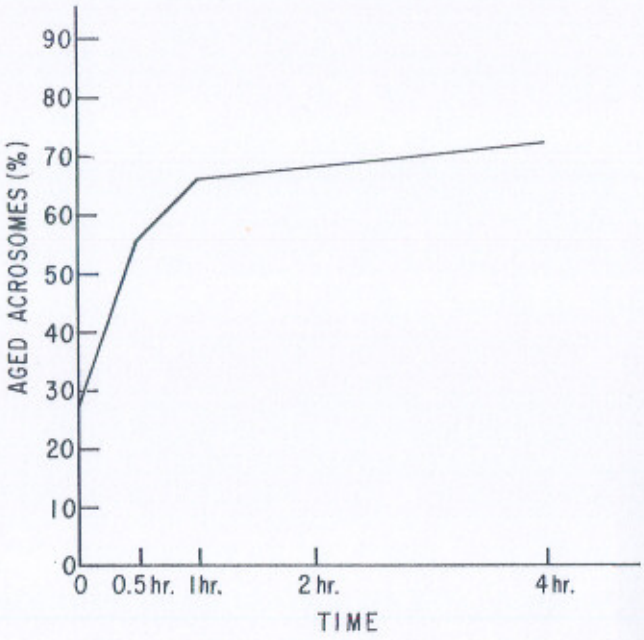


**Figure 2. The effect of uterine environment on the percentage of aged acrosomes.**

centage of aged cells at the time of insemination was 27.4 percent. Within 30 minutes, the percentage had risen to 55.6 percent and increased to 72.8 percent by 4 hours after insemination. This increase in the percentage of aged cells is again striking. Again, no definitive data exists for good comparisons. The uterine environment changed the levels of aged cells in a short period of time. Whether the uterus of the cow in heat or particular sections of the uterus can maintain the cells more desirably awaits further research.

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