# Gametic Incompatibility and its Implications for the Dairy Industry

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The dairy sector continues to invest in discovery research to expand our understanding of the influence that genetics play with regard to reproduction. Here are some of the latest findings from research on gametic incompatibility in dairy cows.

## Key Points

- **Decisions on which sire to use** when breeding cows can be complex.
- **Recent research has shown** that the outcome of a mating can be influenced by different sire-dam combinations and the compatibility of the pair can vary depending on their individual genetics.
- **After analyzing data from almost 300,000 Holstein offspring, dam, and sire trios,** several regions of the genome were found to influence the compatibility of the sire-dam combinations.
- **Further understanding this concept could lead to improved fertility in dairy cows** by avoiding less compatible sire-dam combinations.

## Reproduction in dairy cows enables milk production and cow replacements, and ensures the sustainability of the dairy industry.

Female fertility of dairy cattle has been included on the national selection indexes around the world for several decades; however, male fertility has not been directly selected. There is also a low correlation between male and female fertility, highlighting that focusing on female fertility alone will not improve male fertility. Therefore, the male's contribution needs to be considered to improve overall fertility.

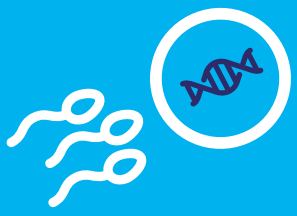
**One challenge with evaluating male fertility is that their true reproduction ability has been masked by the standardization of semen for the widespread use of artificial insemination.**

## Fertilization success is dependent on the compatibility of the gametes, i.e., the spermatozoa from the bull and oocyte from the cow.

A paired mechanism exists between the spermatozoa and the oocyte, which partly depends on gametic compatibility. As a result of the random union of the two gametes during fertilization, the genetic information transmitted by the dam and the sire is expected to be random and equally spread in the offspring generation.

**However, recent studies have identified that random transmission of genetic information may not always occur, which results in a biased amount of genetic contribution in the descendants.**

This may be due to gametic incompatibility, which may impair fertility and generate an unexpected genotypic frequency in the offspring generation.



**Understanding gametic incompatibility in dairy cows could allow for improved fertility and reproduction**

# Unravelling gametic incompatibility in dairy cows

At the University of Guelph, a project was conducted to explore gametic incompatibility in dairy cattle. For this study, a total of 283,817 genotyped Holstein trios (i.e., offspring, dam, and sire) were used to identify regions of the genome that are associated with gametic incompatibility. To do this, the offspring's genomic marker information was compared to that from their dam and sire. A total of 422 genomic regions were identified as having a significant impact on gametic incompatibility. These regions are mostly linked to the immune system and pathways used for communication between cells. The reproductive and the immune systems are often genetically intertwined. It is coherent, as the uterus has to protect the cow against pathogens, while accepting foreign cells, such as the spermatozoa and embryo. This flexibility in reactions strongly relies on cell communications. Moreover, communication between spermatozoa and oocyte is also required for fertilization to occur.

**Interestingly, purely reproductive mechanisms were not of primary importance for gametic incompatibility. Some sexual hormone pathways and oocyte development processes were significant in the study, but they are more likely affecting fertilization outcome by producing a sub-optimal environment for the gametes or embryo.**

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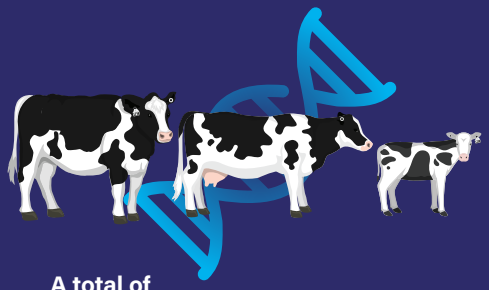

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## What does this all mean and where is this heading?

**The project provides a first look at gametic incompatibility in Holstein cattle.**

Understanding this can lead to improved matings, by avoiding incompatible matings or matings with a lower chance of establishing a successful pregnancy. In addition, bulls and cows may be selected for better overall gametic compatibility in the future.

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