

DairyGen Council of Lactanet Canada

- Research Priorities -

The Dairy Cattle Genetics Research and Development (DairyGen) Council is an advisory committee of Lactanet Canada that focuses on funding dairy cattle genetics research in Canada. The DairyGen Council brings together the interests of the A.I. sector, breed associations, Dairy Farmers of Canada (DFC) and Lactanet for a coordinated effort to fund genetics research. With an annual budget of approximately \$350,000 collected from industry partners, and the accompanied government matching support, the DairyGen Council supports high priority research in the area of dairy cattle genetic improvement. To gain efficiencies and maximize collaborations, the DairyGen Council works closely with DFC's Canadian Dairy Research Council (CDRC), especially in the coordination of projects under the federal government Dairy Research Cluster program.

The DairyGen Council of Lactanet Canada invites researchers in the areas of quantitative genetics, genomics, economics, food science, as well as other areas related to dairy cattle, to submit Letters of Intent for proposed research to be initiated in 2025 that coincides with at least one of the priority topics below. Electronic submissions of Letters of Intent are highly preferred and should be sent to Filippo Miglior (fmiglior@lactanet.ca), using a fillable pdf file available from them. Submission forms for Letters of Intent as well as DairyGen Guidelines for Grant Application have been provided in the electronic mailing of the DairyGen Call for Letters of Intent but they are also available from either contact person above or via a link to the DairyGen Council on the Lactanet web site (www.lactanet.ca). The DairyGen Council accepts Letters of Intent at any time and submissions will be reviewed on an ongoing basis.

The DairyGen Council has established the following areas of high research priority:

Environmental Impact and Efficiency

The dairy cattle industry is under significant pressure to reduce the environmental footprint of milk production. Genetic evaluation for feed efficiency was recently launched in Canada, but other traits need to be evaluated. In this context, international efforts might enable national genomic evaluations for other difficult- and/or expensive-to-measure traits, such as methane emissions and nitrous oxide. Therefore, there is an immediate need to establish optimal methods to combine heterogeneous data from different sources and develop enhanced genomic evaluation systems for these traits. Studies to evaluate the feasibility of different statistical methods to improve the quantification of actual emissions and accuracy of predictions using limited datasets are also desirable. Potential traits and their indicators to be evaluated include:

- Emission of greenhouse gases, such as methane and nitrous oxide
- Enhanced evaluations for feed efficiency, quantity and quality
- Water consumption efficiency and availability

Animal Health and Welfare

Dairy farmers are adapting to evolving consumer demands to maintain their social license to operate. They strive to be efficient at producing high-quality food products ensuring good animal health and welfare. Thanks to industry investment matching public funding, multiple projects and initiatives have resulted in the implementation by Lactanet of a series of genetic evaluation systems to enhance health (resistance to mastitis, metabolic diseases and fertility disorders) and animal welfare (hoof health). However, we have limited metrics to objectively measure animal welfare, therefore, methodologies that measure and demonstrate improved welfare are needed. Nevertheless, it remains a priority to improve accuracy of genetic selection for various health traits and broaden disease resistance by adding new phenotypes including Johne's Disease, Leukosis and calf health and survivability to the health evaluation portfolio. There is a strong need to continuously improve young stock management for long-term health and performance, thus looking at traits in this area from a genetic perspective including genetic variation and relationships with other economically important traits. Potential phenotypes/traits and their indicators to be evaluated include:

- New emerging diseases
- Calf health traits and livability
- Colostrum quality intake and transfer of passive immunity
- Genetic abnormalities
- Animal contentment

Resilience and Adaptation to Climate Change

Intensive selection to increase milk production has led to a higher generation of metabolic heat in dairy cows compared to other animals, which has been a major cause for concern during climate change. Moreover, the current debate about the use of antibiotics has limited its use in dairy farms. As a consequence, dairy farmers are looking for more resilient cows - meaning cows that can maintain (or quickly recover from) sustainable production levels through several adversities, such as climate and environmental changes. In this context, an optimal definition of resilience needs to be identified and validated. Genetic and genomic evaluation systems need to be developed for various resilience indicator traits, which may include resistance to heat stress and diseases. Studies to incorporate the different resilience indicators in the same selection index are also required. In addition, the potential short- and long-term socio-economic impacts of selective breeding for resilience need to be assessed. Resilience indicators to be targeted may include:

- Production: milk production and quality
- Fertility: estrous expression, embryo survival and abortion
- Health: fertility disorders, metabolic disorders and calf health

Genetic Diversity, Breeding Strategies and Economic Indexes

Given the significant developments allowing for the application of genomics to improve the accuracy of genetic evaluations, especially for young bulls, heifers and cows, research is needed to compare the benefits of various strategies for breed improvement and selection. Also of interest is the development of genetic selection strategies and tools aimed at controlling the

current reduction in genetic variation due to increased inbreeding levels in dairy cattle populations. The only tangible manifestation of inbreeding depression so far has been through lethal recessives and genomic information has provided relatively affordable solutions to tackle the problem. This might have mistakenly given the perception that inbreeding is a less pressing issue. However, if increasing selection intensity for greater productivity takes place at the expense of maintenance of genetic diversity there may be significant long-term costs. Thus, there is a strong need to develop new tools for the management of genetic diversity in dairy cattle. Methodologies are needed to differentiate harmful or risky inbreeding from more benign inbreeding. Breeders need tools to help them limit the riskiest matings in terms of negative shorter-term impacts on animal performance for economically important traits. Additionally, with release of genetic evaluations for many novel traits, there is an immediate need to develop selection indexes for overall health and environmental efficiency to significantly benefit from the use of new genomic evaluations for selection.

Cow Profitability

In conjunction with selection placed on improving levels of production, producers are striving to increase their net profits. While good management can alleviate some of the stresses associated with high production, producers are looking for the genetic means to build a more profitable cow for both current and future production environments. Genetic parameters for traits of economic importance need to be identified and validated, which can then contribute to national selection indexes reflecting cow profitability. Studies involving the economic analysis of the various components related to cow profitability are continuously needed. Cost effective data collection methods are required to channel relevant data into these systems. Traits of major importance include:

- Genetic variation and economics of locomotion, mobility, lameness and crampiness
- Economics of reproductive performance traits
- Beef on dairy, body weight and growth of crossbred animals

Novel Ideas and New Technologies

The five main areas of research priorities for the DairyGen Council, as outlined above, reflect those that are currently of greatest interest to producers and the industry. The DairyGen Council also encourages researchers to submit proposals incorporating novel ideas and new technologies (i.e.: artificial intelligence algorithms and machine learning), either through quantitative genetics or genomics, related to dairy cattle improvement of potentially beneficial impact.