CDCB

COUNCIL ON DAIRY CATTLE BREEDING

COUNCIL ON DAIRY CATTLE BREEDING ACTIVITY REPORT

OCT 17 / SEP 18

TABLE OF CONTENTS

ABOUT CDCB

The Council on Dairy Cattle Breeding (CDCB) provides premier dairy genetic information services through industry collaboration centered around a mission to help optimize cow health and productivity in herds worldwide. This non–profit organization is responsible for calculating and distributing the genetic evaluations and genomic predictions, for managing the national cooperator database, and for analyzing and distributing dairy cattle data in the United States. The CDCB drives continuous improvement and maintains the integrity of the world's largest animal database, building on a quality foundation with more than eight decades of recorded U.S. dairy animal performance. The CDCB is a collaboration between four sectors of the U.S. dairy industry: Dairy Records Providers (DRP), Dairy Records Processing Centers (DRPC), National Association of Animal Breeders (NAAB) and Purebred Dairy Cattle Association (PDCA).

This report was prepared for the 2018 CDCB Industry Meeting held at the Alliant Energy Center, Madison, WI, on October 2, 2018.

CDCB CORE VALUE

PROVIDING PREMIER DAIRY GENETIC INFORMATION SERVICES & INDUSTRY COLLABORATION

WORD FROM THE CHAIR John M. Meyer

The past year has been challenging for U.S. dairy farmers. All involved in the dairy community are impacted by the pressures of milk market volatility, regulatory change and an unsettled global economy. The Council on Dairy Cattle Breeding continues to focus on the accurate production of U.S. dairy cattle genetic evaluations through the ups and downs of the dairy industry.

One doesn't have to be in a leadership position of an organization long to realize the importance of human capital. Top organizations are keenly aware of how important talented people are to their success. Talent of every type is in short supply today, but the biggest shortage is skilled, technical aptitude.

A year ago, the CDCB employed nine full-time employees and three consultants. Today, the fine staff at the CDCB has increased to 12 full-time employees, while the number of consultants stayed the same. The staff is made up of individuals with high levels of skilled, technical talent.

In some ways, the CDCB could be looked at like Google. Obviously, Google is an excellent example of how today's information-based economy lets organizations create stakeholder value using very little financial capital, but loads of human capital. Think of the value that official U.S. dairy genetic evaluations have brought to dairy farmers worldwide over the years. It's absolutely enormous!

Currently, CDCB provides 49 different traits, or 66 including genetic conditions. Broken down, that's five selection indexes, five production traits, 17 health/fertility/calving traits, 22 type traits and 17 official genetic conditions and haplotypes.

Some breeders contend that is way too much data to study. Determining the best semen to use and females to buy has become confusing to some, while others are seeking more data. For those, the mantra is, "More is

better." Typically, every animal is strong on some traits and weak on others. The challenge of the CDCB is to present data of the highest quality to farmers, so they can identify and propagate the animals that best fit their operation.

Many thanks to all of the dairy cattle owners who contribute data for the critical national dairy cattle genetic evaluation program. In January 2018, there were 4,380,688 cows in 15,526 herds enrolled in DHI test plans – 21,621 fewer cows and 846 less herds than January 2017.

Since the inception of genotyping dairy cattle, 2,535,337 head have been genotyped through September 2018 – 2,212,849 females and 322,488 males. On a breed basis, Holsteins represented 2,194,305 of the 2,535,337 genotypes. From there, Jerseys represented 290,203, Brown Swiss 37,842, Ayrshires 8,794, and Guernseys 4,193 of the genotyped total.
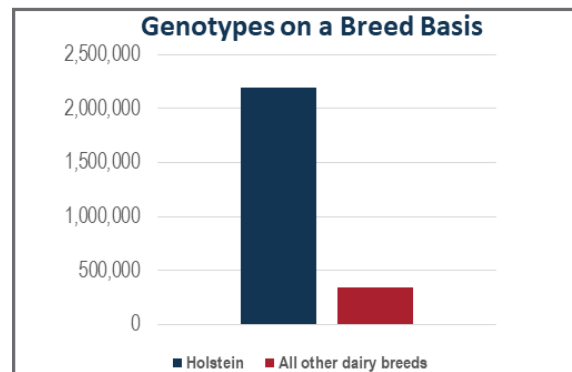
At the CDCB Board of Directors organizational level, there are notable actions to report. The CDCB signed a research agreement with the University of Wisconsin-Madison for feed efficiency data collection. We are pleased to be able to work on this important research. The CDCB and USDA ARS[1] signed a five-year research collaboration, the Material Transfer Research Data Exchange Agreement, which replaced the Non-Funded Cooperative Agreement.

Dairy industry cooperation over time – from the dairy cattle breeder, organizations like USDA, PDCA, DHIA, NAAB, dairy records processing centers, and allied industry – has been the foundation of the great success of U.S. dairy cattle genetic evaluations.

Thank you for your continued support of the CDCB.

WORD FROM THE CEO João Dürr

Next year will mark the 10th year that genomic evaluations have been available in U.S. When genomic tools were proposed, it was a challenge to imagine how valuable they might be, how they could possibly be applied commercially and adopted so quickly. Some visionary minds could foresee the future and drove us to the high genomic adoption rate 10 years later. The pioneer work by the Animal Genomics and Improvement Laboratory (AGIL) at USDA ensured that the theoretical potential of genomic selection could be realized by the dairy industry.

No wonder that the past 10 years are associated with a "genomic revolution." We all know dairy genetic improvement is forever changed. We thank the scientists and industry leaders that left their comfort zone and invested in the new genomic technology.

As we look forward to the next decade, here are the five most important conversations that we must have to move U.S. dairy improvement to a new level of global leadership.

1 What level of involvement do dairy farmers wish to have in U.S. dairy genetics moving forward? Would we be content with moving toward a more integrated breeding program as in poultry or swine genetics?

2 What is the value of a cooperator database with performance, management and genomic data? How can such database support optimal decision-making in dairy herds?

3 How do we leverage new technologies to provide performance data and phenotypes to the cooperator database?

4 How can we maintain sustainable genetic progress to satisfy dairy customers and consumers?

5 What is the importance of independent research and genetic evaluations to provide innovation and empower dairy farmers to shape their business models?

The dairy industry is changing rapidly. Herd size is increasing dramatically, industry consolidation continues, proprietary technologies are commercially available, fewer resources are available for public research and farm automation, and sensors are generating an explosion of data. To continue adding value, the CDCB and its members need to adapt to and thrive in this new environment.

Beginning to address these questions, the CDCB Board of Directors supported some key first steps in 2018. Dr. Javier Burchard will start as the CDCB Innovation Director in October 2018. CDCB has partnered with the Innovation Center for U.S. Dairy to develop a business plan to foster and coordinate U.S. research and development. The CDCB is making direct investments in research and the generation of feed efficiency data.

While the CDCB staff continues working at full steam – with the support from USDA AGIL – to continuously improve U.S. dairy genetic evaluations, we must actively determine how to shape the future of this wonderful dairy community.

On behalf of the dedicated team at CDCB, we look forward to collaborating with the dairy community to advance the progress of this genomic revolution!

CDCB PERSONNEL

João Dürr, CEO
Ezequiel Nicolazzi, Technical Director
Javier Burchard, Innovation Director
Duane Norman, Technical Advisor & Industry Liaison
George Wiggans, Technical Advisor
Leigh Walton, Technical Applications Mgr.
José Carrillo, Genomic Data Mgr.

Kristen Parker Gaddis, Geneticist
Jay Megonigal, Data Scientist
Ike Nnabugwu, Systems Administrator
Kendra Randall, Administrative Assistant
Frank Ross, Web Application Mgr.
Rohith Shetty, Programmer
Marius Temzem, Database Administrator
Kaori Tokuhisa, Genomic Data Analyst

Thank you to the CDCB staff for dedicated service. Left to right: George Wiggans, José Carrillo, Jay Megonigal, Marius Temzem, Ezequiel Nicolazzi. Frank Ross, Kendra Randall, Rohith Shetty, Ike Nnabugwu, Kristen Parker Gaddis, Duane Norman and João Dürr. Not pictured: Kaori Tokuhisa, Javier Burchard and Leigh Walton.

CDCB BOARD OF DIRECTORS

The CDCB Board of Directors provides direction for the development and continuous improvement of U.S. dairy genetics and CDCB services. Equal representation on the CDCB Board of Directors is granted to four sectors of the U.S. dairy community – *Dairy Records Providers* (DRP), *Dairy Records Processing Centers* (DRPC), *National Association of Animal Breeders* (NAAB) and *Purebred Dairy Cattle Association* (PDCA).

In August 2017, the CDCB Board elected new officers who serve in those roles for two years:

- **John M. Meyer,** *Chair*
- **John Clay,** *Vice Chair*
- **Chuck Sattler,** *Secretary*
- **Dan Sheldon,** *Treasurer*

The CDCB Finance Committee includes **Dan Sheldon**, **John Clay**, **Chuck Sattler** and **Neal Smith**. The Bylaws Review Committee will guide the CDCB Board through the review process and includes: **Boyd Schaufelberger** (Chair), **Jay Mattison**, **Bill VerBoort** and **Nate Zwald**.

In 2017, two non-voting advisory members provided valuable input to the Board. CDCB thanks **Don Bennink** of *North Florida Holsteins, Bell, Fla.*, and **Juan Tricarico**, *Innovation Center for U.S. Dairy, Rosemont, Ill.*, for their support.

Jay Weiker of NAAB and **Lee Day** of Amelicor joined the CDCB Board in April 2018, replacing two directors whose terms came to close. **Gordon Doak** of *Columbia, Mo*. and **Ted Foster** of *Foster Brothers Dairy Farm*, *Middlebury, Vt.*, retired from the CDCB Board, representing NAAB and the DRPCs, respectively.

It is only possible to achieve the CDCB mission through the dedication, expertise and commitment of individuals like Don, Juan, Gordon and Ted – and all who serve CDCB. Thank you.

2018–19 CDCB BOARD OF DIRECTORS

Dairy Records Providers
- **Pat Baier,** *AgSource Cooperative Services*
- **Jay Mattison**, *National DHIA*
- **Dan Sheldon**, *Treasurer, Woody Hill Farms*

Dairy Records Processing Centers
- **John Clay**, *Vice Chair, Dairy Records Management Systems*
- **Lee Day**, *Amelicor*
- **Bill Verboort**, *AgriTech Analytics*

National Association of Animal Breeders
- **Chuck Sattler,** *Secretary, Select Sires, Inc.*
- **Jay Weiker**, *NAAB*
- **Nate Zwald**, *ABS Global*

Purebred Dairy Cattle Association
- **John M. Meyer**, *Chair, Holstein Association USA, Inc.*
- **Boyd Schaufelberger**, *Schaufine Farms*
- **Neal Smith**, *American Jersey Cattle Association*

Non-Members Supporting the CDCB Board
- **Paul VanRaden**, *USDA AGIL Industry Liaison*
- **Jack Cravelle**, *CDCB Attorney, Porter Wright Morris & Aurthur LLLP*
- **João Dürr**, *CDCB Chief Executive Officer*
- **Duane Norman**, *CDCB Technical Advisor & Industry Liaison*

The 2018-19 CDCB Board of Directors includes (front row, L–R) CEO João Dürr, Secretary Chuck Sattler, Chair John Meyer, Treasurer Dan Sheldon, Vice Chair John Clay, Pat Baier and Neal Smith. Back row (L–R) includes Nate Zwald, Jay Weiker, Boyd Schaufelberger, Lee Day, Bill Verboort and Jay Mattison

CDCB DATA PROVIDERS

DAIRY RECORDS PROVIDERS

Aguiar Milk Testing, Inc.
AgSource Cooperative Services
Arizona DHIA
Central Counties DHIA
Dairy Lab Services
Dairy One Cooperative Inc.
DHIA Cooperative, Inc.

DHIA West
Gallenberger Dairy Records
Heart of America DHIA
Idaho DHIA
Indiana State Dairy Association
Integrated Milk Testing Services
Jim Sousa Testing

Lancaster DHIA
Mid-South Dairy Records
Minnesota DHIA
Northstar Cooperative DHI Services
Puerto Rico DHIA
Rocky Mountain DHIA
San Joaquin DHIA

Southern DHA Affiliates
Tennessee DHIA
Texas DHIA
Tulare DHIA
United Federation of DHIA's
Washington State DHIA

GENOMIC NOMINATORS

ABS Global, Inc.
Alta Genetics
American Jersey Cattle Association
Bio-Genesys Ltd.

Genetic Visions-ST LLC
Genex Cooperative, Inc.
Holstein Association USA, Inc.
Holstein Canada

National Association of Animal Breeders, Inc.
Neogen Corporation dba Geneseek
Select Sires Inc. / Accelerated Genetics

Semex Alliance
VHL Genetics
Weatherbys Scientific
Zoetis

PUREBRED DAIRY CATTLE ASSOCIATION

American Guernsey Association
American Jersey Cattle Association
American Milking Shorthorn Society
Brown Swiss Cattle Breeders' Association

Holstein Association USA, Inc.
Red and White Dairy Cattle Association
U.S. Ayrshire Breeders' Association

DAIRY RECORDS PROCESSING CENTERS

AgriTech Analytics
AgSource Cooperative Services
Amelicor
Dairy Records Management Systems

GENOMIC LABORATORIES

Bio-Genesys Ltd.
EuroFins Bio Diagnostics Inc.
Neogen Corporation dba Geneseek
Genetic Visions-ST LLC

VHL Genetics
Weatherbys Scientific
Zoetis Genetics

INTERNATIONAL COOPERATORS

Agriculture and Horticulture Development Board (GBR)
ANAFI (ITA)
BSW Intergenomics (8 countries)

Canadian Dairy Network (CAN)
Interbull Centre (35 countries)
Qualitas (CHE)
vit (DEU)

CDCB IN NUMBERS

CDCB manages the cooperator database – phenotypic and genomic – of U.S. dairy herd data, a strategic asset in providing value and leadership. Management and performance benchmarks, as well as genetic and genomic evaluations, are derived from these data.

In January 2018, 4.4 million dairy cows in 15,500 herds were enrolled in dairy herd information services (DHI) and voluntarily contributed data to the CDCB system (Table 1).

Table 1 – Dairy cow enrollment in DHI test by breed (January 1, 2018)

BREED	HERDS	COWS
Ayrshire	60	2,600
Brown Swiss	138	10,198
Guernsey	78	3,613
Holstein	12,616	3,545,514
Jersey	818	338,697
Milking Shorthorn	23	1,192
Multi-breed[1]	1,793	478,874
Total	15,526	4,380,688

[1]If no breed has 75% or more of the cows, the herd is designated a multi-breed herd

Since the start of the U.S. genomic evaluations in 2009, the CDCB has accumulated 2.5 million genotypes total for the five dairy breeds evaluated (Figures 1 to 4).

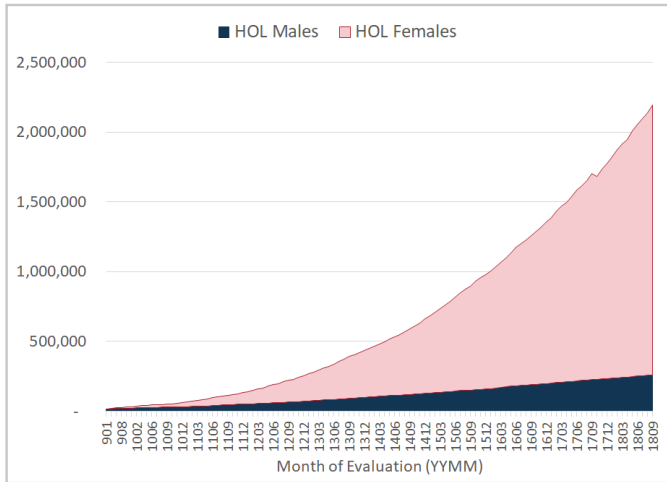**FIGURE 1 – Holstein genotypes added monthly to CDCB database since January 2009**

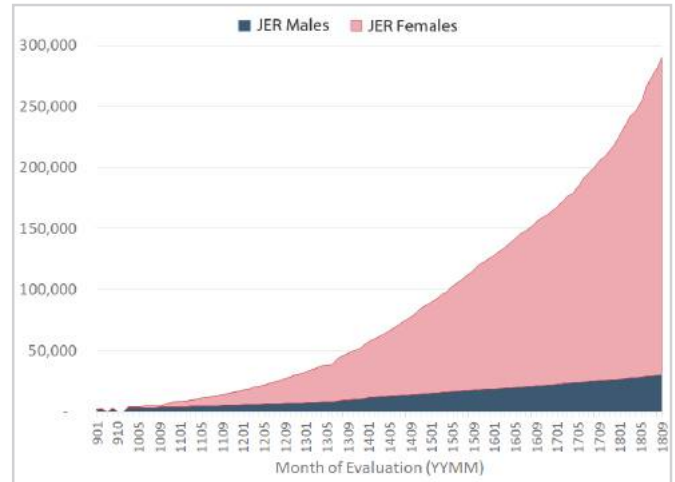**FIGURE 2 – Jersey genotypes added monthly to CDCB database since January 2009**

FIGURE 3 – Brown Swiss genotypes added monthly to CDCB database since August 2009
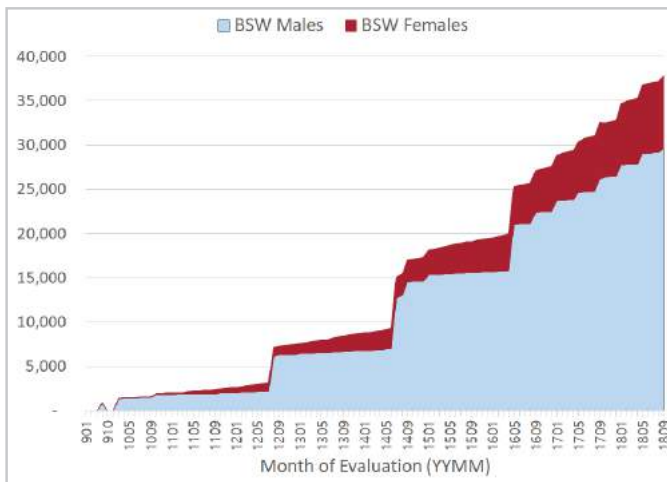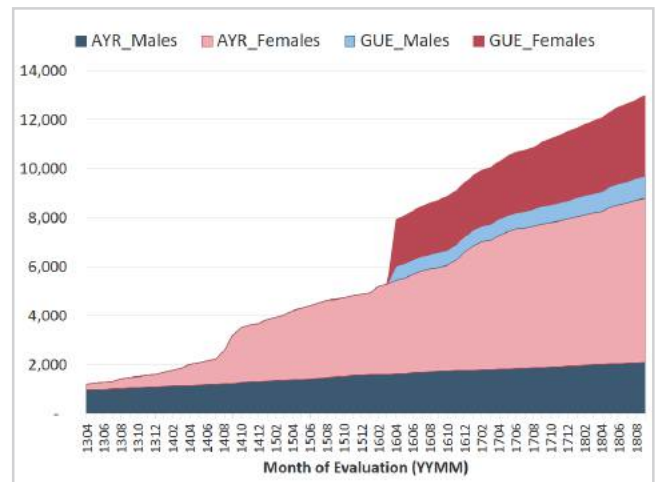

FIGURE 4 – Ayrshire and Guernsey genotypes added monthly to CDCB database since April

CDCB introduced six new health traits in April 2018. Genetic trends of disease resistance in male and female Holsteins born since 2000 are shown for each new trait in the following figures.

FIGURE 5 – Genetic trend for resistance to Displaced Abomasum for Holstein males and females born since 2000
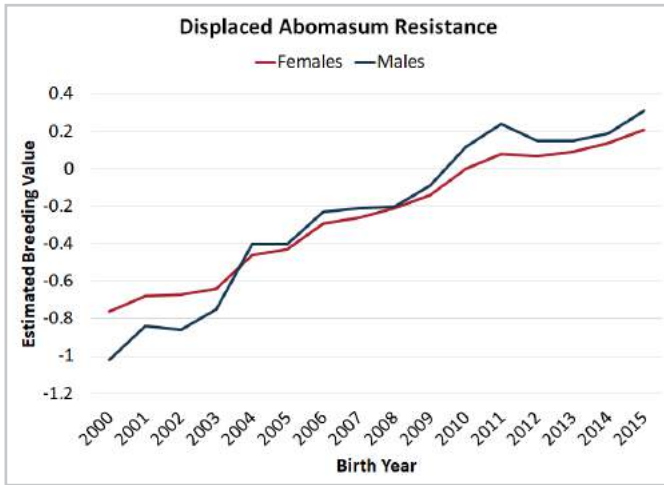

FIGURE 6 – Genetic trend for resistance to Hypocalcemia for Holstein males and females born since 2000

FIGURE 7 – Genetic trend for resistance to Ketosis for Holstein males and females born since 2000

FIGURE 8 – Genetic trend for resistance to Mastitis for Holstein males and females born since 2000
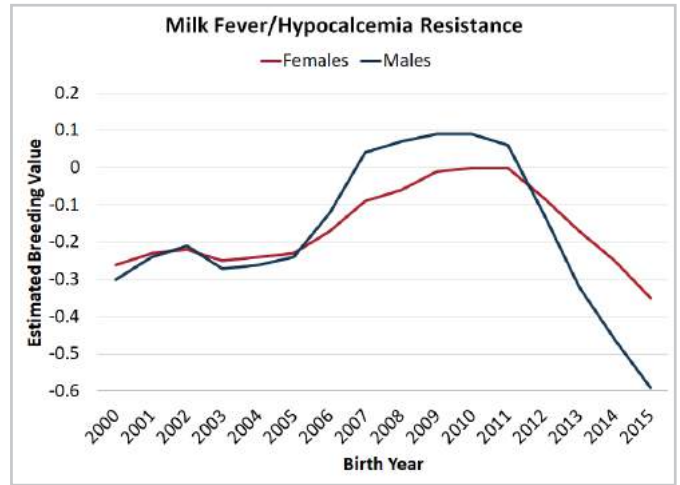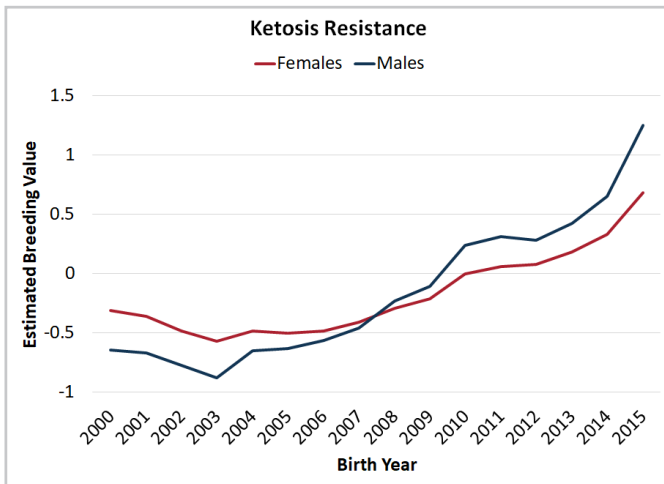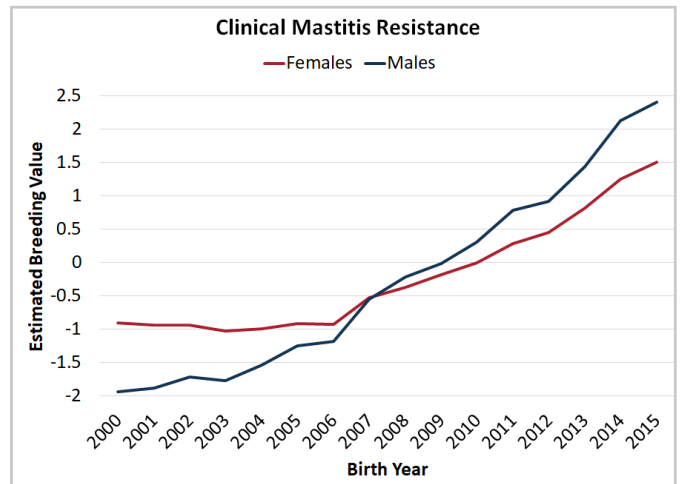

FIGURE 9 – Genetic trend for resistance to Metritis for Holstein males and females born since 2000
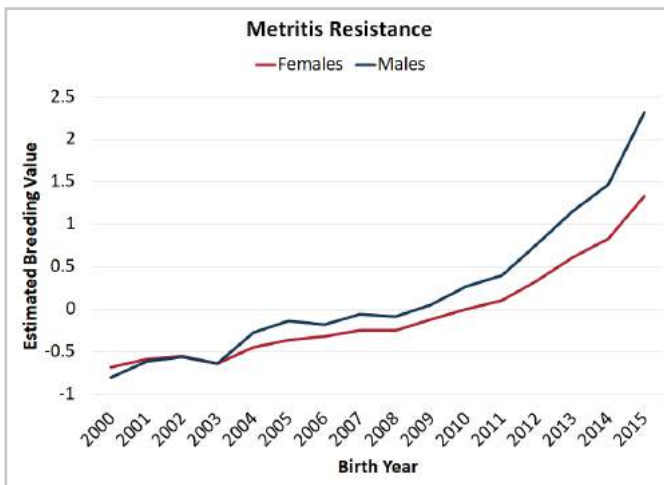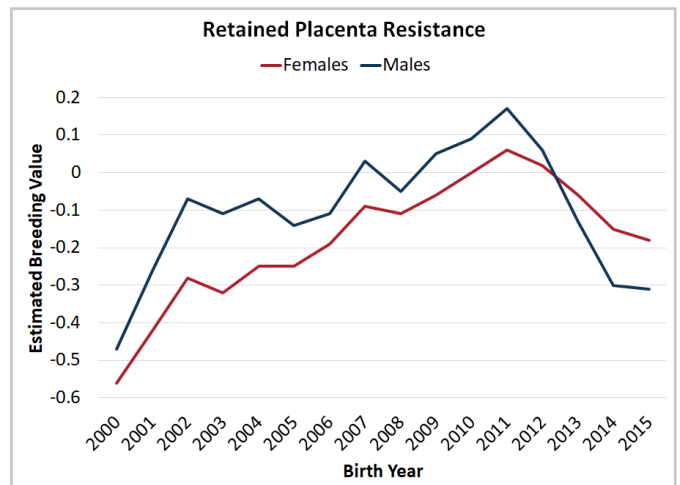

FIGURE 10 – Genetic trend for resistance to Retained Placenta for Holstein males and females born since 2000

INDUSTRY ENGAGED THROUGH CDCB WORKING GROUPS

To help drive continuous improvement and progress, three CDCB working groups have been actively engaged in 2018. CDCB thanks these representatives of breed associations, artificial insemination companies, DHI and universities, who provide valuable input in a spirit of ongoing collaboration.

DAIRY EVALUATION REVIEW TEAM (DERT)

`PURPOSE` Provide independent, objective and confidential reviews of the CDCB triannual dairy genetic evaluation results prior to the public (official) release in April, August and December

`PROGRESS` Review by this group, following checks by the CDCB staff, has enabled identification of issues and improved evaluation–day data release. Group members have signed a confidentiality agreement that applies to sensitive pre-release material. The CDCB staff sincerely appreciates their contribution.

Group Members

Mark Chamberlain, *Select Sires Inc.*
Sam Comstock, *Holstein Association-USA*
Tom Lawlor, *Holstein Association-USA*

Ryan Starkenberg, *ABS Global, Inc.*
Bob Welper, *Alta Genetics*
Cari Wolfe, *American Jersey Cattle Association*

GENETIC EVALUATION METHODS (GEM)

`PURPOSE` Provide independent, objective and impartial advice and strategic guidance to AGIL and CDCB staff throughout the development of dairy genetic evaluations

`PROGRESS` Early 2018 initiatives focused on computing genomic evaluations (GPTAs) for crossbred (multi-breed) animals, with the end goal for CDCB to provide crossbred evaluations, answering the call from producers that would find them useful for herd management decisions. GPTAs for crossbreds could be estimated one of two ways – either entirely from the 'primary' breed or by weighting predictions from each breed based on the allelic percentages of the individual breeds. The GEM team, with AGIL researchers, have evaluated the merits of the alternatives to help optimize the accuracy of the resulting predictions. CDCB, the GEM team and AGIL are committed to the necessary steps in R&D to validate results and deliver accurate evaluations.

Group Members

Chuck Sattler, *Select Sires Inc., Chair*
Chad Dechow, *Penn State University*
Tom Lawlor, *Holstein Association-USA*

Christian Maltecca, *North Carolina State University*
Paul VanRaden, *USDA AGIL*
Ezequiel Nicolazzi, *CDCB*

PURSUING DATA QUALITY TEAM (PDQ)

`PURPOSE` Provide independent, impartial advice and strategic guidance for dairy data quality

`PROGRESS` Agenda items of 2018 have focused on data file formats and impact on Quality Certification, reasons for calf disposal and data used in the CDCB health traits. The team evaluated a proposal to revise data codes that record calf health issues, and that proposal was forwarded to the dairy record processing centers for feedback. The group collaborated with CDCB staff to review data from additional DRPCs before launch of the disease resistance evaluations in April, finding new data consistent with the original test files used in research and development. Thus, more records from a wider geographical area can be utilized in the CDCB health traits, compared to data used in research and development.

Group members

Angie Coburn, *AgSource Cooperative Services, Chair*
Sam Comstock, *Holstein Association-USA*
Burke Day, *Amelicor*
Jenny DeMunck, *GENEX*
Jana Hutchison, *USDA AGIL*

Erick Metzger, *American Jersey Cattle Association*
Steven Sievert, *Quality Certification Services Inc.*
Duane Norman, *CDCB*
Kristen Parker Gaddis, *CDCB*

YEAR IN REVIEW OCT 17 / SEP 18

OCTOBER 2017

· CDCB hosted a **record crowd** of 175 attendees at 2017 CDCB industry meeting during World Dairy Expo in Madison, Wis.

· **New CDCB website, new query system and secure FTP went live**, providing user-friendly navigation and query capabilities.

· CDCB Genomic Laboratory **Quality Certification guidelines were implemented**, concluding development by and support of the GENLAB working group.

DECEMBER 2017

· **CDCB and USDA ARS AGIL[2] extended their collaboration** in research and data exchange through a new five-year agreement.

· The **end user agreement** defining the use of CDCB information was updated to improve clarity.

· The first **CDCB genomic nominator audit** was conducted.

· Disease resistant trait evaluations are first released (privately) to the industry collaborators in a test-run.

MARCH 2018

· Frank Ross joins the CDCB team as Web Administrator, bringing deep systems knowledge from experience at USDA ARS.

NOVEMBER 2017

· *Journal of Dairy Science* published Genome-wide association study for ketosis in US Jerseys using producer-recorded data[1].

· An **Indirect Cost Policy was approved**, setting budget standards for research projects sponsored by CDCB.

FEBRUARY 2018

· University of Wisconsin-Madison and CDCB signed a **five-year collaboration to generate residual feed intake data** from Holstein cows for future genetic evaluations.

· CDCB posted five new annual summaries based on DHI[3] records: DHI Participation, Lactation Averages by Breed, DHIA Herd Averages, DRPC[3] Activity and Somatic Cell Counts.

APRIL 2018

Three major advancements were made with the triannual genetic evaluation release:

· CDCB introduced national **genetic evaluations for disease resistance** through six new traits in Holsteins.

· **All-breed system was extended to genomic evaluations**, allowing records from animals of all breeds to be analyzed on the same scale.

· New **multi-trait Productive Life genomic model** was implemented for more accurate processing of incoming Interbull data.

MAY 2018

· The 2nd annual **Genomic Nominators and Laboratories Workshop** provided open dialogue among CDCB and 24 representatives from 13 organizations.

JULY 2018

· CDCB added the new role of Genomic Data Manager, filled by José Carrillo to enhance functionality of the genomic processing system.

· For the 3rd year, CDCB sponsored an **intern program** for future geneticists, welcoming Elif Gunal (summer 2018) and Laura Jensen (early 2019).

SEPTEMBER 2018

· Javier Burchard was selected for the new role of CDCB Innovation Director, a steward of data integrity and strategic visionary for creation of new data pipelines

· CDCB enters **Interbull validation** process for clinical mastitis

JUNE 2018

· CDCB released **two updated** DHI summaries: Reasons Cows Exit the Herd and Reproductive Status in DHI Herds.

· The **Lush Award in Animal Breeding**, sponsored by CDCB, was presented at the 2018 American Dairy Science Association® meeting to Flavio S Schenkel (right in photo above).

AUGUST 2018

· **Net Merit $ and other CDCB indexes were revised**, to incorporate disease resistance traits and update economic values.

· A new **trust fund to support AGIL research was approved**, with CDCB contributions for the next five years.

· The CDCB Board approved an **investment policy** and engaged Graystone Consulting of Columbus, Ohio, as manager.

· Members of the BSW Intergenomics consortium are added as "Approved Partners."

· The Board approved flexibilization of data exchange rules for German partner organizations, provided specific conditions are met.

· The CDCB board approved DRPC service fees for health data.

STAKEHOLDER OUTREACH OCT 17 / SEP 18

The CDCB team is committed to interaction with U.S. and global partners and stakeholders, as an integral step in collaboration, continuous improvement, and research and development.

Mount Whitney Dairy, Riverdale, Calif., hosted CDCB's João Dürr and Kristen Gaddis as they aim to keep pace with the evolving needs of dairy producers. Left to right: Travis Kamper, João Dürr, Rodney Kamper and Kristen Gaddis.

FALL 2017

João Dürr advocated for advanced research and education on dairy data and genomics at "Investing in Science to Transform Lives," an input session hosted by USDA's National Institute of Food and Agriculture.

CDCB staff visited leaders at AgriTech Analytics, Visalia, Calif., and AgSource Cooperative Services, Verona, Wis., to finetune data flow and implementation of health evaluations.

João Dürr and Kristen Parker Gaddis participated in Amelicor's training and conference for field operators.

João Dürr reported CDCB developments to the National DHIA[1] Board of Directors.

"Development of feed efficiency evaluation in the U.S." was presented by João Dürr at the Breeding for Efficiency symposium in Ontario, affiliated with the Efficient Dairy Genome Project.

CDCB staff visited the University of Wisconsin–Madison dairy research center, advancing partnership for residual feed intake data and future evaluations.

George Wiggans lectured at the University of Liverpool's School of Veterinary Science, presenting "Genomic Selection in the USA," for veterinarians working toward a Diploma in Bovine Reproduction.

João Dürr participated in the 2017 Interbull annual meeting in Estonia, as well as Canadian Dairy Network's annual forum.

George Wiggans presented at the International Workshop on Genomic Selection organized by BAIF Development Research Foundation in India.

CDCB engaged in the Livestock High-Throughput Phenotyping (HTP) and Big Data Analytics conference in Beltsville, Md., an assembly of livestock industries and research communities to address big data and issues as animal health, efficiency and food safety.

[1] Dairy Herd Information Association
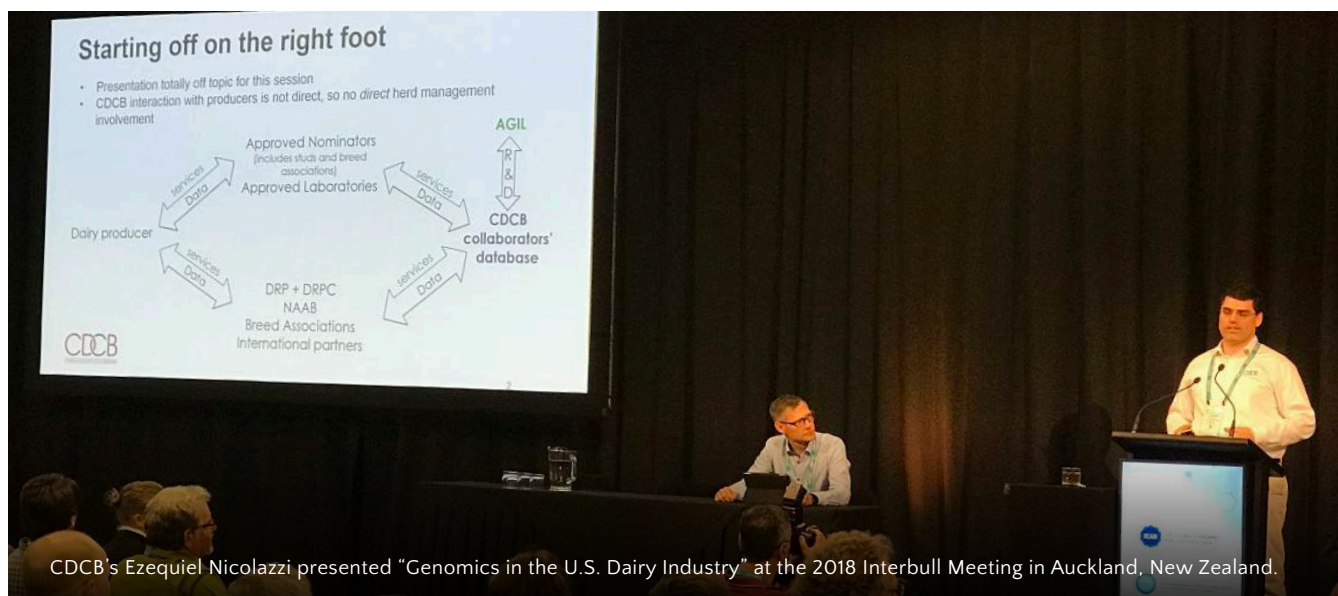
CDCB's Ezequiel Nicolazzi presented "Genomics in the U.S. Dairy Industry" at the 2018 Interbull Meeting in Auckland, New Zealand.

2018

New Zealand hosted three important global meetings in February 2018 – the 41st International Committee for Animal Recording (ICAR), the 2018 Interbull Meeting and the 11th World Congress on Genetics Applied to Livestock Production (WCGALP). CDCB and AGIL[2] staff presented papers on genomic analyses, new traits, changes in dairy population and future developments.

CDCB hosted the annual meeting of the DRPC[3] Advisory Group in Bowie, Md., with 18 representatives of U.S. DRPCs, National DHIA, AGIL and CDCB.

Ezequiel Nicolazzi participated in the Canadian Dairy Network Open Industry session in Guelph, Ontario.

At Scotland's Rural College, George Wiggans presented the development of crossbred genomic evaluations.

Kristen Parker Gaddis presented "Identification of genomic regions associated with resistance to clinical mastitis in US Holstein cattle" during the 2018

American Dairy Science Association® annual meeting, Collaborators included John B. Cole, Colin Willard and Daniel J. Null of AGIL, Christian Maltecca of North Carolina State University and John Clay of Dairy Records Management Systems.

Duane Norman and João Dürr presented "CDCB tools for the improvement of the Jersey breed" during the combined meeting of World Jersey Cattle Bureau and American Jersey Cattle Association.

CDCB hosted administrators from the Agricultural Research Service to reinforce the valuable contributions by USDA[4] to dairy genetic improvement over the past century and to generate open dialogue and further understanding for continued cooperation.

At the Interbull technical workshop in August in Croatia, João Dürr presented, "Variance adjustments and Mendelian Sampling tests," a paper co-authored by AGIL's Paul VanRaden and CDCB's Jay Megonigal.

2019 EVENTS: MARK YOUR CALENDARS!

CDCB will host two symposiums to honor the first decade of genomic selection and foster an open dialogue about dairy genetics for the next decade and beyond.

· **Monday**, **February 25**, with Western Dairy Management Conference in Reno, Nev.

· **Monday**, **June 24**, in association with the American Dairy Science Association and Interbull meetings in Cincinnati, Ohio

The 2019 triannual genetic evaluations are **April 2**, **August 13** and **December 3, 2019**.

GENETIC EVALUATION CHANGES

DECEMBER 2017

A handful of minor modifications were made for the December 5, 2017, evaluations.

- Changes in age grouping for sire conception rate (SCR) in Holsteins
- Publication of AH2, the second haplotype affecting Ayrshire fertility
- Updates on udder and feet/leg composites in all breeds
- New body weight composites for Jerseys and Brown Swiss
- New phantom groups in productive traits for polygenic effect
- Exclusion of animals with unlikely grandparent information

Detail at https://www.uscdcb.com/news/cdcb-changes-to-evaluation-system-december-2017/

APRIL 2018

Three major advancements were implemented for the April 3, 2018, evaluations.

1. CDCB introduced national **genetic evaluations for disease resistance** through six new traits in Holsteins: Displaced Abomasum, Hypocalcemia (milk fever), Ketosis, Mastitis, Metritis and Retained Placenta. Evaluations were developed from data collected through Dairy Herd Information (DHI) from herds across the U.S., and strict editing was applied to ensure the most reliable data was included. Predicted transmitting abilities (PTAs) are presented as percentage points of event resistance above or below the breed average.

2. **All-breed system was extended to genomic evaluations**, allowing records from animals of all breeds to be analyzed on the same scale. Relatives – regardless of breed composition – now contribute to every animal's parent average and impact directly its genomic evaluation, and changes were greatest for animals containing pedigrees from other breeds, as expected. This is the first step in development and future implementation of genomic evaluations for crossbred animals.

3. **Multiple-trait Productive Life (PL)** processing for incoming Interbull data was completely revised, to reduce the tendency of the previous system to inflate evaluations of foreign bulls. Because the SNP effects used to estimate genomic evaluations were also affected, there were subtle impacts for the general population.

Minor modifications included:

- Inclusion of foreign dam data when its reliability is higher than U.S. domestic reliability
- Changes to use of PTAs for bulls with 1 to 9 daughters in the reference population
- Redefinition of heterosis for Ayrshires, now considering Swedish Red, Norwegian Red and Red European the same breed as Ayrshire in the male population

Detail at https://www.uscdcb.com/cdcb-changes-to-evaluation-system-april-2018/

AUGUST 2018

Net Merit $ and other CDCB indexes were revised for the August 7, 2018, evaluations to incorporate the new disease resistance traits and to update economic values. The six disease resistance traits are grouped into a health sub-index (HTH$) that is not published separately, similar to the calving ability sub-index (CA$). The health sub-index has a weighting of 2.3%. Relative emphasis on most other traits reduced slightly due to the addition of HTH$; however, yield trait emphasis increased slightly and somatic cell score (SCS) emphasis decreased greatly because of correlated health costs now assigned directly to HTH$.

Other changes included:

- Improvements to the model that calculates Daughter Pregnancy Rate and Cow Conception Rate, addressing larger-than-expected variation observed in April
- Modification of heterosis procedure, replacing approximate methods for Expected Future Inbreeding (EFI) with exact EFI when possible
- Exclusion of dismissed IDs from Interbull pedigree
- Full implementation of rules for genomic mating inbreeding file in Holsteins
- Changes to the routine formatting of daughter/herd information for all traits
- Edit to Jersey elite cow criteria to include the registry code practices of American Jersey Cattle Association
- Modification to address unknown parent groups that affected Guernsey evaluations in April

Detail at https://www.uscdcb.com/cdcb-changes-to-evaluation-system-august-2018/

HEALTH TRAITS & 2018 NET MERIT $

CDCB HEALTH EVALUATIONS LAUNCHED

Official CDCB evaluations for resistance to six health disorders were launched on April 3, 2018. Genetic and genomic evaluations are now available for Holstein males and females, for six of the most common and costly health events impacting dairy herds: Displaced Abomasum (DA), Hypocalcemia (MFEV), Ketosis (KETO), Mastitis (MAST), Metritis (METR) and Retained Placenta (RETP).

Predicted transmitting abilities (PTAs) for CDCB health traits are presented as percentage points of event resistance above or below the breed average. These evaluations were developed from data collected through Dairy Herd Information (DHI) affiliates from herds across the U.S. Strict editing was applied to ensure only the most reliable data was included for the development of genetic evaluations.

The CDCB developed several resources to help dairy producers and industry personnel understand the new CDCB health traits and resulting 2018 Net Merit revision.

· Health traits: Frequently Asked Questions
· Individual trait reference sheets on CDCB website
· Presentation: How selection for better health impacts dairy profitability by Dr. John B. Cole, USDA AGIL
· Presentation: Introducing CDCB health evaluations by Dr. Kristen Parker Gaddis, CDCB
· Net Merit: Frequently Asked Questions

Learn more at uscdcb.com/cdcb-health-traits.

Accurate health evaluations require the continued cooperation among many in the dairy community – notably producers, Dairy Records Providers, Dairy Records Processing Centers, genomic nominators and USDA AGIL. Thank you to all who helped bring national U.S. health evaluations to reality.

2018 NET MERIT $ INCLUDES HEALTH TRAITS

Net Merit $ and other CDCB lifetime profit indexes were revised – effective with the August 7, 2018, triannual genetic evaluation – to incorporate the new CDCB disease resistance traits and to update economic values in calculations.
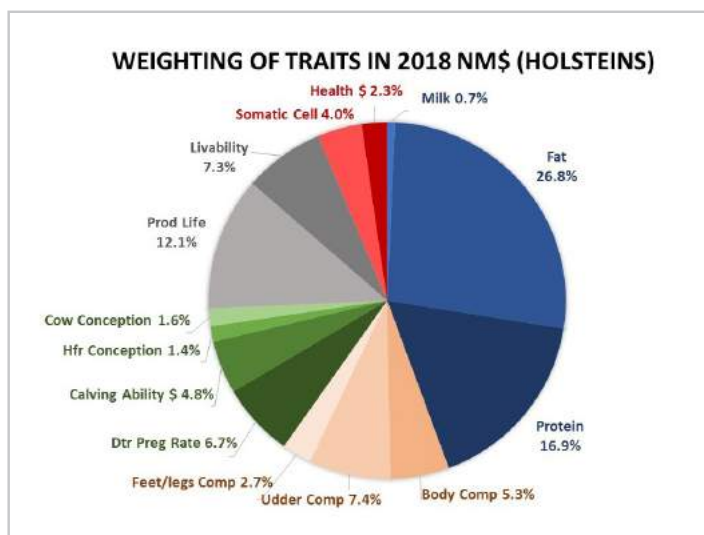
Net Merit $ and the other lifetime profit indexes are updated periodically to include new traits and to reflect prices expected in the next few years. At its 1994 introduction, Net Merit included five traits, and the 2018 update includes 14 traits or sub-indexes that combine information from 35 individual traits. The evolution of NM$ demonstrates the increased research and adoption of newer fitness and fertility-related traits.

These six individual traits were incorporated in NM$ for Holsteins through the new sub-index, Health Trait $ (HTH$), at a relative value of 2.3% for NM$, 1.9% for Cheese Merit (CM$), 2.3% for Fluid Merit (FM$) and 2.1% for Grazing Merit (GM$). The new Health Trait $ sub-index is not published separately, similar to the calving trait sub-index (CA$). Relative emphasis on most other traits reduced slightly due to the addition of HTH$; however, yield trait emphasis increased slightly and somatic cell score (SCS) emphasis decreased greatly because of correlated health costs now assigned directly to HTH$.

Economic values of the six disease resistance traits were obtained as averages of two recent research studies. Liang et al. (2017) estimated direct treatment, labor and discarded milk costs for health disorders from veterinary and producer survey responses, and Donnelly (2017) obtained health treatment costs from eight cooperating herds in Minnesota. Also considered were some yield losses associated with health disorders, which are not fully accounted for in published genetic evaluations for yield traits.

WEIGHTING OF TRAITS IN 2018 NM$ (HOLSTEINS)

Health $ 2.3%
Somatic Cell 4.0%
Milk 0.7%
Livability 7.3%
Fat 26.8%
Prod Life 12.1%
Cow Conception 1.6%
Hfr Conception 1.4%
Calving Ability $ 4.8%
Dtr Preg Rate 6.7%
Protein 16.9%
Feet/legs Comp 2.7%
Udder Comp 7.4%
Body Comp 5.3%

FUTURE DEVELOPMENTS

Three large research projects are nearing completion, as part of the close collaboration between CDCB and USDA AGIL[1] for continuous assessment and improvement of U.S. dairy genetic evaluations. Next steps are to develop implementation plans and timelines. Additionally, emphasis continues to be placed on development of data streams and genetic measures for feed efficiency.

NEW TRAIT: AGE AT FIRST CALVING (AFC)

Research completed by AGIL shows benefit to developing the new trait, Age at First Calving (AFC). Research results will be transferred to CDCB, and an implementation plan will be developed. Accurate reports of age at first calving are available from nearly all cows on Dairy Herd Information (DHI) since 1960, for a national database of approximately 15 million records. Using this data, AGIL staff conducted research originally prompted by the NAAB Dairy Sire Evaluation Committee, which led to the development of the first AFC evaluation on a research level. Research was published in Journal of Dairy Science, 2017.

UPDATE OF THE REFERENCE GENOME ASSEMBLY

An updated genome sequencing reference map – called the genome assembly – can now be utilized by all cattle researchers worldwide. The updated assembly is expected to improve imputation accuracy and recessive haplotype calculation, and lead to a new SNP list for genomic evaluations.

In 2018, USDA AGIL and other USDA ARS[1] researchers, in cooperation with the University of California–Davis, released a new version of the cattle DNA reference genome assembly named ARS-UCD1. The new assembly replaces the University of Maryland version used since 2009 (UMD3). International researchers in the 1000 Bull

Genomes Project, the largest sequencing effort in cattle, have decided to use the new ARS- UCD1 reference genome instead of UMD3 as the common language for tracking variation in cattle.

As SNP positioning is improved, the new reference map will improve the imputation accuracy of genotypes. Thanks to AGIL's supporting research, recessive haplotypes are expected to be more accurate and include more precise information in calculations. The new reference assembly will update the SNP list used in CDCB evaluations, including SNPs selected to have larger effects on traits. CDCB and AGIL research over the past year shows this update will be beneficial toward greater accuracies of traits currently evaluated.

GENOMIC EVALUATIONS FOR CROSSBRED ANIMALS

Producing accurate genomic evaluations of crossbred animals has been an emphasis for more than a year, involving a robust, two–phase process coordinated between AGIL and CDCB. The first phase was driven by research at AGIL and concluded in April 2018, when the genomic evaluation process was changed to an "all–breed" system, similar to that used in traditional evaluations since 2007. The all–breed system allows records from animals of all breeds to be analyzed together on the same scale, and relatives – regardless of breed composition – contribute to every animal's parent average and impact directly its genomic evaluation.

The second phase is the impact assessment and planning for genomic evaluations of crossbred animals. Prior to final decisions, the potential impact of the proposed methodology will be assessed and quantified, including a series of hypothetical long–term scenarios. CDCB's Genetic Evaluation Methods working group (including academia and industry), breed associations and other stakeholders are engaged in the research review and validation. CDCB's goal is to publish genomic evaluations on crossbred animals in 2019.

FEED EFFICIENCY DEVELOPMENTS

Feed efficiency is one of the most economically important traits not yet directly included in dairy cattle genetic improvement, mainly due to recording costs.

A five-year project funded by the USDA National Institute of Food and Agriculture generated an unprecedented data set of more than 9,000 residual feed intake (RFI) records from U.S. Holstein cows in nine research herds. Genomic predictions for RFI have been successfully computed by USDA AGIL, demonstrating the feasibility to include this promising new trait into U.S. genomic evaluations.

The CDCB is working to continue data collection through partnerships with herds capable of generating RFI data. In February 2018, CDCB and the University of Wisconsin–Madison established a five-year collaboration to generate feed intake data from Holstein cows. Wisconsin data is collected using the Insentec Roughage Intake Control (RIC) system in a free-stall barn at the Emmons Blaine Dairy Cattle Research Center in Arlington, Wis., and by measuring feed refusals in a tie-stall barn at the USDA–ARS Dairy Forage Research Center (USDFRC) in Prairie du Sac, Wis. This project will be under the direction of Dr. Kent Weigel. The new data from UW-Madison will further build the database, increase the accuracy of genomic predictions for feed efficiency, and ensure new animals and current genetics are included in the database.

The CDCB is working with other participants of the original NIFA project, as well as other interested U.S. and global parties, to develop ways to amplify the number of records for the national feed intake evaluations. The goal is to offer genomic predictions for RFI after adequate data streams are secured and appropriate assessment occurs.

CDCB, USDA EXTEND COOPERATION

The CDCB and USDA Agricultural Research Service (ARS) have finalized a new five-year agreement extending cooperation through the Animal Genomics and Improvement Laboratory (AGIL). CDCB maintains responsibility for the service portion of genetic and genomic evaluations, and AGIL geneticists have access to the comprehensive CDCB database for research and development. CDCB and AGIL collaborate to ensure use of cutting-edge research in dairy genetics. This new agreement replaces the previous Non-funded Cooperative Agreement in place since March 2013.

"This agreement is very relevant for the future of dairy genetic improvement, and it reinforces the long-standing partnership between the dairy industry, producers and the federal government. This cooperation dating back more than 100 years has built an information and genetic system regarded as the gold standard worldwide."

– João Dürr, Chief Operating Officer of the CDCB

[1] United States Department of Agriculture, Animal Genomics and Improvement Laboratory

INTERBULL REPORT

Interbull works with organizations around the world – such as the CDCB – that compute national genetic and genomic evaluations. A key Interbull service involves receiving national evaluations, blending them with comparable evaluations from other countries, and returning higher reliability blended evaluation data to the participating country.

The 2018 Interbull Meeting was held in Auckland, New Zealand, February 10-13, with a record 400 people attending the open sessions. Key topics included genomics for herd management, genetic evaluations for functional traits (health, feed efficiency, sensor data), and challenges for national and international genomic evaluations. More than 30 papers were presented, including:

· Genomics in the U.S. dairy industry; current and future challenges, by Ezequiel Nicolazzi, CDCB
· Discovering and validating relationships among genotyped animals, by George Wiggans, CDCB
· Validating Genomic reliabilities and gains from phenotypic updates, by Paul VanRaden, USDA AGIL

On August 25-26, Interbull conducted a technical workshop in Dubrovnick, Croatia. Four main themes were discussed: SNP MACE methodology, InterGenomics-Holstein, Interbull Mendelian Sampling validation test and Interbull's genomic reliability method. João Dürr presented the report, "Variance adjustments and Mendelian Sampling tests," co-authored by Paul VanRaden of USDA AGIL and Jay Megonigal of CDCB.

2018 PRIORITIES

Three initiatives take priority – review of Mendelian Sampling test results, InterGenomics-Holstein and SNP MACE. First, Interbull reviewed the newly-implemented Mendelian Sampling (MS) test results from national evaluation centers and discussed findings at the August 2018 Technical Workshop in Dubrovnik, Croatia. This is an attempt to verify if genomic selection is introducing significant biases into the national genetic evaluations.

Following the experience of the Brown Swiss populations, InterGenomics-Holstein will be a service to pool genotypes, allowing countries with small Holstein reference populations to develop their own national genomic evaluations. While small countries are interested, countries with large reference populations will need to understand the value of this service before investing their reference population genotypes in this service.

SNP MACE is a meta-analysis method that is still in the research and development phase. It aims to overcome bias concerns due to pre-selection (a threat to the value of current evaluations).

Interbull has also launched a new service, Parentage SNP Exchange (GenoEx-PSE) to exchange standardized sets of SNPs for genotyped animals to facilitate parentage analysis activities by authorized users of the service.

U.S. REPRESENTATIVE TO THE INTERBULL STEERING COMMITTEE

Gordon Doak serves as the U.S. representative on the Interbull Steering Committee. In April, Gordon retired from the CDCB Board of Directors, after involvement since its formation, and from NAAB after 42 years of dedicated service. In October 2018, Gordon received the highest recognition from the National Dairy Shrine, that of Guest of Honor. CDCB joins the U.S. dairy community in congratulating Gordon and thanking him for his continued commitment to dairy cattle improvement worldwide.

Gordon Doak (center) was recognized in April for his three-term service on the CDCB Board, with CDCB Chair John Meyer (left) and CDCB CEO João Dürr (right).

FINANCIAL REPORT

Provided here are the Council on Dairy Cattle Breeding (CDCB) audited financial statements for fiscal year (FY) 2017 and 2016 (January–December). The CDCB is in a solid financial position, and 2017 followed a similar pattern to 2016 regarding operating expenses and investments in infrastructure.

Financial statements are prepared monthly and reviewed by the CDCB Board of Directors. In addition, Tidwell Group performed an audit for year ended December 31, 2017. The audit report documents the financial statements are presented fairly, in all material respects, the financial position of Council on Dairy Cattle Breeding as of December 31, 2017, and the changes in its net assets for the year then ended in accordance with accounting principles generally accepted in the United States of America. The financial statements as of December 31, 2016 were audited by Clark, Schaefer, Hackett & Co.

2016 AND 2017 AUDITED FINANCIAL STATEMENTS

ASSETS	2017	2016
Cash	$ 5,583,484	$ 5,455,963
Accounts Receivable	538,836	644,245
Property & Equipment (net book value)	221,880	401,575
Other	95,099	62,807
Total Assets	$ 6,439,299	$ 6,564,590
LIABILITIES & NET ASSETS		
Accounts payable	$ 206,337	$ 111,619
Accrued Expenses	5,592	26,926
Notes Payable	–	299,966
Total Liabilities	211,929	438,511
Unrestricted Net Assets	6,227,370	6,126,079
Total Liabilities & Net Assets	$ 6,439,299	$ 6,564,590
REVENUES		
Female Fees	$ 851,497	$ 537,384
Male Fees		
Initial Fees	892,298	906,742
AI Fees	1,287,525	1,628,750
Other	29,665	4,531
Total Revenues	$ 3,060,985	$ 3,077,407
COST OF OPERATIONS		
Salaries, Service and Administration	$2,748,279	$ 2,357,134
Depreciation	210,276	167,337
Interest Expense	1,139	3,495
Total Cost of Operations	$ 2,959,694	$ 2,527,966
Increase in Net Assets	$ 101,291	$ 549,441

CDCB repaid all notes payable due during 2016. Unrestricted net assets at year–end 2017 were $6,227,370 – a 1.6% increase over year–end 2016.

FY 2017 revenues of $3,060,985 were virtually the same as compared to FY 2016, but the fee breakdown behaved differently. Female initial fees that represented 17% of total revenues in FY 2016 responded for 28% of revenues in FY 2017. While male initial fees represented 29% of revenues in both years, artificial insemination fees contribution decreased from 53% in FY 2016 to 42% of total revenues in FY 2017.

The CDCB continued building staff capacity in FY 2017 which resulted in greater payroll and employee benefit expense. Also, there was additional capital expenditures for hardware and software as the CDCB completed the operations infrastructure. The CDCB reported net income from operations $101,291 for FY 2017.

CDCB VISION

THE COUNCIL ON DAIRY CATTLE BREEDING (CDCB) IS AN INDUSTRY COLLABORATION THAT BENEFITS THE DAIRY COMMUNITY BY PROVIDING GOLD STANDARD GENETIC EVALUATIONS FOR THE IMPROVEMENT OF DAIRY CATTLE POPULATIONS.

CDCB

COUNCIL ON DAIRY CATTLE BREEDING

USCDCB.COM

4201 Northview Drive, Suite 302 | Bowie, MD 20716 | 240.334.4164