Council on Dairy Cattle Breeding

Genomics in the U.S. Dairy Industry: current and future challenges

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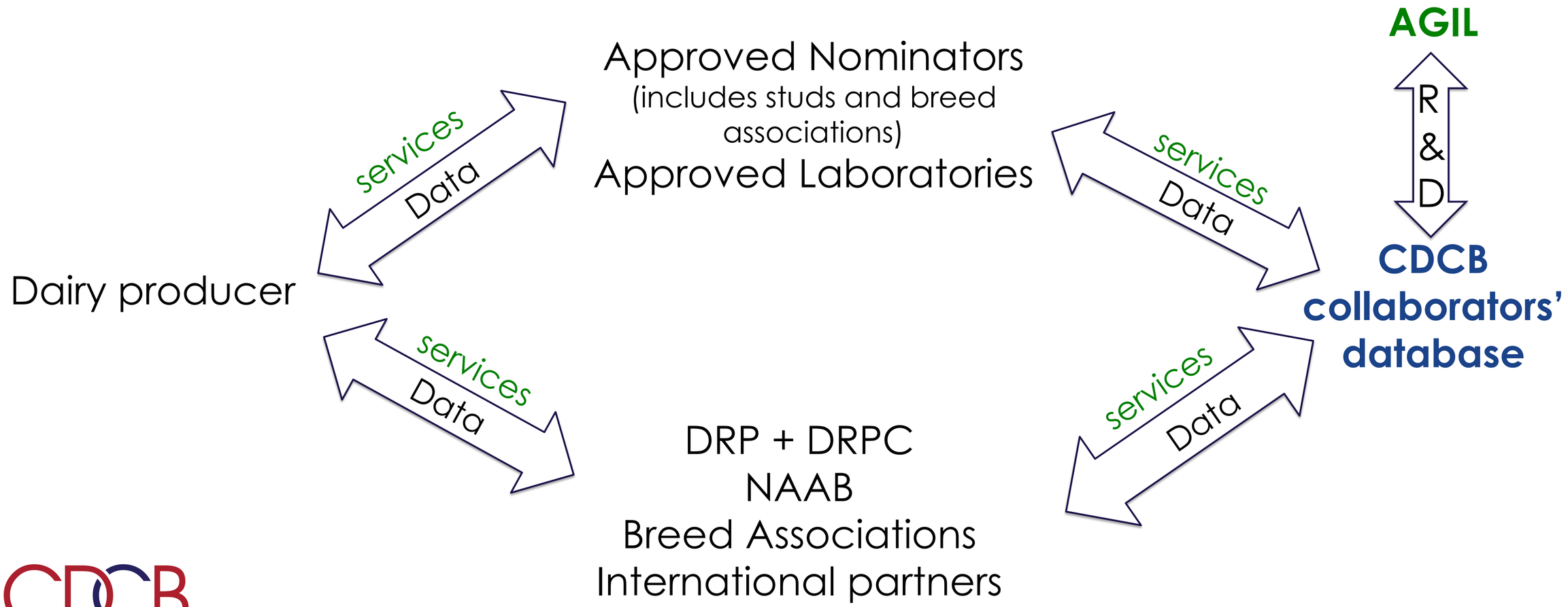
Starting off on the right foot

- Presentation totally off topic for this session
- CDCB interaction with producers is not direct, so no *direct* herd management involvement



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CDCB collaborators' database

- Central to US Dairy Industry. Data received from all industry sources, and used to provide services to all industry (especially dairy producers).
  - Collaborative effort
  - Maintained and controlled by CDCB (**not owned**)
  - Used to provide services to US dairy industry (genetic and genomic evaluations are one example)
- Only approved partners (quality-certified) can submit records to the CDCB collaborator's database.
- In this talk: genomics only (a part of the CDCB collaborators' database)

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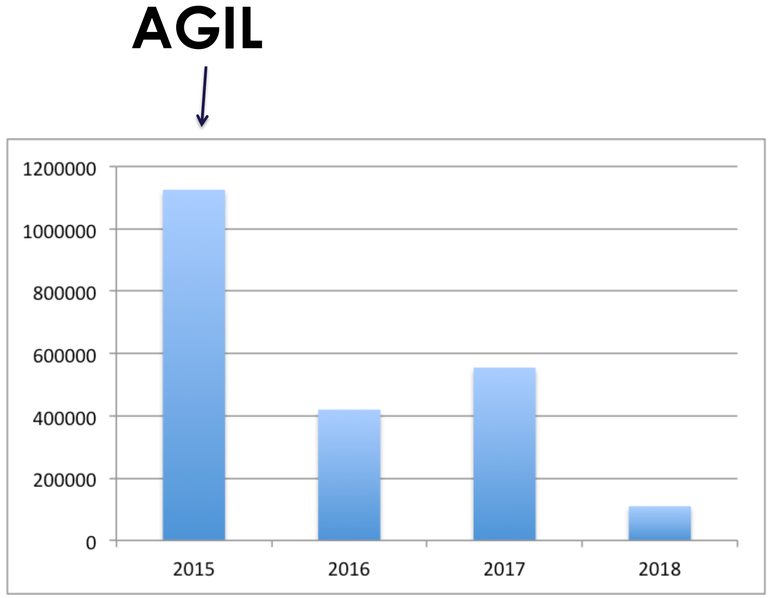
Genomics in numbers

- 2,372,681 genotypes in total (Jan’18)
- ~2.1 mln used in evaluation (Jan’18)
  - Sex ratio: 90/10 % (F/M)
- 30 SNP arrays currently validated



~ 550,000 new (usable) genotypes in 2017

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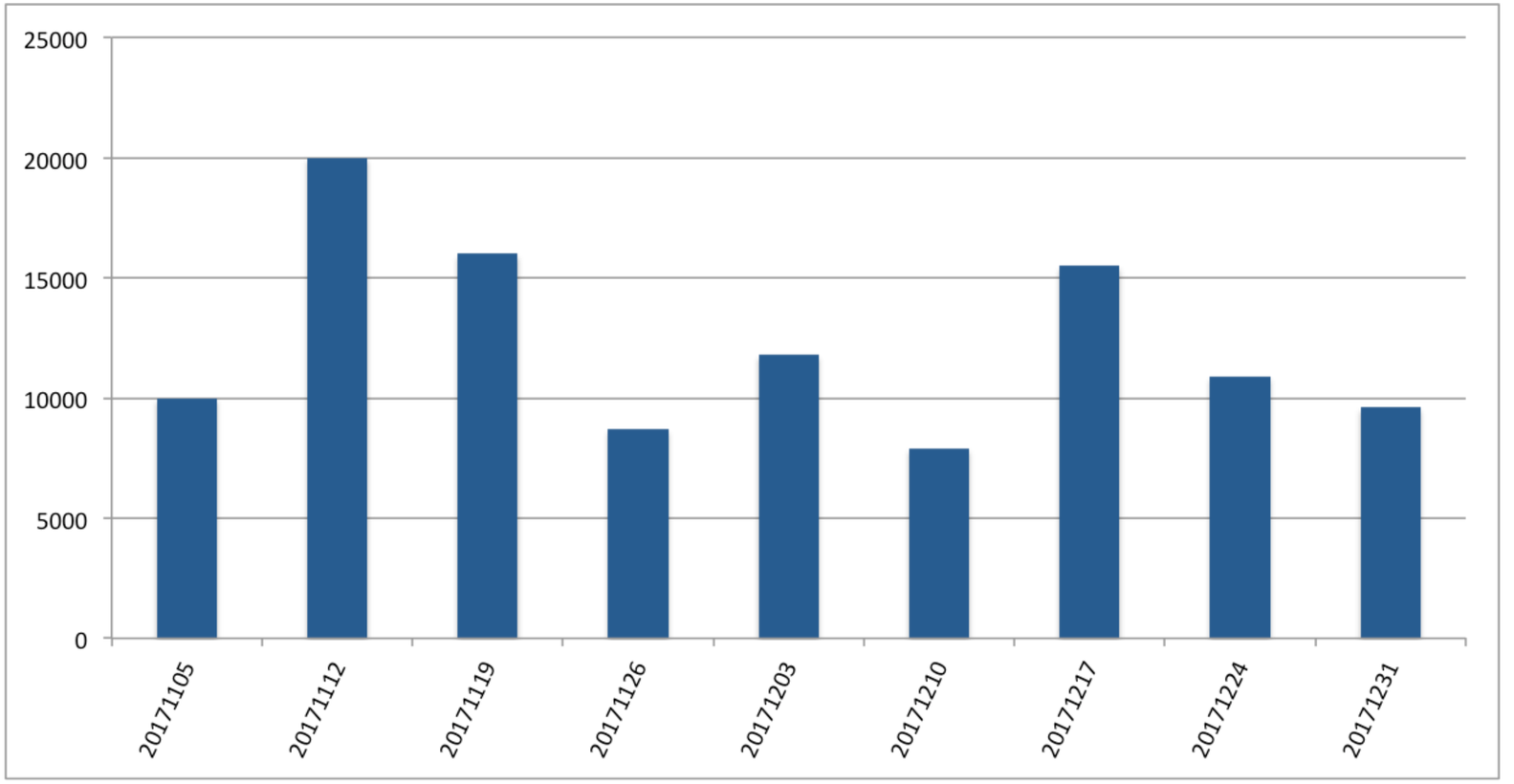
New usable genotype counts by week (Nov-Dec 2017)

(110k new animals getting G-evaluations)



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Edits to every genotype received

- Each genotype received is evaluated for:
  - Call rate
  - Sex
  - Portion of heterozygous
  - Parent-progeny consistency
  - Grand-parent likelihood
  - Undeclared or potential relationships (meaning all vs. all comparison)
  - *Approximate* breed check
  - Other

AGIL and CDCB are actively working on methods to reduce computation burden without impacting data quality

- *More controls prior to process*
- *MGS candidates* ***(G.Wiggans' talk)***
- *SNP sets used* ***(G.Wiggans' talk)***
- *Timing of processing* ***(G.Wiggans' talk)***
- *Interaction with partners*

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Genomic Evaluations

- In December 2015, CDCB took charge of the U.S. dairy evaluation service. AGIL still provides R&D to the U.S. dairy Industry:
  - Weekly, monthly and tri-annual evaluations (traditional/genomics)
  - 35 genomic traits for HOL, JER, BSW, AYR, GUE
    - **Note1**: HOL traditional type traits are run by HAUSA
    - **Note2**: Althoug breed-association specific selection indexes (TPI, JPI, etc) are obtained using CDCB evaluations, they are **not** CDCB products.

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Genomic Evaluations – Traits

- New traits in 2017: **Livability** and **Gestation Length**
- **Health trait evaluations** will be published in April 2018: Hypocalcemia / milk fever, Displaced abomasum, Ketosis, Mastitis, Metritis, Retained placenta
  - Industry collaboration success story. Whole country input data.
  - HT will not be included in April's NM$.
  - For more information, visit CDCB website (Genetic Evaluations)
  - ***K. Gaddis (service) + J.Cole (research) talk @WCGALP***
- **In research** (AGIL / CDCB):
  - Feed efficiency (Residual feed intake) – ***P. VanRaden's talk @WCGALP***
  - Multi-breed evaluations

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Genomic Evaluations

- 60,671 SNPs used.
  - Research undergone to increase the # of SNPs to 77,000
    - update on informative SNPs
    - Encouraging preliminary results: increasing genomic REL 1.4% across traits
    - Final phase: testing timing and computation impact.
- More than genomic evaluation:
  - 12 haplotypes that affect fertility
    - Dec. 2017: AH2 (Ayrshire second haplotype affecting fertility)
  - Genomic inbreeding
  - Breed Base Representation
  - Etc

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Reliance on Genomic Evaluations

- In 2016, 67% of breedings through AI were to bulls with no milking progeny
- All of top 10 **young** (genomic) Holstein/Jersey bulls in 2014 have AI sons (up to 260 AI sons – Supersire) in 2017 (not seen in **proven** bulls!)
- The age of parents at bull birth has dropped to just over 2 years, nearly the biological minimum.
- This reduction in generation interval has led to almost doubling the annual genetic improvement

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CDCB opportunities for the future

1. Continue to take ownership of the evaluation system
   - Documentation of business rules
   - Standardizing/rewriting processes
2. Improving public documentation and enhancing integration with available tools.
3. Clearer (and stricter) rules to accept files from partners
   - Pre-checks, requires 2) to be completed
4. New software, new traits and new evaluations
   - New IT infrastructure, documentation system and website in 2017
   - New querying system in 2018/2019.
5. New and old data pipelines
   - Recruiting a CDO and a Genomic Data Manager
6. Improving communication with industry and dairy producers.

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THANK YOU FOR YOUR ATTENTION

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