Cow Reference Population
- Benefit for Genomic Evaluation Systems
- and Farmers

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Genotyping of German Holstein females

- 2.4 Mio. Holstein cows in milk recording
- 1.9 Mio. Holstein cows herdbook registered

Genotyped females (07-2015 / 06-2016):
  - ca. 1,000 / month
  - in ca. 10% of all herds
  - i.e. <2% of all new females
  - high pre-selected females for breeding program
  - almost no genotyping for management purpose (whole herd genotyping)

Reasons?
  - Technical reasons? no
  - Price genotyping? 49€ package price individual female
  - No promotion?
Why Female reference population?

- The established bull reference populations have limitations
  - Less new bulls/year
  - More and more biased by genomic (pre) selection
  - Hard to extend to new traits
- We need an alternative resp. enhancement
- Female reference population
Why Female reference population?

- The established bull reference populations have limitations
  - Less new bulls per year
  - More and more biased by genomic (pre) selection

- Number of new active DEU HOL bulls per year has decreased
Setting up a female reference population

Requirements by genomic evaluation system
- Not preselected females
- Representing entire genetics of population
- Performing in representative range of management conditions
- Good data quality incl. new traits
- needs cooperation of commercial dairy farmers

Requirements by commercial dairy farmers
- Increase of profit and/or management benefits
- Easy to handle
Joint project KuhVision

- Joint project by all partners in German Genomic Consortium (11 herdbook organizations, meanwhile plus LUX)

- Goals:
  - 120,000 unselected genotyped and phenotyped cows by mid 2019
  - Majority contributing data on health traits and hoof trimming data
  - In farms across whole country representing the entire Holstein population
  - After initial phase adding >35,000 additional cows per year
  - Initial spark for promoting herd genotyping as standard management tool
KuhVision: how does it work?

- Contract farmer ⇔ local breeding organization
  - Genotyping all new females for at least 3 years
  - Recording of health and routine hoof trimming data and herd classification
  - Reduced/subsidized fee for genotyping guaranteed

- Initial genotyping assisted by breeding organization
  - All cows in first lactation (max. 200 d. in milk) for free
  - All female young stock in farm

- Continuous genotyping new born females
  - Individual tissue eartag provided automatically after registration
  - Providing data (on new traits) via herd management system => DHI => vit
  - Individual access to results by internet portal or data files for herd management system
KuhVision: Where are we?

- **1st June 2016:** Start of project
- **February 2017:** 550 herds with >100,000 milking cows signed
  - Closure list for new participants
- **August 2017:** 650 herds with >130,000 milking cows
  - 180,000 animals genotyped
  - >75,000 cows in milk with genotypes

**Reasons for success**

- Subsidized price for genotyping + genomic evaluation (19.50 € / animal versus 49€)
- Intensive promoting by organizations
- Strong support to the farms:
  - With technical tools (e.g. eartag supply, recording software, …)
  - Assistance with initial genotyping entire herd (young stock + all cows in 1st lact.)
- Good feedback of results
Distribution of herds in KuhVision (DEU & LUX)

- (normal) distribution of gRZG (gTMI)
  - Scale relative breeding values $\sim 100/ s 12$
Benefit for the farmer

- Effective selection tool among female calves
  - and tool for precise mating of heifers and cows

- How to prove?

- Comparison of female gEBV with phenotypic performance within herd
  - gEBV: calculated without own performance (sire-pedigree-index + dGV)
  - Phenotypic performance: deviation from herd average

- First results
  - Including data from pilot research project KuhL (ca. 15,000 cows born 2012/2013)

- strong promotion tool to convince more commercial farmers
gEBV ↔ phenotype: Milk kg 1st lactation (305 d.)

- N = 26,877
- $\bar{g}$EBV = +232 kg milk
- $\bar{m}$ Milk kg = 9,093 kg
gEBV ↔ phenotype: SCC (thousand) first 3 test days 1st lactation

![Graph showing gEBV RZS (SCS) and SCC 3TD (Tsd) deviation from herd.]

- n = 42,617
- \( \overline{\sigma} \) gEBV = 103
- \( \overline{\sigma} \) SCC = 153 Tsd
gEBV ↔ phenotype: Non-Return-Rate 56 in 1st lactation

\[ \text{Deviation from herd } \phi \ (\text{Non-Return-Rate 56 days}) \]

\[ \text{N}=33,692 \]

\[ \circ \ gEBV = 102 \]

\[ \circ \ NR56 = 58\% \]
gEBV $\leftrightarrow$ phenotype: maternal Still Birth 1$^{st}$ calving (% dead calves)

N= 41,106
$\bar{\sigma}$ gEBV = 101
$\bar{\sigma}$ mSB = 13 %
gEBV ↔ phenotype: Udder score 1st lactation

-1.4
-0.2
0.4
1.2

N = 36,711
φ gEBV = 104
φ Udder = 81.4
Summary and Outlook

- Project KuhVision to set up an un-selected female reference population is very successful
  - >120,000 genotyped cows with phenotypes expected mid 2019
  - Inclusion in EG bull reference population adds reliability in all traits
    - see Alkhoder et al. this meeting

- Next steps
  - Integration of reference cows in routine Genomics for standard traits (2018)
  - Routine Genomics for direct health traits based on female reference population (2019)

- The future?
  - Sharing of information from cow reference population with other countries?
  - e.g. via or SNP-MACE?
    - see Liu et al. this meeting