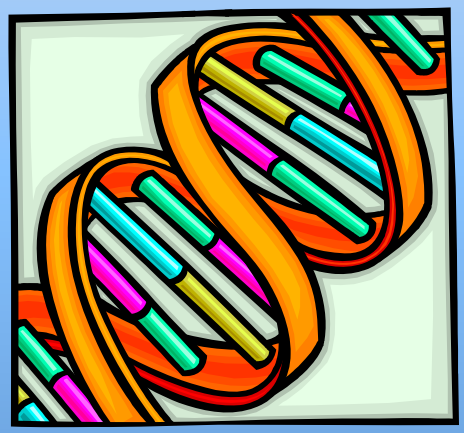
Interbull's Activities in Genomic Evaluation



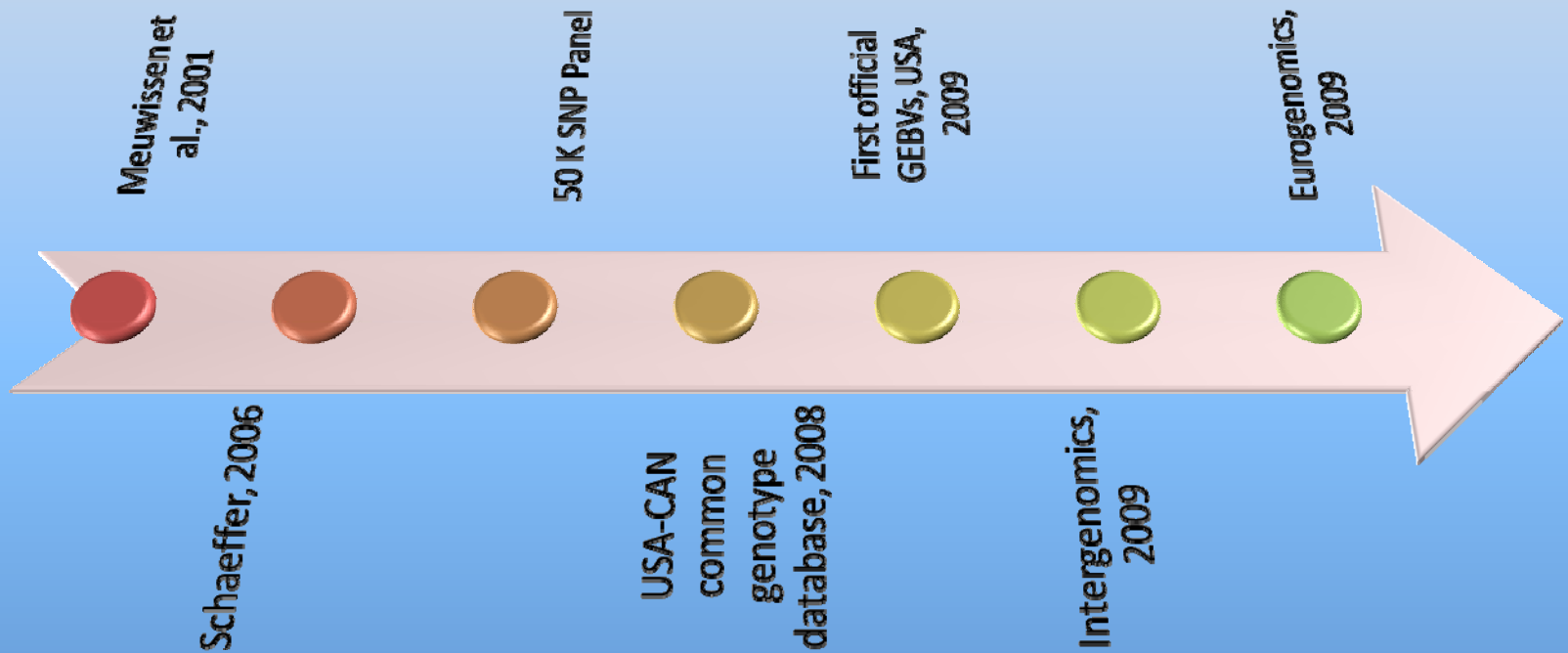
João Dürr (Interbull Centre)
Reinhard Reents (vit, Interbull Chairman)

2010 ICAR/Interbull, Riga, Latvia

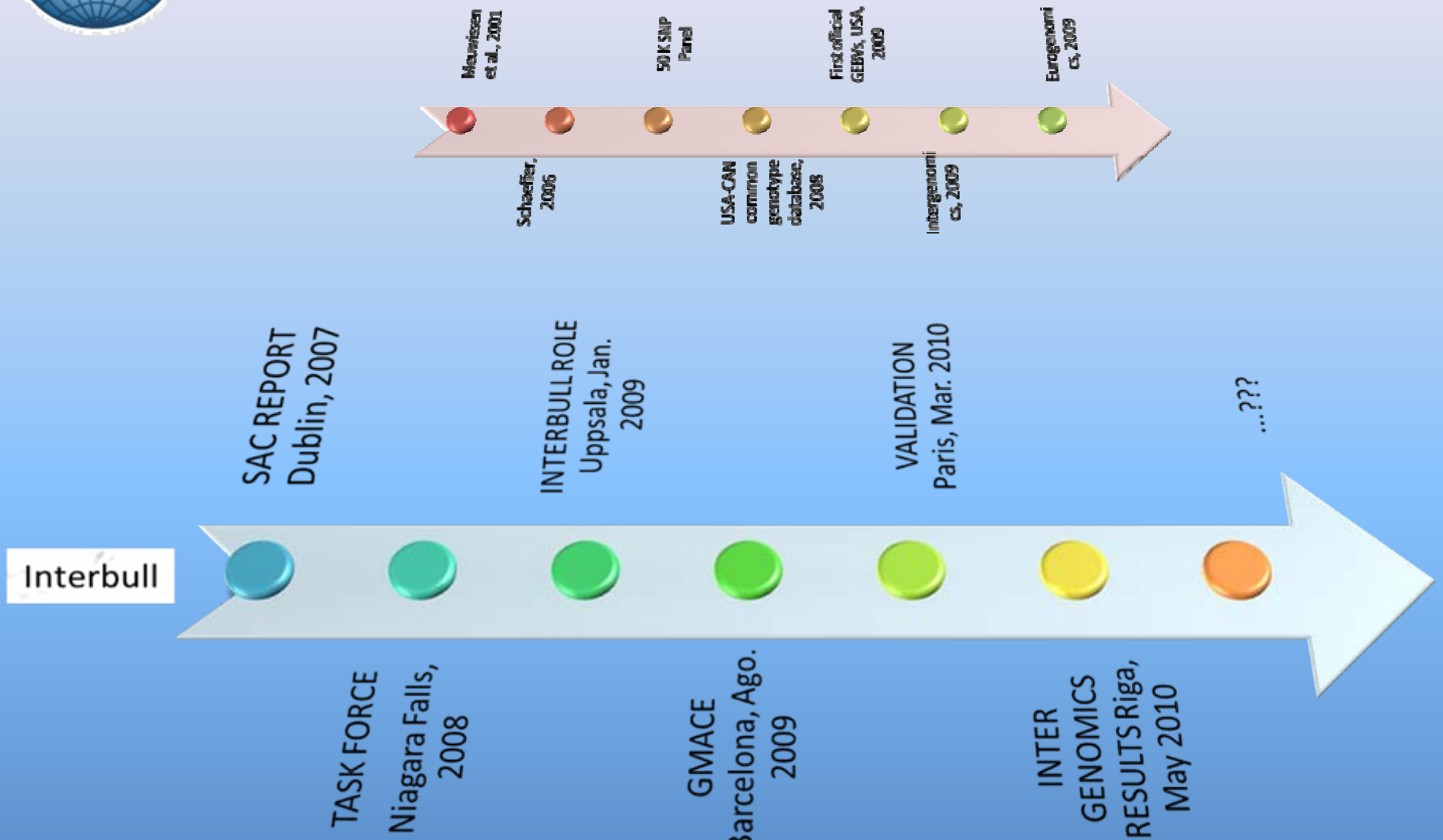
Genomics

Technology with the largest impact on dairy genetics since the introduction of artificial insemination.

Genomics: short history, long story



Genomics: short history, long story



Outline

- Industry needs
- Interbull's role
- Interbull services portfolio
- Current developments
- Future possibilities

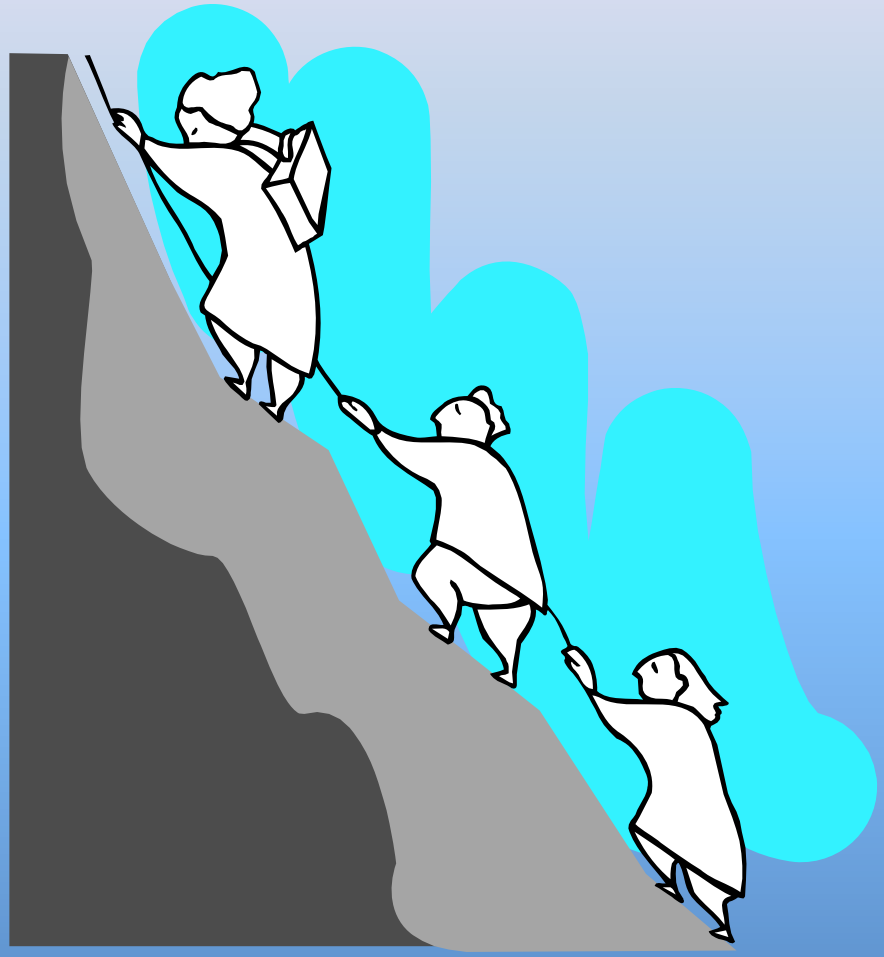
Industry Needs

- More and better phetotypic records
- Sufiicciently large reference populations
- Multiple choice of SNP pannels
- Cheaper SNP pannels
- Reliable genomic predictions
- Customers comfortable with the new technology
- Profitable selection scheme

INTERBULL'S ROLE

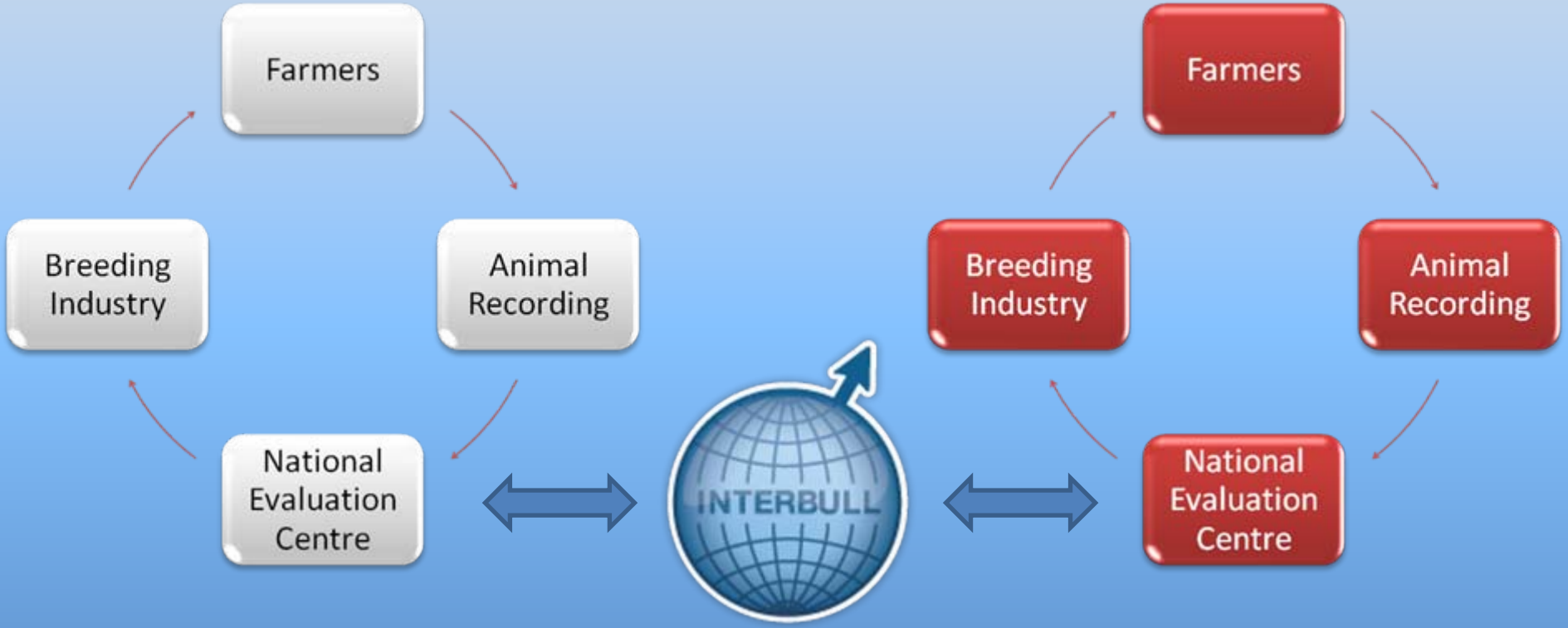
Interbull: the worldwide network providing genetic information services for improvement of livestock

Interbull Ultimate Goal

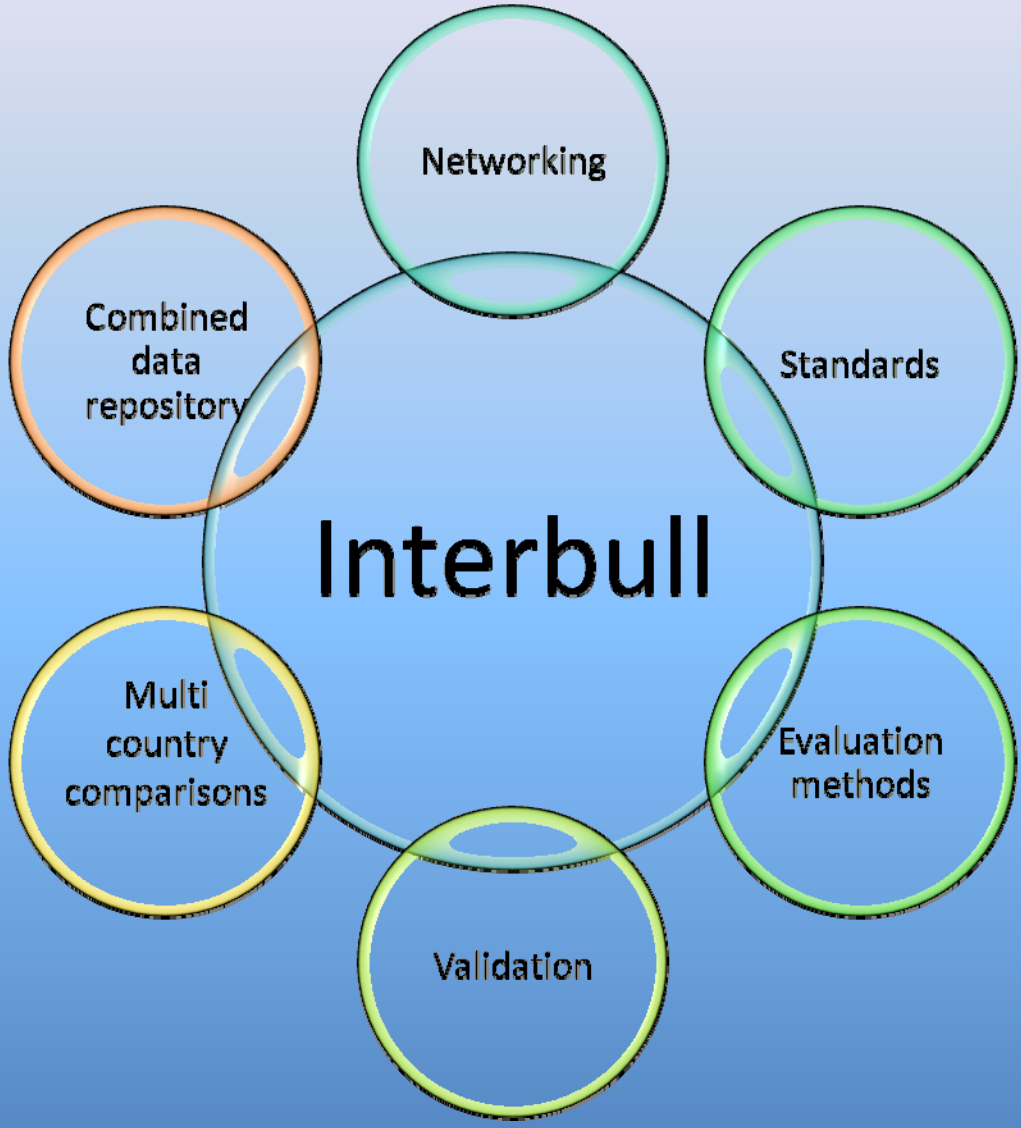


Facilitate "FAIR" INTERNATIONAL TRADE of cattle genetics!

Interbull's role



Interbull's role



Interbull services portfolio

Conventional (present)

- International Pedigrees
- National EBVs Validation
- Documentation on national and international genetic evaluations
- MACE evaluations
- International forum
  - Events
  - Publications
- International guidelines and standards

Genomic (near future)

- National GEBVs Validation
- Documentation on national and international genomic evaluations
- GMACE evaluations
- International guidelines and standards
- Genomic information exchange
- Multi-country genomic evaluations
- Historical national EBVs and MACE results

CURRENT DEVELOPMENTS

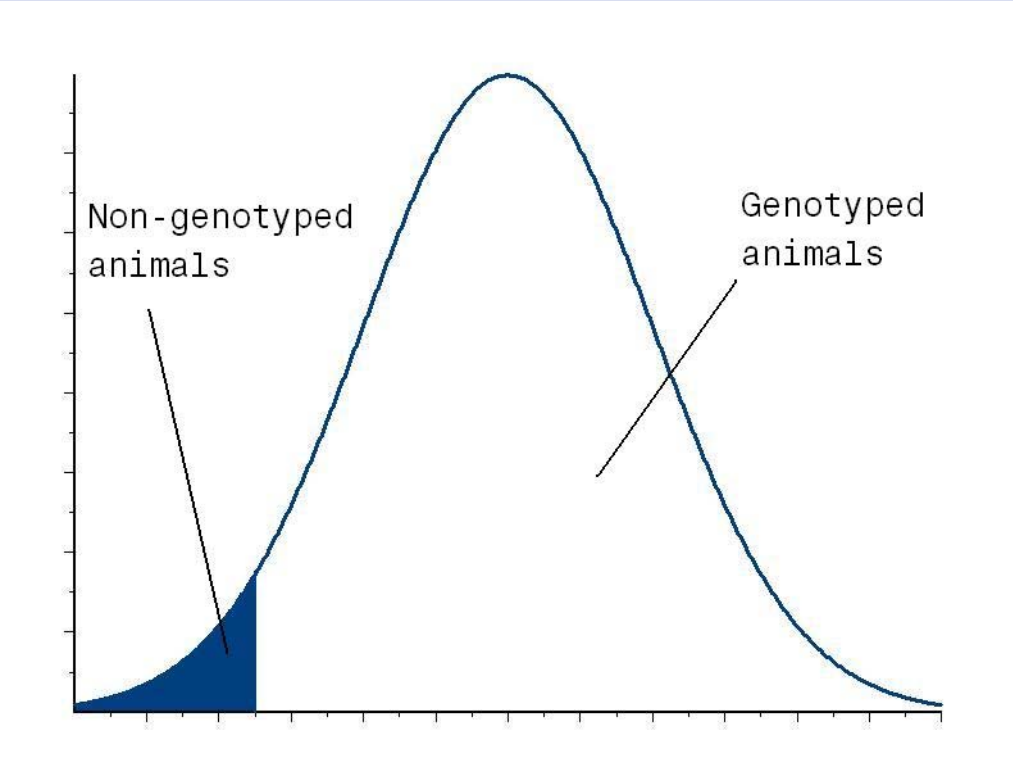
Validation of national GEBVs

- Why?
  - Any evaluation needs to provide evidence about its predictive ability
  - Preparation for international comparisons
    - Standards
    - Minimum quality requirements
  - Regulation within EU
    - ICAR/Interbull as reference body
    - Intermediate step before international comparisons

GEBV validation test

- ***Model1: φ = b0 + b1× GEBVr + e***
  - *φ* = DYD or DPRF
  - If *φ* = DPRF, then *φ* = *φ*×EDC/(EDC+k)
  - GEBVr = genomic EBV of animals from a reduced dataset (r) including bulls that have current EDC>20 and EDCr = 0
  - Test: b1 = E(b1) ?
- ***Model2: φ = b0 + b1× EBVr + e***
  - Test: $R^2_{model1} > R^2_{model2}$?

$E(b_1) \neq 1$



What should be the expected b_1 value?

Accuracy would not be the same as with no pre-selection.

Changes in expectations due to selection

$i = (\mu EBVg - \mu EBVall)/\sigma all$

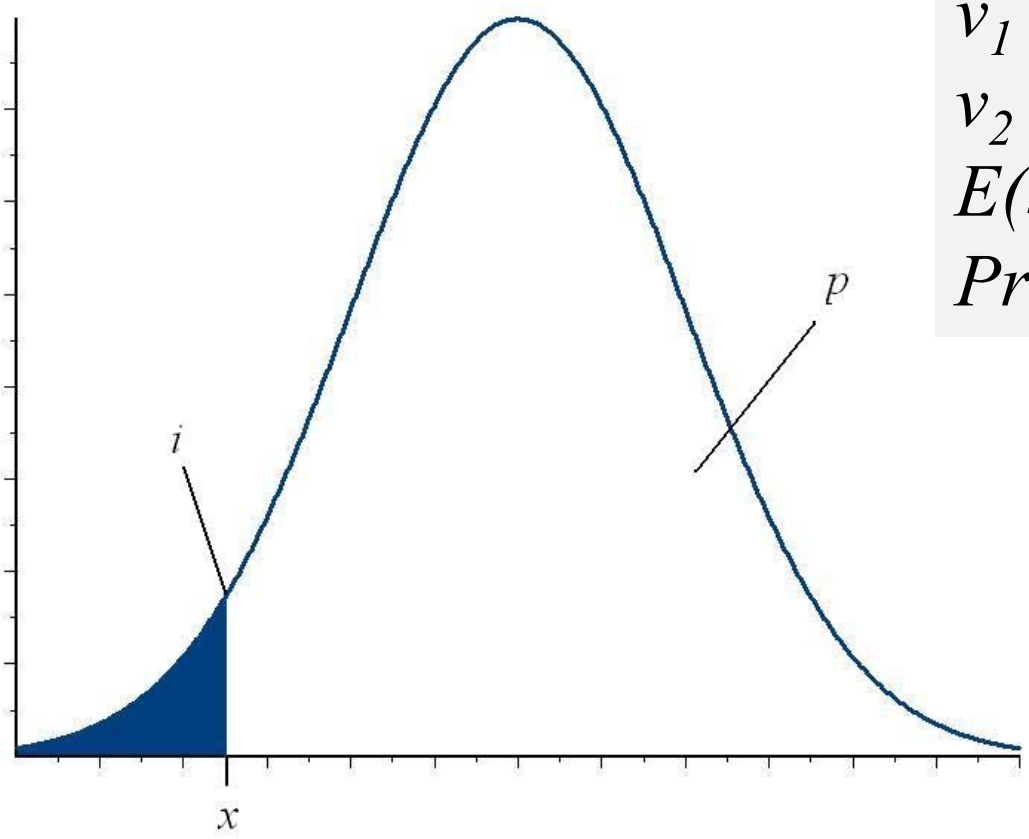
$k = i(i - x)$

$v_1 = 1 - k$

$v_2 = 1 - kr^2$

$E(b_1) = v_1/v_2$

$Pre\text{-}selection\ R^2 = r^2(v_1/v_2)$



Validation of national GEBVs

- When?
  - June 2010: finalize text and publish method
  - July 2010: receive official validation data from countries interested
    - Protein, stature, SCC, direct longevity, direct calving ease
  - August 2010: first release of validation results
    - Successfull validations by Country/Breed/Trait

Multi-Country Evaluation

- MACE: combine y across countries
- $[D + A^{-1} \quad T^{-1}] a = D y$
- GMACE: combine y_g across countries
- $[D+D_g + A^{-1} \otimes T^{-1}] g_{\otimes} = (D+D_g) y_g$
- mtGEBV: Multi-country genotype exchange
- $[D + G^{-1} \otimes T^{-1}] a = D y$

  - T is genetic covariance matrix across countries
  - G is genomic relationship matrix for bulls

Multi-Country Evaluation

- MACE: combine y across countries
- $[D + A^{-1} \quad T^{-1}] a = D y$
- GMACE: combine y_g across countries
- $[E^{-1} + A^{-1} \otimes T^{-1}] g = (\underset{\otimes}{E^{-1}}) y_g$
- mtGEBV: Multi-country genotype exchange
- $[D + G^{-1} \otimes T^{-1}] a = D y$

  - E accounts for residual covariances from data sharing

Residual Correlations in GMACE

- D and D_g are diagonal matrices
  - Residual variances of de-regressed proofs
- E accounts for shared genotypes, MACE EBV
  - Residuals covariances from shared foreign data

% common (shared) data

$$E_{ij} = r_g \sqrt{\gamma_i \gamma_j E_i E_j}$$

Max correlation between genomic predictions

Genomic portion of variance

(γ = %EDC from genomics)

Simplified GMACE

- Additional MACE including GEBVs only from the country of first evaluation
- All countries included in the MACE runs
- No need to account for correlated residuals
- Provisional solution, but probably better than using conventional conversion equations

intergenomics

Project Agreement between coutries & Interbull

Technical Committee: countries expertise + Interbull Centre

International genotype database at Interbull

R&D: develop SNP predictions in country scale from common reference population

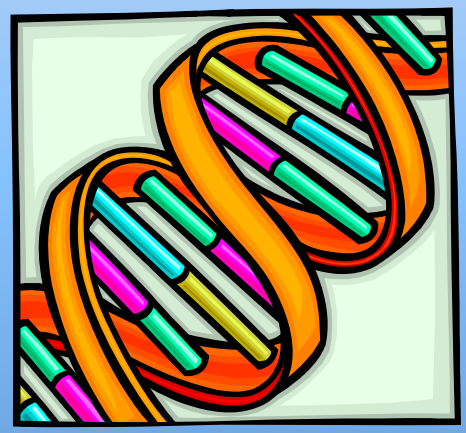
- The partners
  - Austria (Arge Braunvieh)
  - France (BGS)
  - Germany (AHG-Kempten)
  - Italy (ANARB)
  - Slovenia (ZRGRPS)
  - Switzerland (SBVZ)
  - USA (BSCBA)

- Riga, 2010
  - First preliminary results delivered
  - Machinery in place for GBLUP
- Leipzig, 2010
  - Technical Committee
- Stavanger, 2011
  - End of pilot project

Future possibilities

- Standards for genomic data storage and exchange
- International reference information
- Guidelines to set up genomic evaluations
- Genomic information exchange (”bull list”)
- Genomic data repository
- Multicountry genomic evaluations for other breeds
- International service to facilitate imputation of genotypes

Thank you!



Interbull's Activities in Genomic Evaluation

www.interbull.org

2011 Interbull Meeting

2011 EAAP

Stavanger, Norway

August 26-28, 2011