Explaining genetic variation in energy balance using high density SNP info

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Energy balance

- Energy balance: Energy intake – Energy usage
- Link between production and non-production traits
  - Common source of energy
- Severe negative energy balance
  - Harmful for health and fertility
- Not only consequence of nutrition and production, but also of *genetics*
  - $h^2 = 0.30$ (e.g. Veerkamp et al., 2003)

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Energy balance in selection schemes

- Accounting for energy balance in selection schemes is complicated
  - Not practical to measure feed intake in progeny testing
- Advantage genomic selection
  - Predict and select animals based on their genomic values
  - Phenotypic recordings only needed for reference population

Aim of this study

To demonstrate the genetic basis of energy balance and the potential use of genomic selection to facilitate inclusion of energy balance in selection programmes

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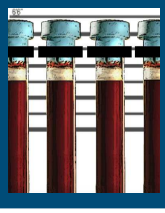
Collected data

- Experimental farm: 613 cows (1990-1997)
  - Feed intake (daily)
  - Body weight (weekly)
  - Milk production & milk contents (weekly)
- Blood samples: 588 cows (2009)
  - Illumina 50k Chip



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Trait definition

- 527 cows with both phenotype and genotype
  - 43,011 SNPs
- Energy balance (MJ/d)
  - Energy intake – energy requirements for milk, fat, protein, and maintenance (as function of body weight)

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Statistical analyses

- 10-fold cross validation approach
  - data randomly partitioned into 10 subsets
  - 1 subset as validation set, 9 sets to predict
- Estimation of genomic EBVs
  (Calus et al., 2008)

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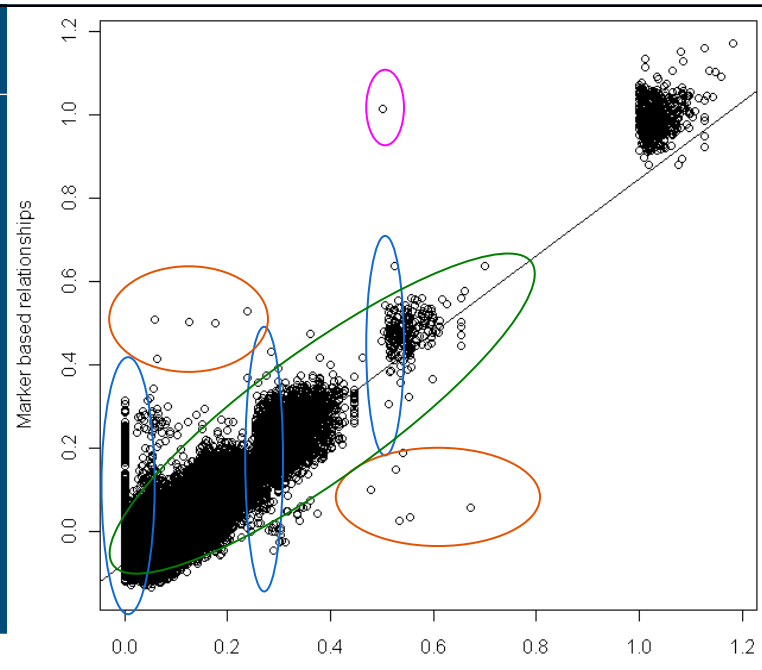

Accuracies of predicting energy balance

	Phenotype	Breeding value
Pedigree	0.21	0.37
Pedigree + SNP	0.29	0.52

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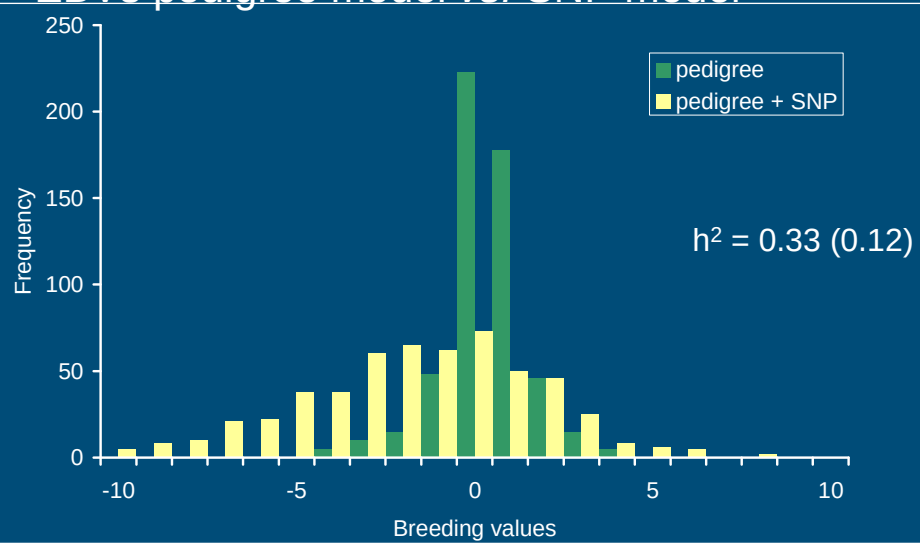
EBVs pedigree model *vs.* SNP model



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Conclusions

- SNP information explains variation between the energy balance of animals
- The use of SNP information showed an increase in the accuracy of prediction for energy balance
- In future, selection for energy balance could be performed using genomic selection

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Thank you for your attention

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Questions?

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- The use of SNP information showed an increase in the accuracy of prediction for energy balance
- In future, selection for energy balance could be performed using genomic selection

Verbyla et al., 2010. JDS93: 2757-2764

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