Genetic change of resilience within and between lactations in dairy cattle

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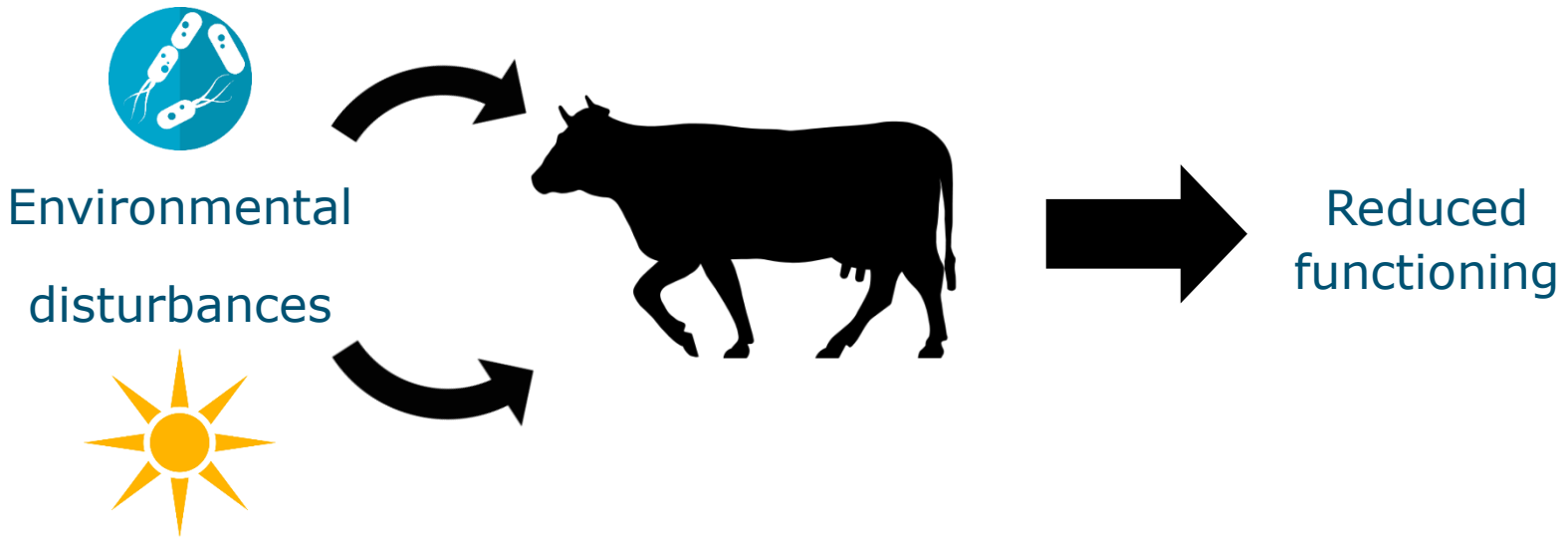
Resilience in dairy cattle



The ability to be minimally affected by disturbances

AND/OR

to quickly recover

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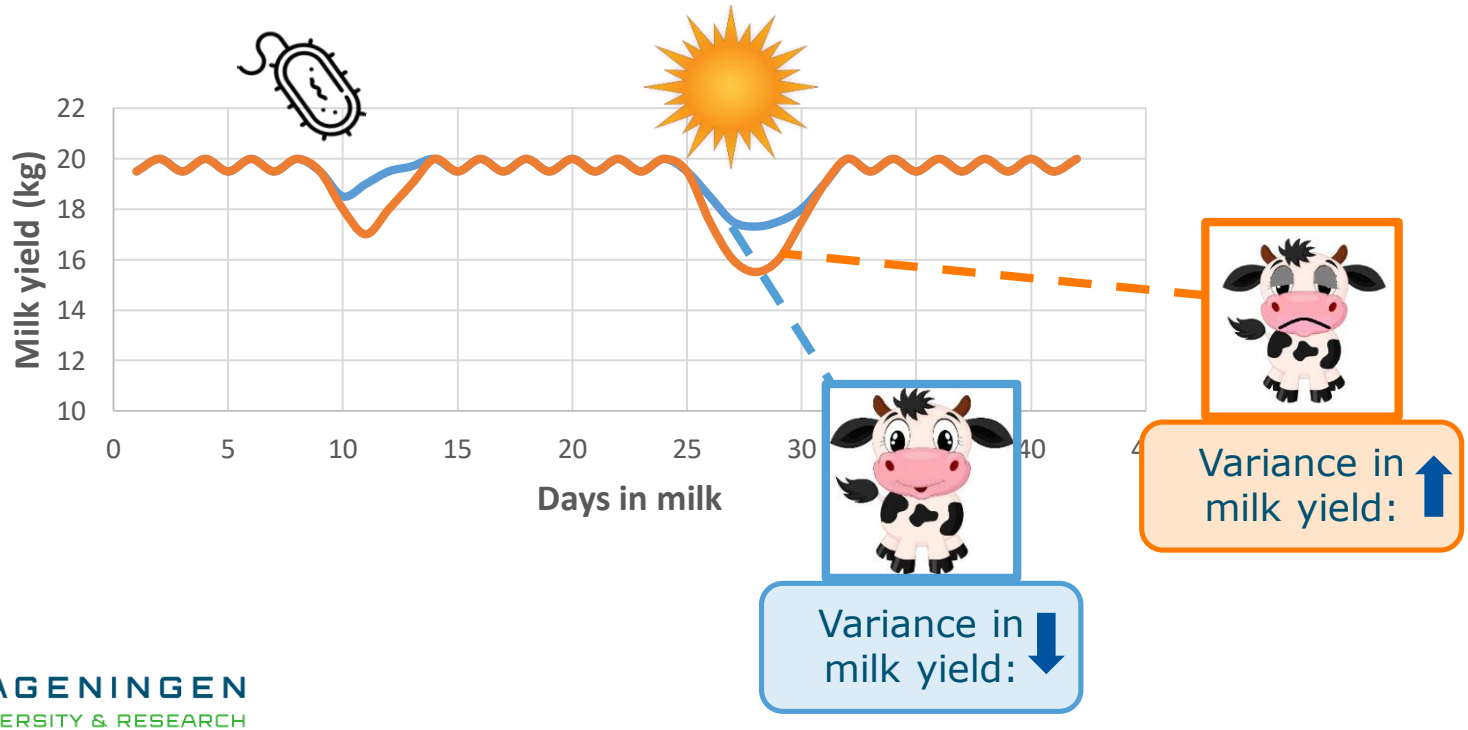
Breeding for resilience

- Resilience indicator based on fluctuations in daily milk yield → **variance** of daily milk yield
- Primiparous cows
- Up to 350 days in milk



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Breeding for resilience

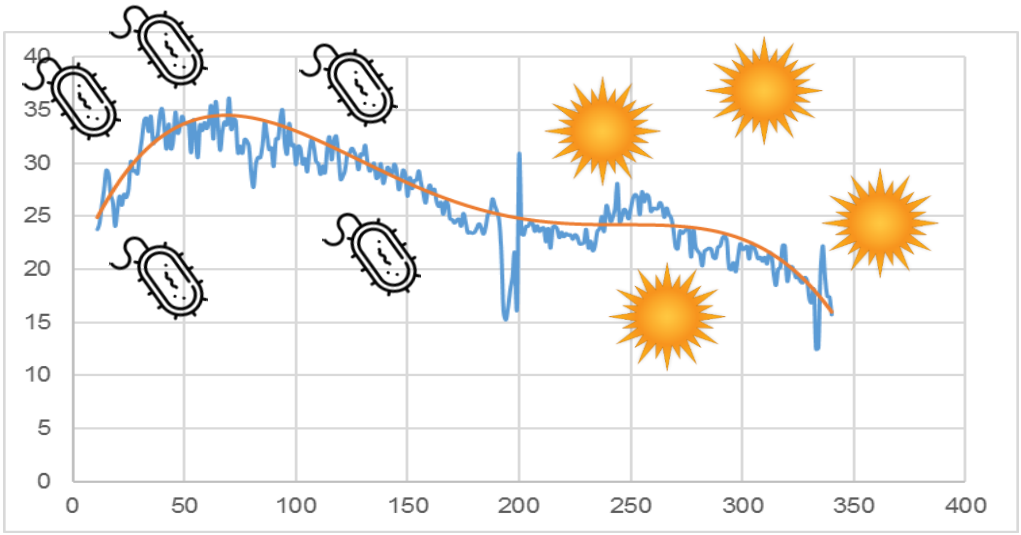
- Variance was:
  - Heritable (0.21)
  - Strongly genetically correlated with mean milk yield (0.79)
  - After adjustment for genetic correlations with mean milk yield, low variance genetically correlated with:
    - Good udder health
    - Low incidence of ketosis
    - Good longevity

$r_g \sim -0.3$

Variance promising resilience indicator!

Change of resilience over time

- Genetic change within and between lactations
  - Health traits often change
  - Fluctuations in milk yield in different periods due to different disturbances?



Aim

Study genetic change of resilience over time

By

Genetic analysis of resilience indicator **variance** at different periods within lactation and in different lactations

Work performed by Gerbrich Bonekamp

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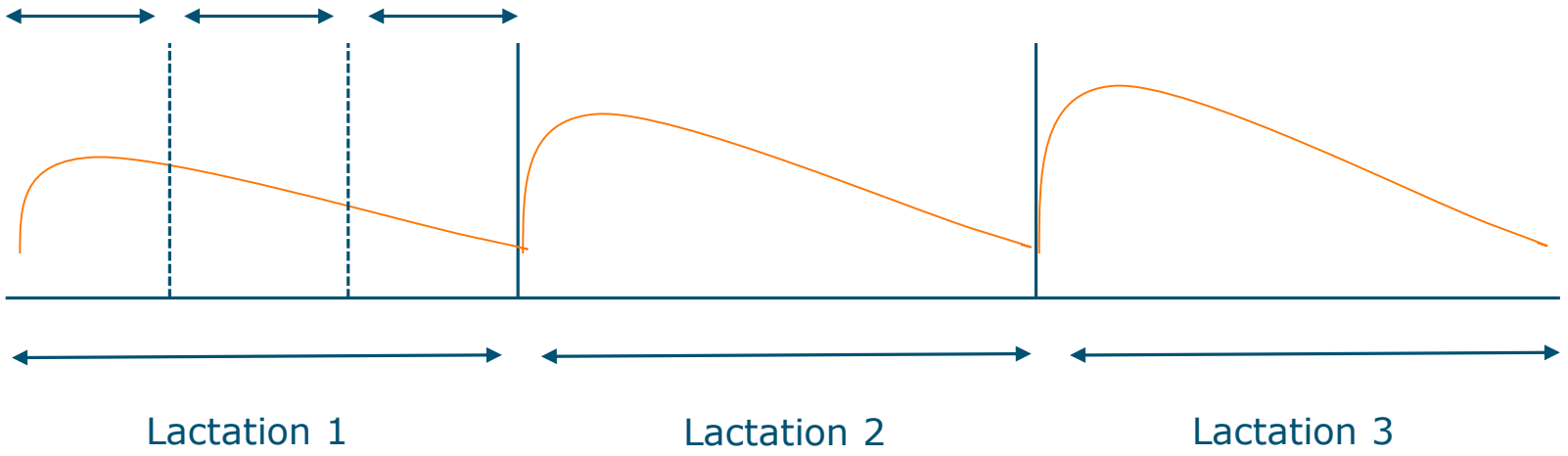
Materials and methods

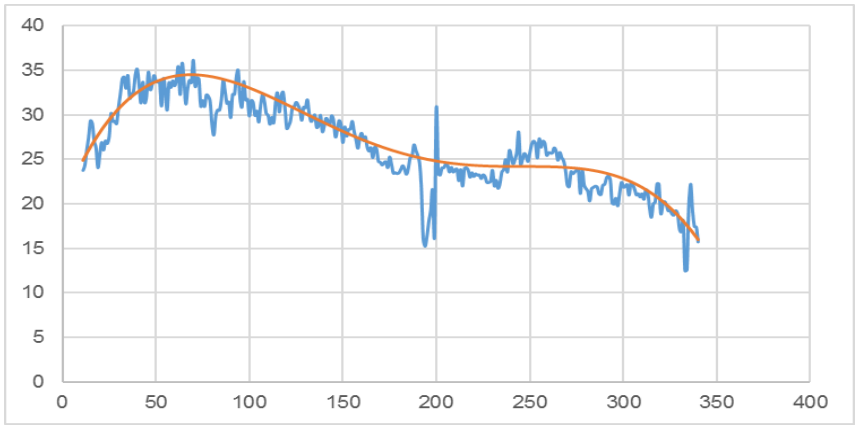
- Variance in lactation 1, 2, 3 up to 350 days after calving
  - 200,000 – 90,000 cows
- Variance in 3 periods of lactation 1 (~100 days)
  - 202,000 – 188,000 cows



Materials and methods

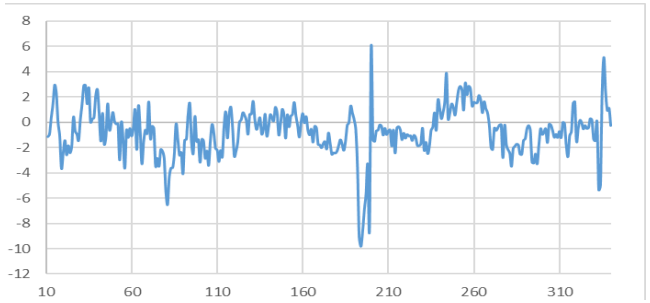
- Natural log transformation of variance
- Deviations from expected milk yield (4th order polynomial regression on the 0.7 quantile)

Milk yield (kg)



Days after calving

Deviations (kg)



Days after calving

Materials & methods

- Genetic analysis
  - Heritability
  - Genetic correlations between lactations & lactation periods
  - Genetic correlations with health traits & longevity (MACE)

$$Variance = \mu + AFC + LL + HYS + animal + e$$

AFC = age at first calving

LL = lactation length

HYS = herd*year*season

Heritability

	h^2 (SE)
Lactation period 1	0.13 (0.01)
Lactation period 2	0.12 (0.01)
Lactation period 3	0.15 (0.01)
Full lactation 1	0.20 (0.00)
Full lactation 2	0.18 (0.01)
Full lactation 3	0.19 (0.01)

Genetic correlations between lactation periods

	Lactation period 2	Lactation period 3
Lactation period 1	0.88 (0.01)	0.81 (0.02)
Lactation period 2		0.97 (0.01)

Genetic correlations between full lactations

	Lactation 2	Lactation 3
Lactation 1	0.94 (0.01)	0.91 (0.02)
Lactation 2		0.99 (0.01)

Genetic correlations with udder health & longevity adjusted for milk yield level

	Udder health	Longevity
Lactation period 1	-0.19	-0.23
Lactation period 2	-0.26	-0.28
Lactation period 3	-0.23	-0.25
Full lactation 1	-0.31	-0.30
Full lactation 2	-0.51	-0.45
Full lactation 3	-0.51	-0.42

Conclusion

- Variance genetically changes over time, especially within lactation
- Heritability full lactations higher than lactation periods
- Genetic correlations with udder health and longevity strongest for full lactations
- Index EBV lactation 1, 2 & 3 to improve resilience

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