

Genetics and Technology: Genetic Effects on Bovine Milk Infrared Spectra

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Background

- Infrared spectra (IR) have been used to predict milk composition.
- Since genes have large effect on milk composition, it is interesting to investigate the effect of genetics on milk IR wavenumbers

Objective

Estimate heritability and quantify the effects of polymorphisms on individual wavenumbers in milk infrared spectra.

Material and Methods

Data

- **1,759** Holstein Friesians cows
- **3** polymorphisms (*DGAT1*, *SCD1*, *κ-Cn*)
- **1,060** Mid-InfraRed wavenumbers
 - FOSS MilkoScan FT 6000 spectrometer



Mixed Model Analysis

$$IR_{ijklm} = \mu + \beta_1 * DIM_{ijklm} + \beta_2 * age\ of\ calving_{ijklm} + season\ of\ calving_i + sirecode_j + herd_k + animal_l + SNP_m + e_{ijklm}$$

1,060 single trait analyses in ASREML 3.0

Variance components due to:

Additive genetic (σ_a^2), differences between herds (σ_h^2), and residual (σ_e^2)

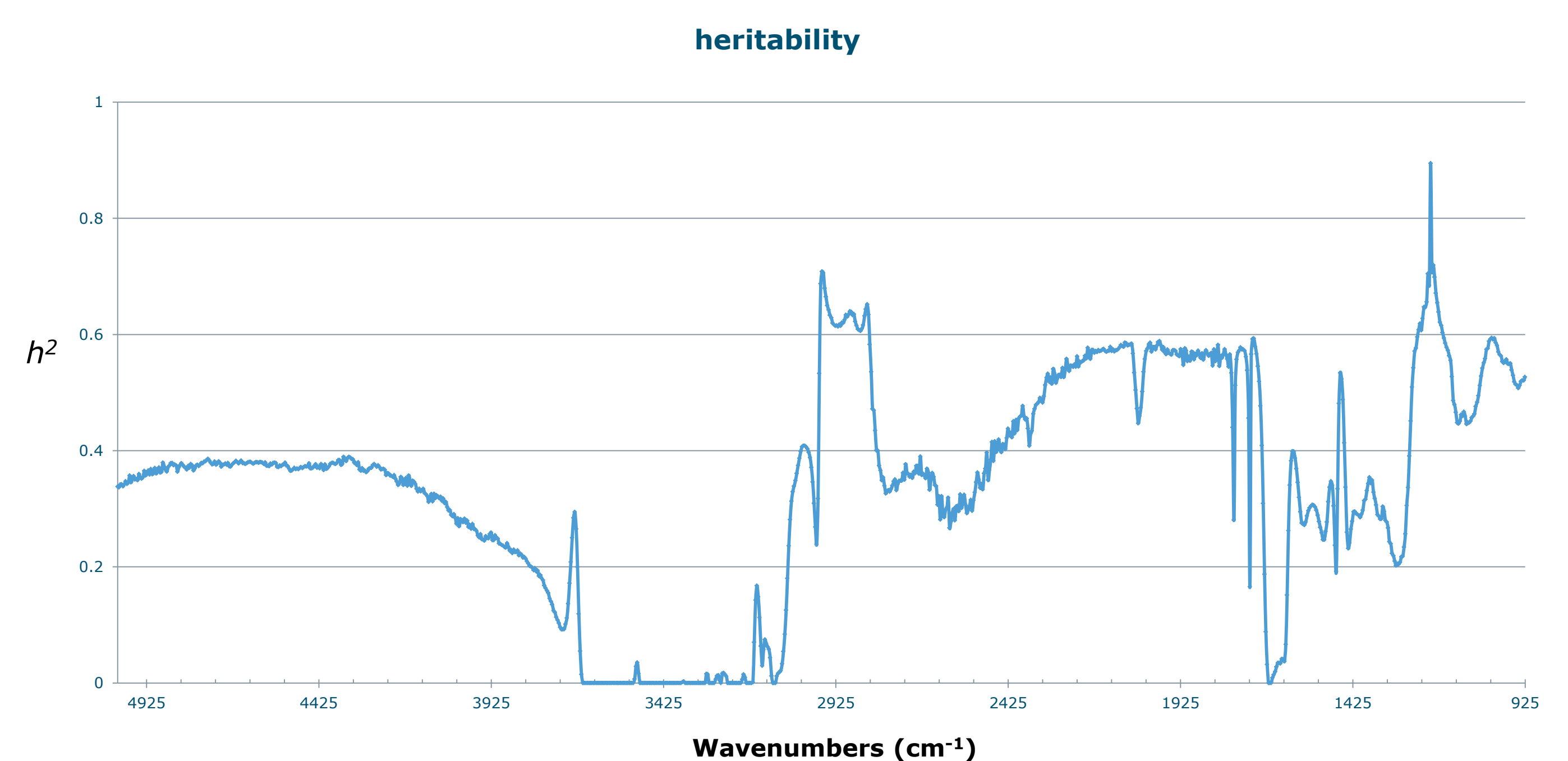
$$h^2 = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_h^2 + \sigma_e^2}$$

- Significance of fixed effects ($-\log_{10}(P)$)

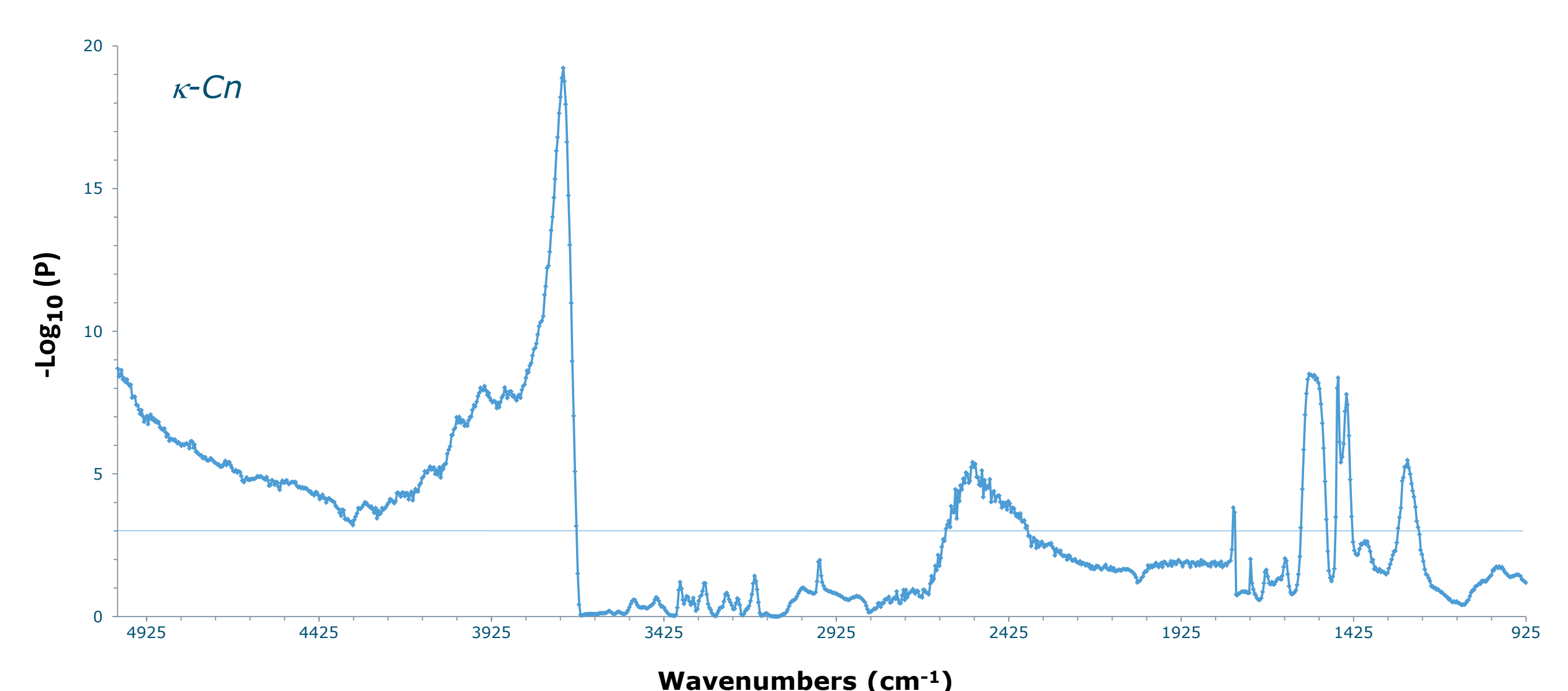
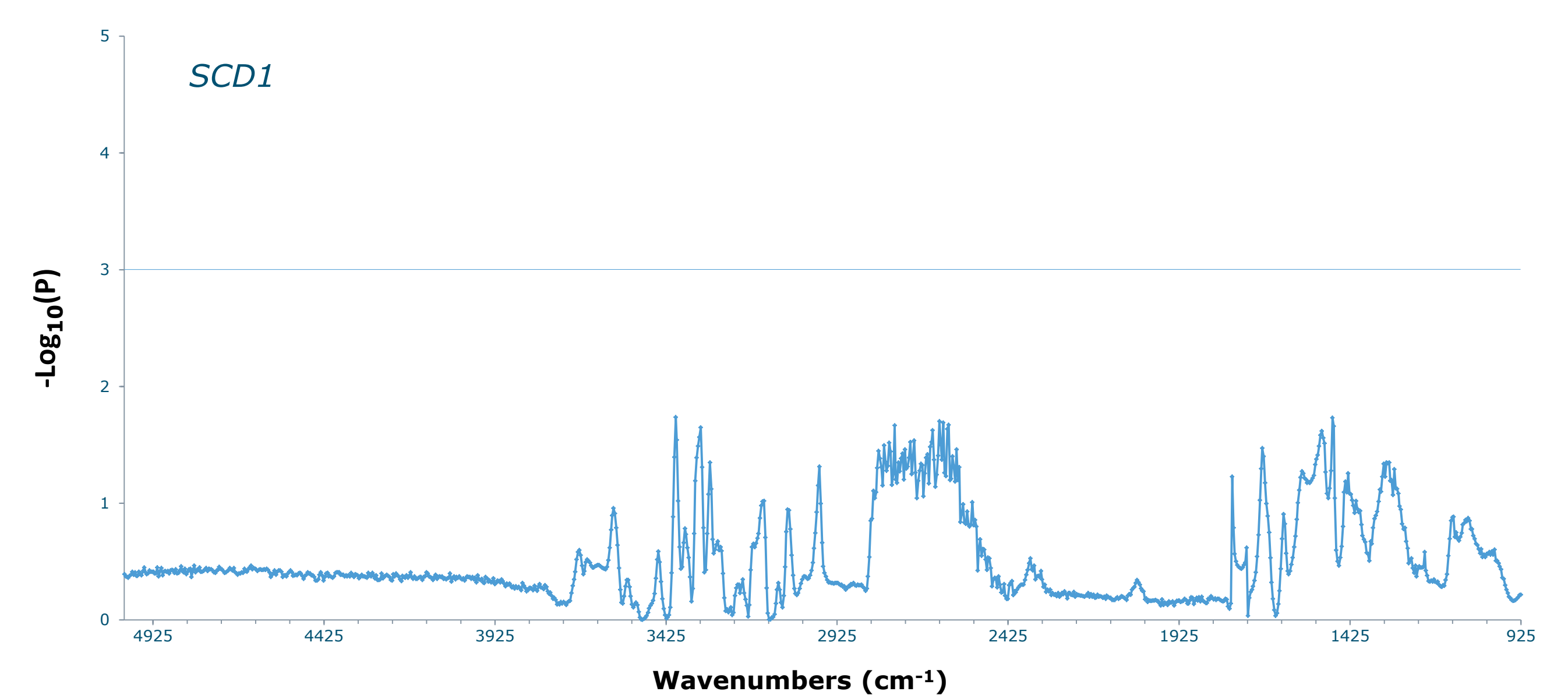
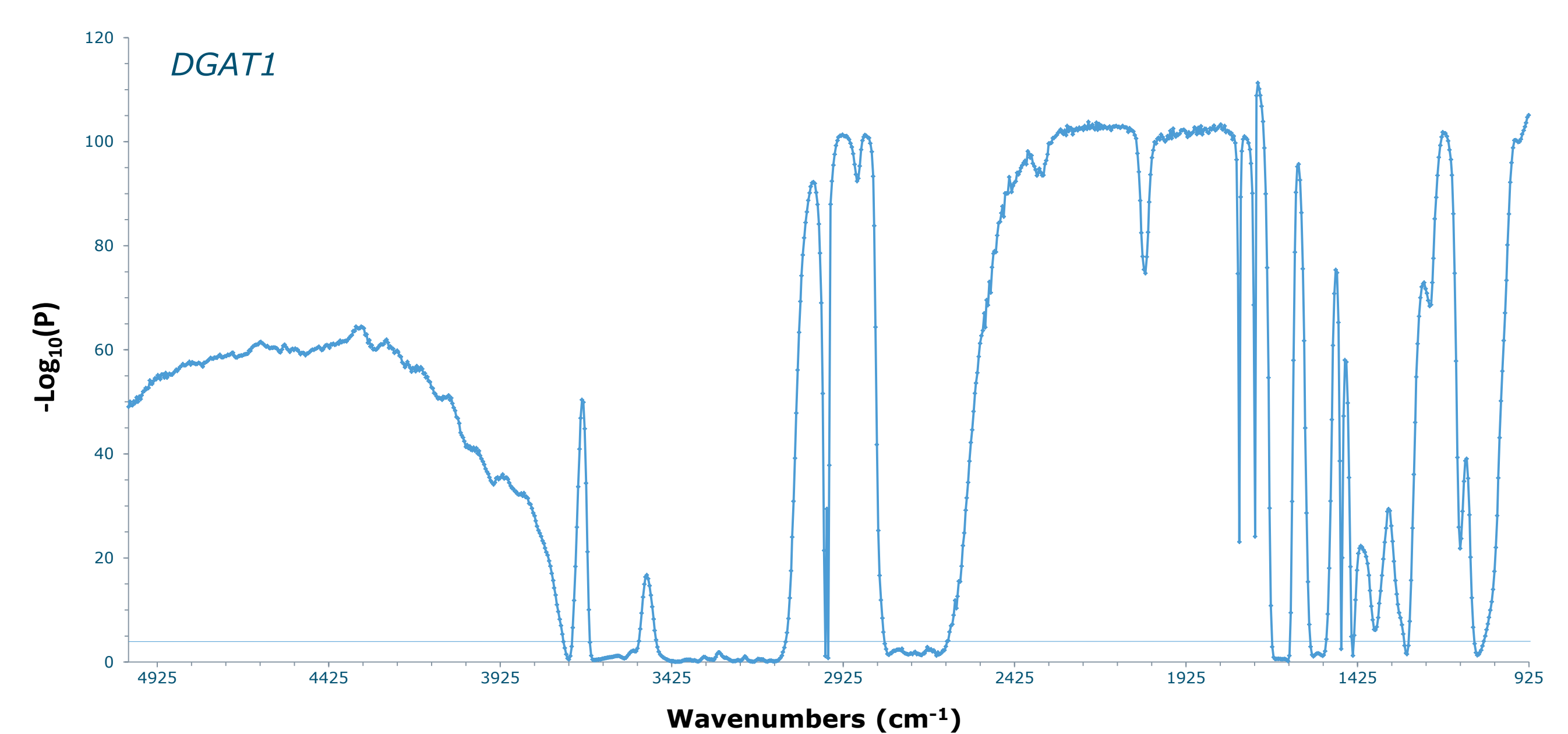
Conclusions

- ✓ Many IR wavenumbers of milk were strongly affected by genetic differences.
- ✓ Not all gene polymorphisms have significant effects on individual IR wavenumbers of milk.

Results and Discussion



- Moderate to high h^2 were estimated. **796** wavenumbers have h^2 between 0.2 and 0.6.
- Wavenumbers with low h^2 are mainly due to water (O-H band) absorption.



- *DGAT1* had significant effects on most wavenumbers, while *SCD1* had no effects on milk IR. *κ-Cn* had significant effects on the wavenumbers associated with milk protein.

