



Inbreeding and Inbreeding Depression in Irish Holstein-Friesians

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Introduction

- **Inbreeding:** Mating related animals
- **Inbreeding depression:** The reduction in performance as a result of inbreeding
 - Reduces milk production
 - Impairs health, fertility, survival and calving performance
- Never been quantified in Ireland

Objective

To estimate the level of inbreeding in Irish Holstein-Friesians and to quantify its effects on milk production, somatic cell count, fertility and survival

Materials and Methods

1. Pedigree analysis

Pedigree records extracted from Irish database

- 1950-2005 (n=2,851,081)
- Birth years estimated
- Pedig software (*Boichard, 2002*)
 - Pedigree depth
 - Inbreeding

Materials and Methods

2. Production and Fertility analysis

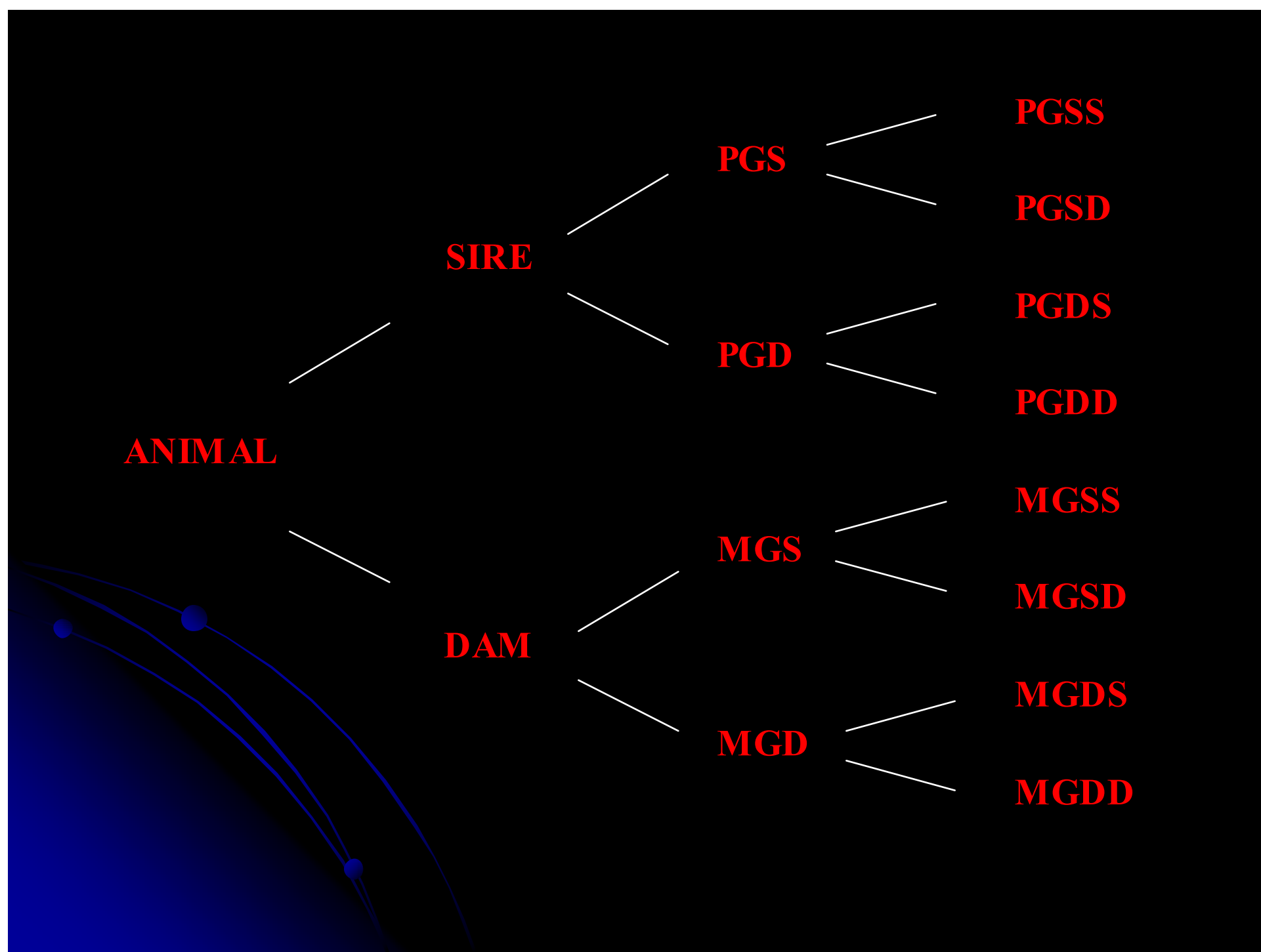
Production & fertility records (2003 - 2005) extracted from Irish database

- Milk/fat/protein yield
- Somatic cell count (SCC)
 - Log₁₀ transformed to SCS
- Calving dates
 - Age at first calving
 - Calving interval
 - Survival

Materials and Methods

Data edits

- 3 complete generations
- HYS created
 - n<3 removed
- Production
 - Outliers removed
 - 3 standard deviations from mean
 - Age nested within parity
- Fertility
 - 1st lactation animals
 - Age at first calving 660-900 days
 - Calving interval 300-800 days



Materials and Methods

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Data Structure

Inbreeding Class (%)	Population		Analysis	
	Number	Percent	Number	Percent
F=0	1,605,110	56.30	5,512	3.97
0<F≤6.25	1,190,744	41.76	126,461	91.26
6.25<F≤12.5	40,775	1.43	5,659	4.08
12.5<F≤25	9,734	0.34	688	0.50
F>25	4,718	0.17	257	0.19

Materials and Methods

Inbreeding depression estimated using linear mixed models in ASReml

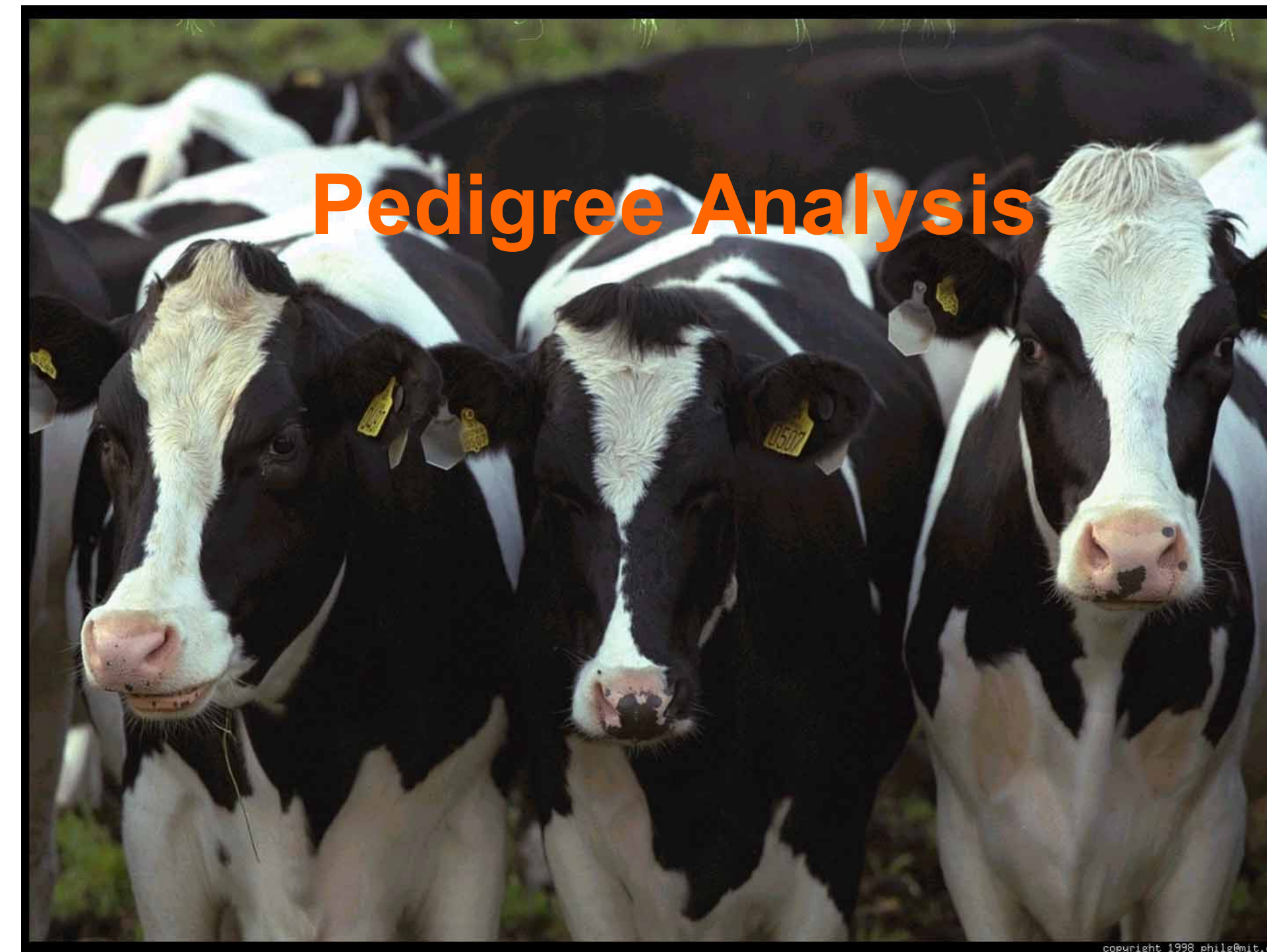
Fixed Effects

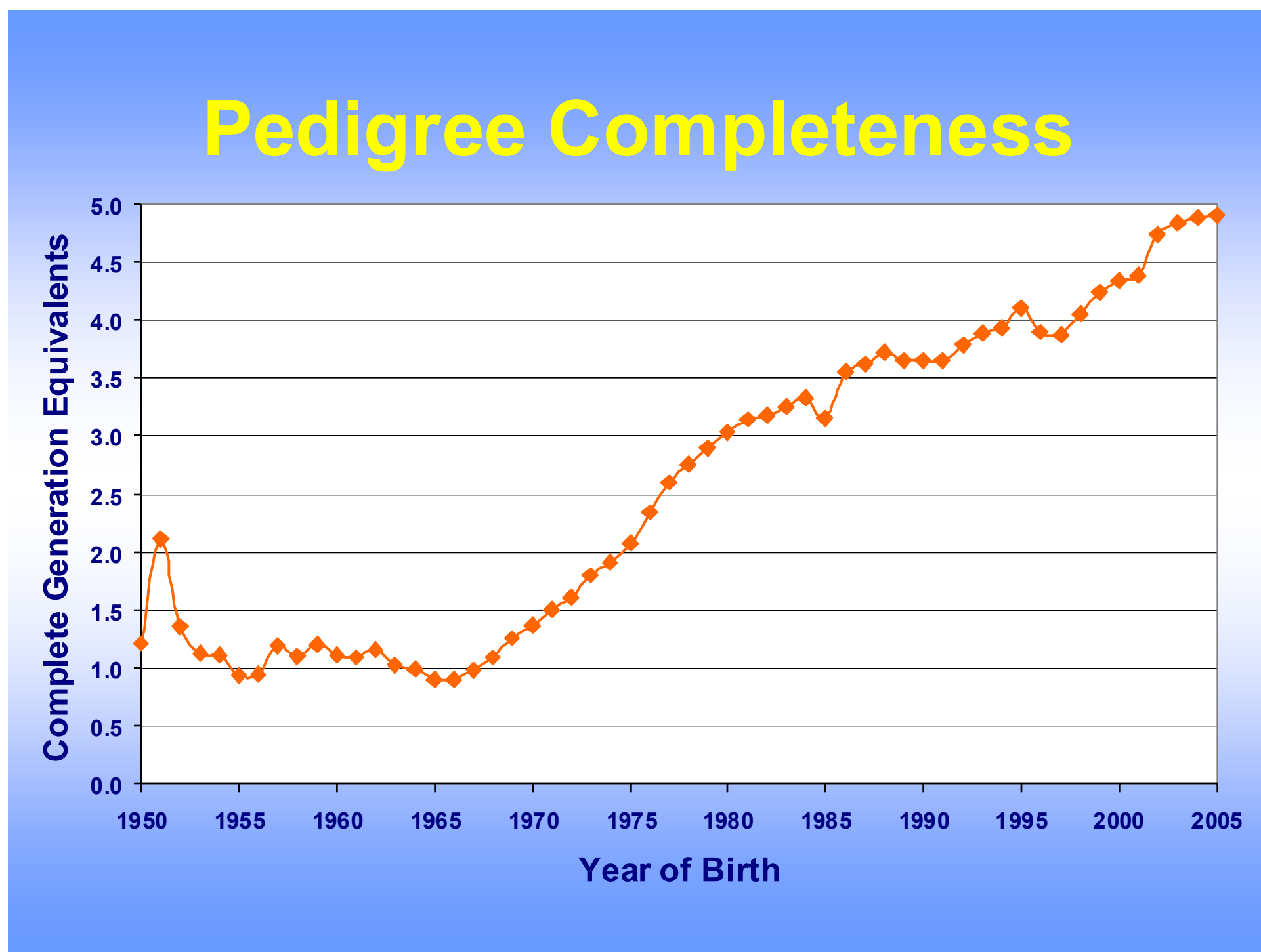
- HYS, parity, age(parity), lactation length
- Inbreeding included as continuous & class
- Interactions tested

Random Effects

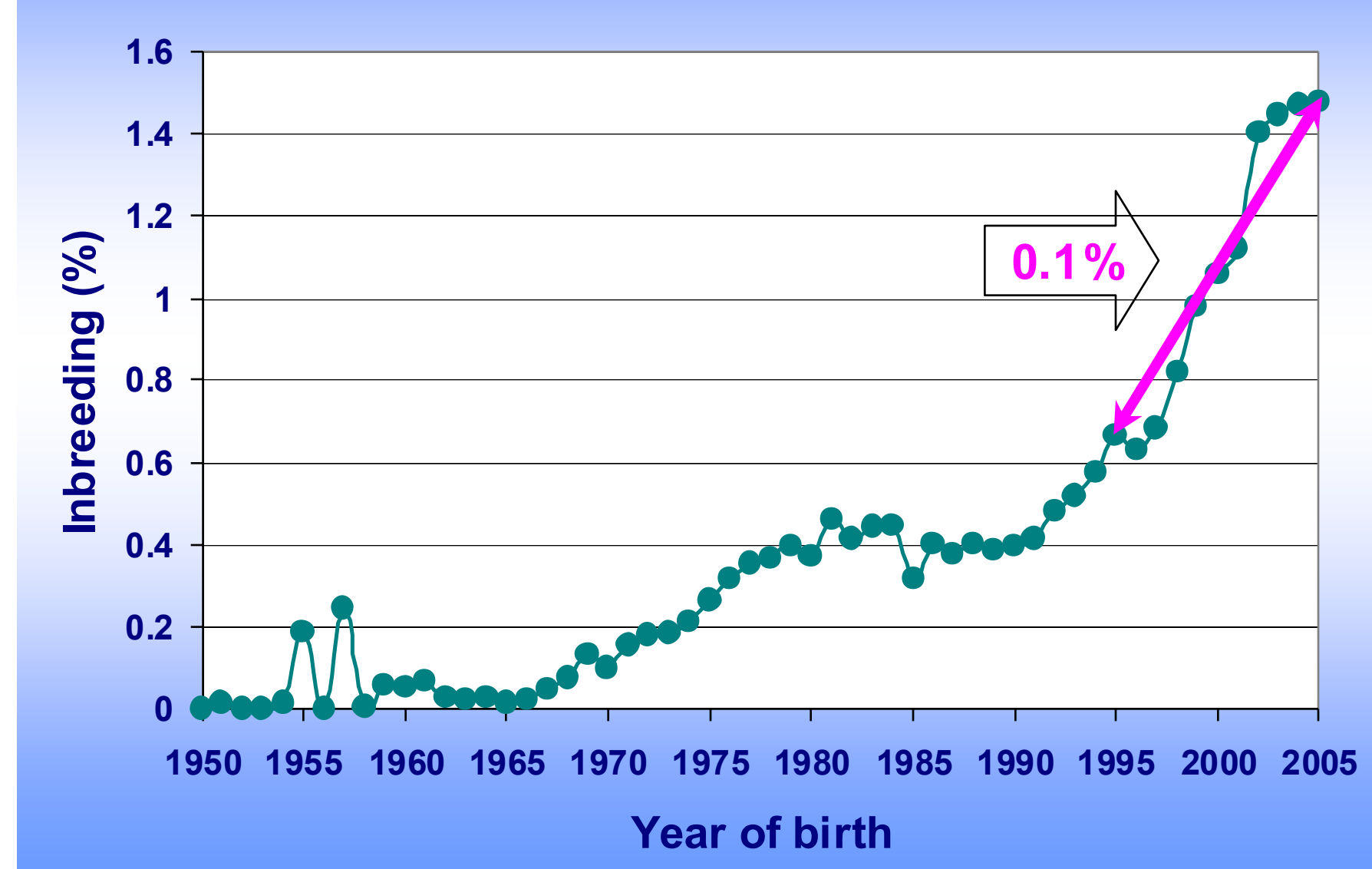
- Sire
- Permanent environmental effect
- Residual error

Pedigree Analysis

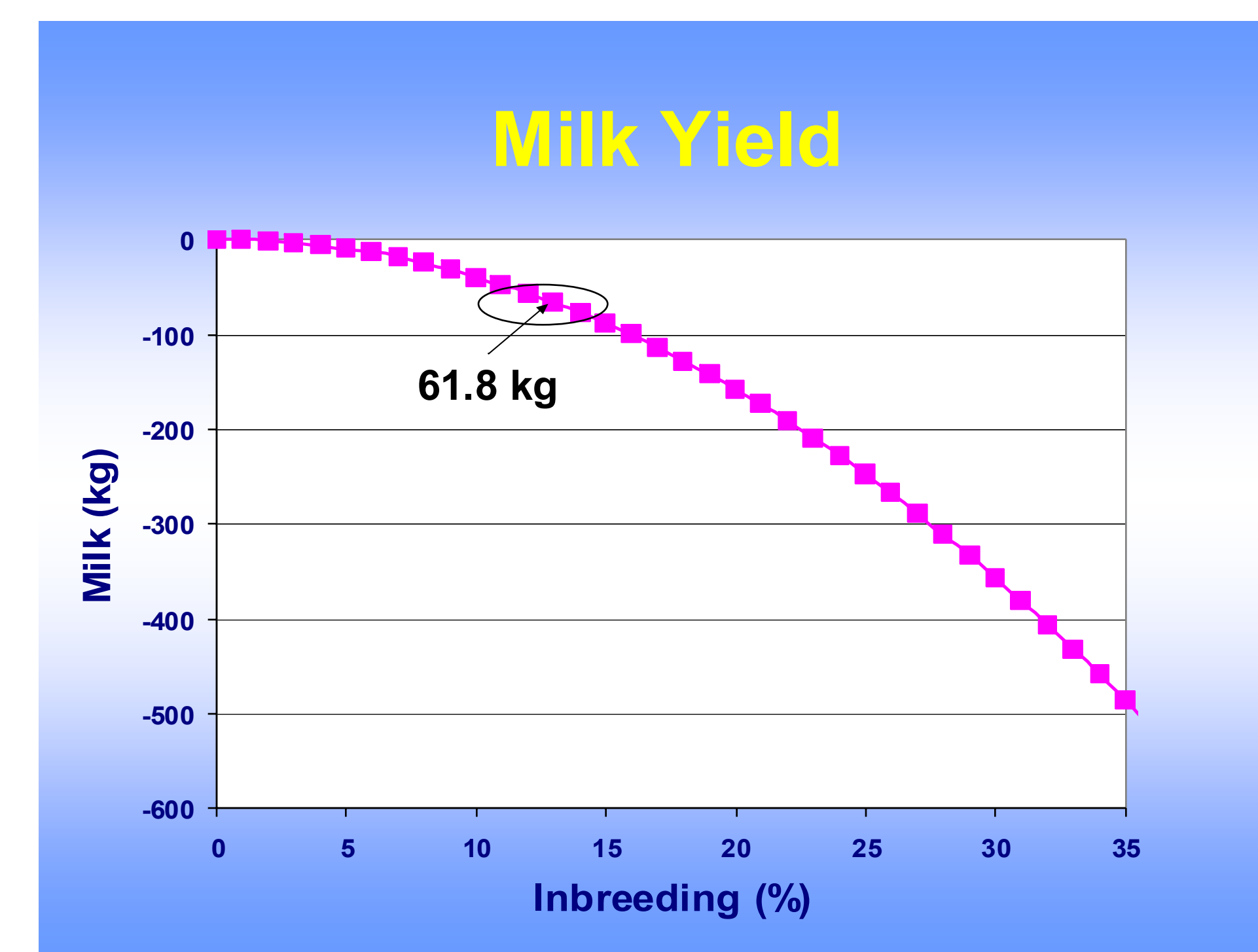


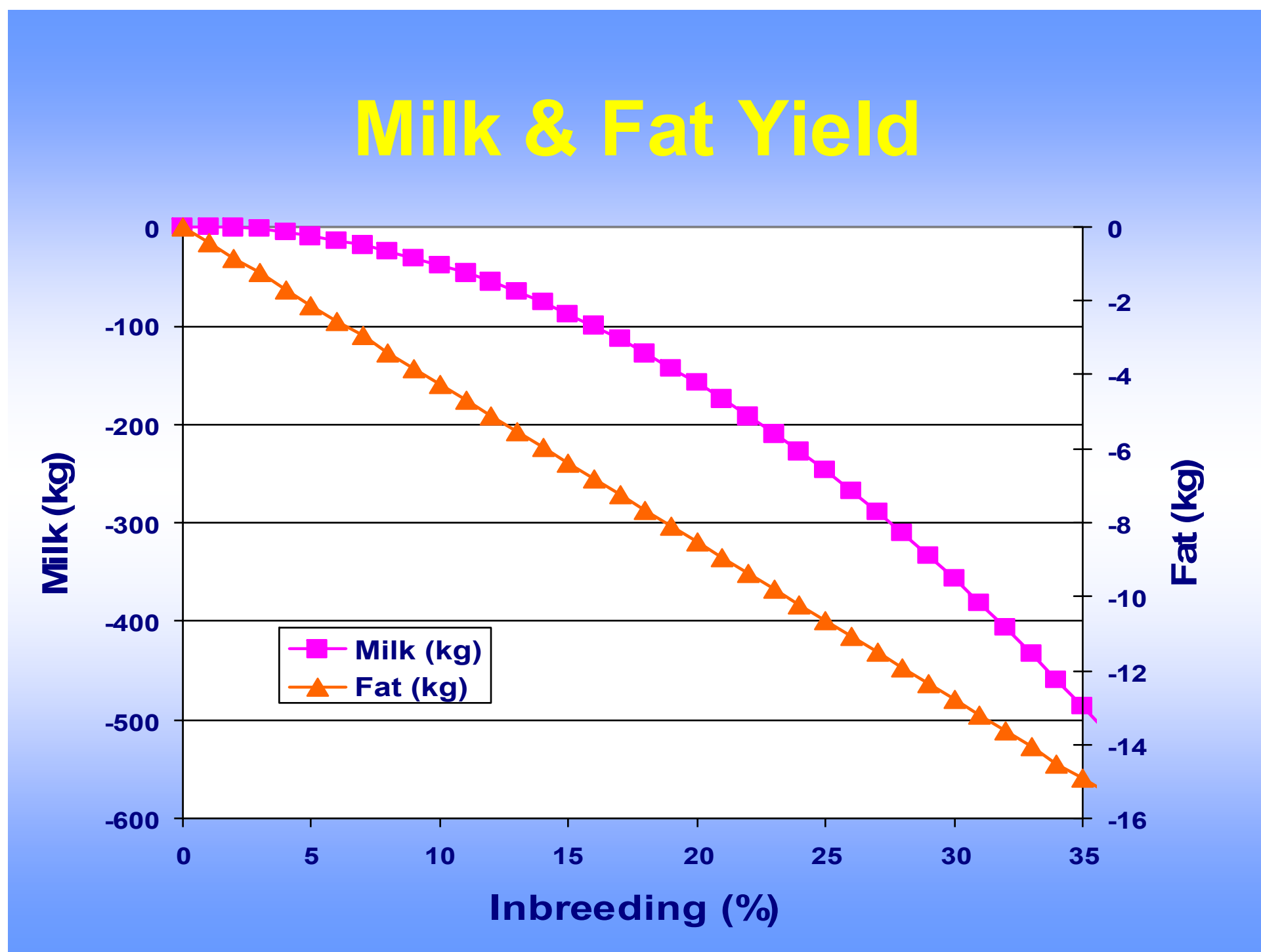


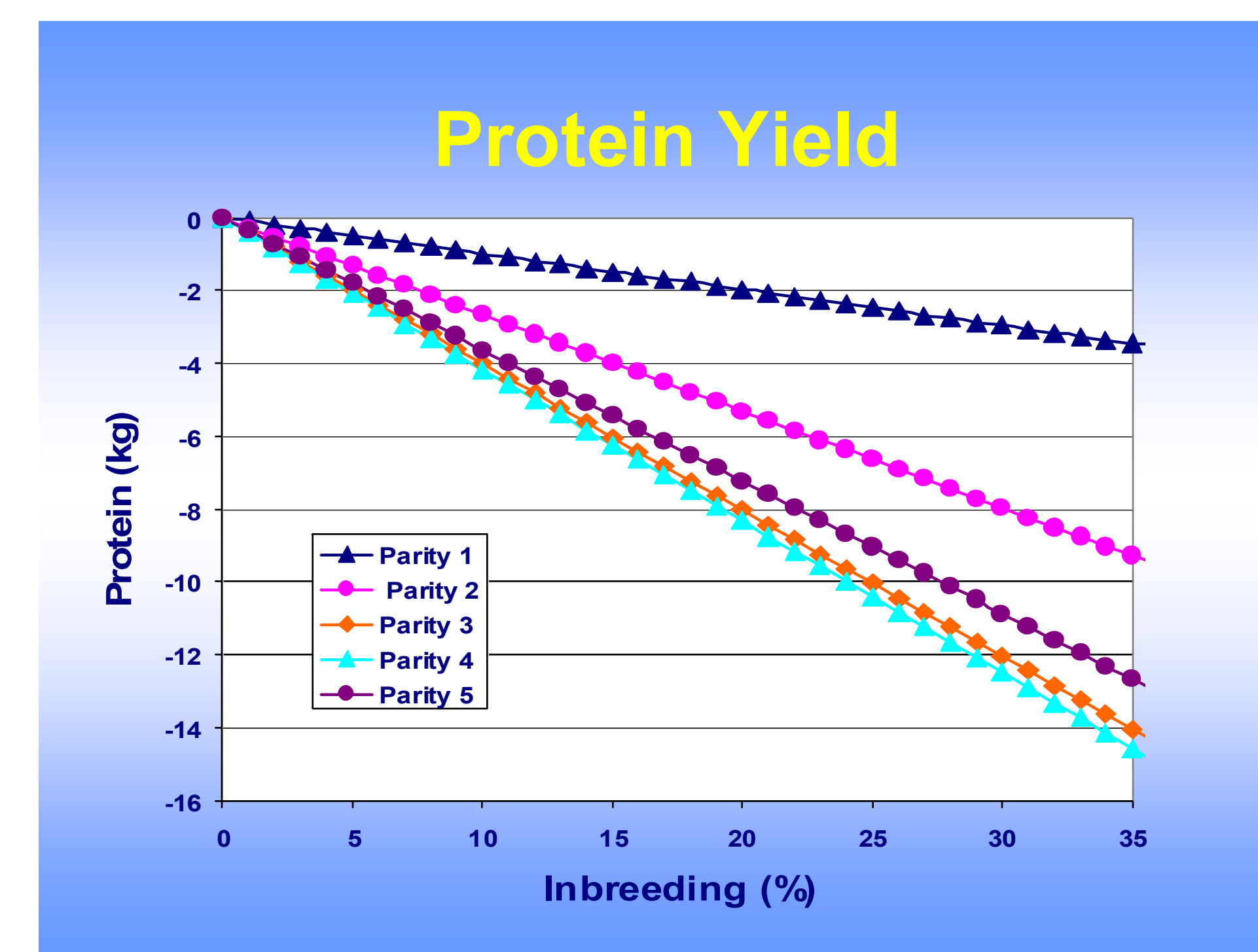
Inbreeding

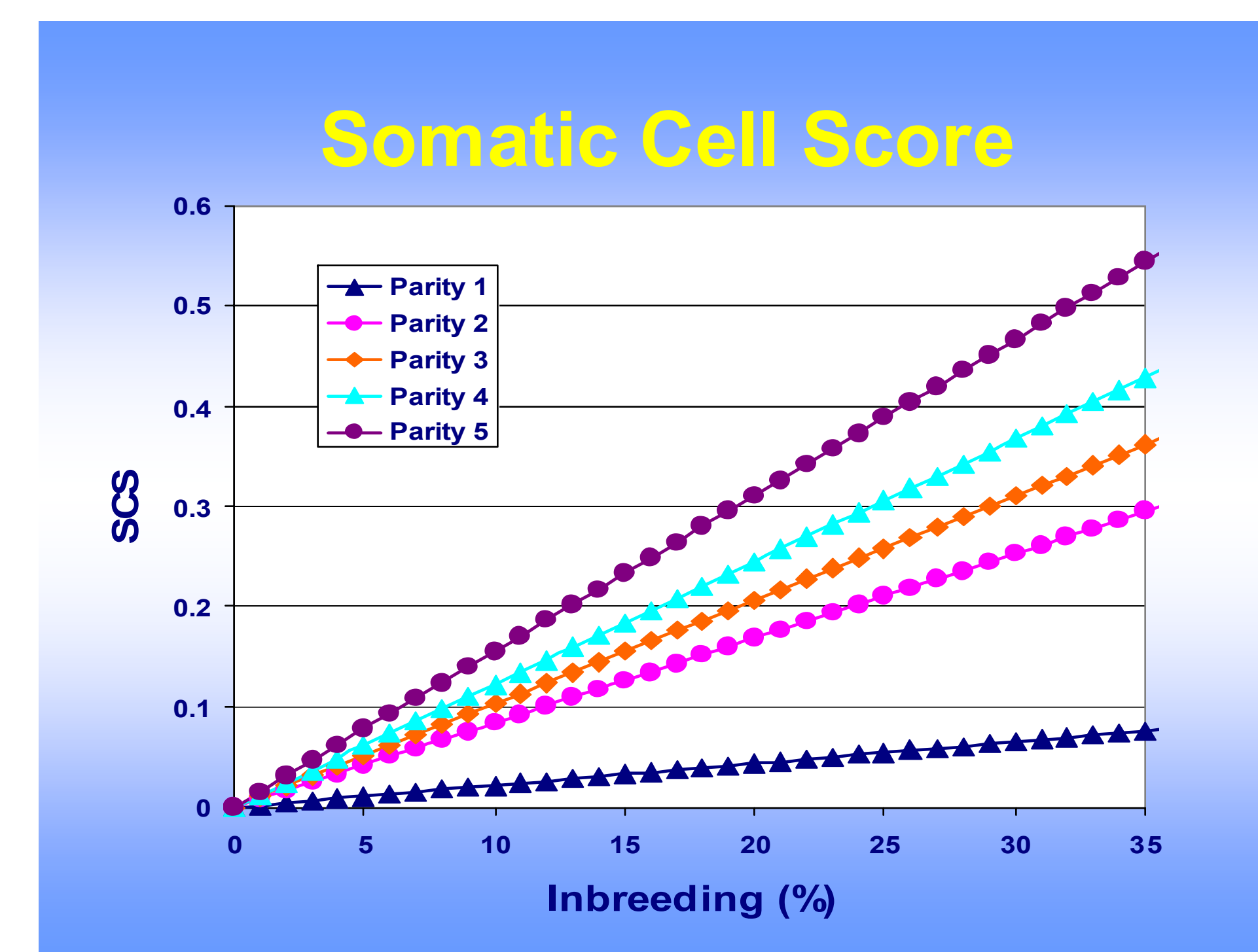












Fertility and Survival

- Per 1% increase in inbreeding
 - ↑ Age at first calving 0.2d (0.08d)
 - ↑ Calving Interval 0.7d (0.21d)
 - ↓ Survival 0.3% (0.10%)

Summary

- Inbreeding increasing by 0.1% p.a.
- Average Holstein-Friesian born 2005:
 - 4.9 CGEs
 - F = 1.48%
- A primiparous cow with 12.5% inbreeding:
 - ↓milk 62 kg
 - ↓fat 5.3 kg
 - ↓protein 1.2 kg
 - somatic cell score 0.03 units
 - calving interval 9 days
 - age at first calving 2.5 days
 - ↓survival 4% units



Conclusions

- Pedigree recording is improving in Irish dairy herds
- Inbreeding is increasing in Irish Holstein-Friesians
- Inbreeding negatively affects milk production, udder health, fertility and survival
- Unlikely to make a large financial impact
- May cause concern if inbreeding continues to intensify

Thank You

