Fertility - *Work in Progress*

Stephen Butler – Moorepark

Michael Diskin and Seamus Hanrahan - Athenry

teagasc
Agriculture and Food Development Authority

Sheep Reproduction Research at Athenry

- Genetic control of ovulation rate, litter size, conception rate & embryo survival
- Phenotypic & genetic variation in incidence of lambing assistance
- Two genes with major effects on ovarian function have been identified.
  - Ovulation rate increase
  - Homozygous carriers are sterile
- Recent evidence for putative new gene segregating in Cambridge population
  - Small effects on ovulation rate
  - May increase embryo survival
  - Localisation studies planned using 64 k SNP chip

Sheep Reproduction Research at Athenry

Artificial Insemination

Develop cost effective procedures to facilitate use of AI in sheep

Problems

- **Transcervical AI not usually possible in ewes**
- **Cervical AI with FT semen yields unacceptably low pregnancy rates**
  - **Ewe breed effects have been identified at Athenry**
- **High sperm dose usually required**
- **Seasonality of breeding**

Current Studies

- **Physiological basis for major ewe breed effect on pregnancy rate to cervical AI of frozen-thawed semen**
- **Diluents to increase semen lifespan**
- **Preg rate – sperm dose response curve for fresh semen**

Cattle Reproduction Research at Athenry

- Repeatability and heritability of metabolic hormones in the cow
- Effect of dietary restriction on gene expression in the anterior pituitary and hypothalamic tissues of cattle.
- Identification of uterine proteomic and genomic differences in dairy heifers with different levels of embryo survival rate
- Uterine and embryo gene expression of cows with high and low polyunsaturated fatty acid concentrations
- The effect of stage of cycle and steroid environment on the uterine proteome of the cow and differences from plasma.

Athenry Resources

Personnel

- Research Staff – Cattle 4, Sheep 1
- Walsh Fellows – Cattle 5 (1 finishing), Sheep 2
- Technicians – 2 field tech, 2 lab techs

Fully equipped Laboratories

- Endocrine
- Molecular
- Proteomic Labs

Animals & Facilities

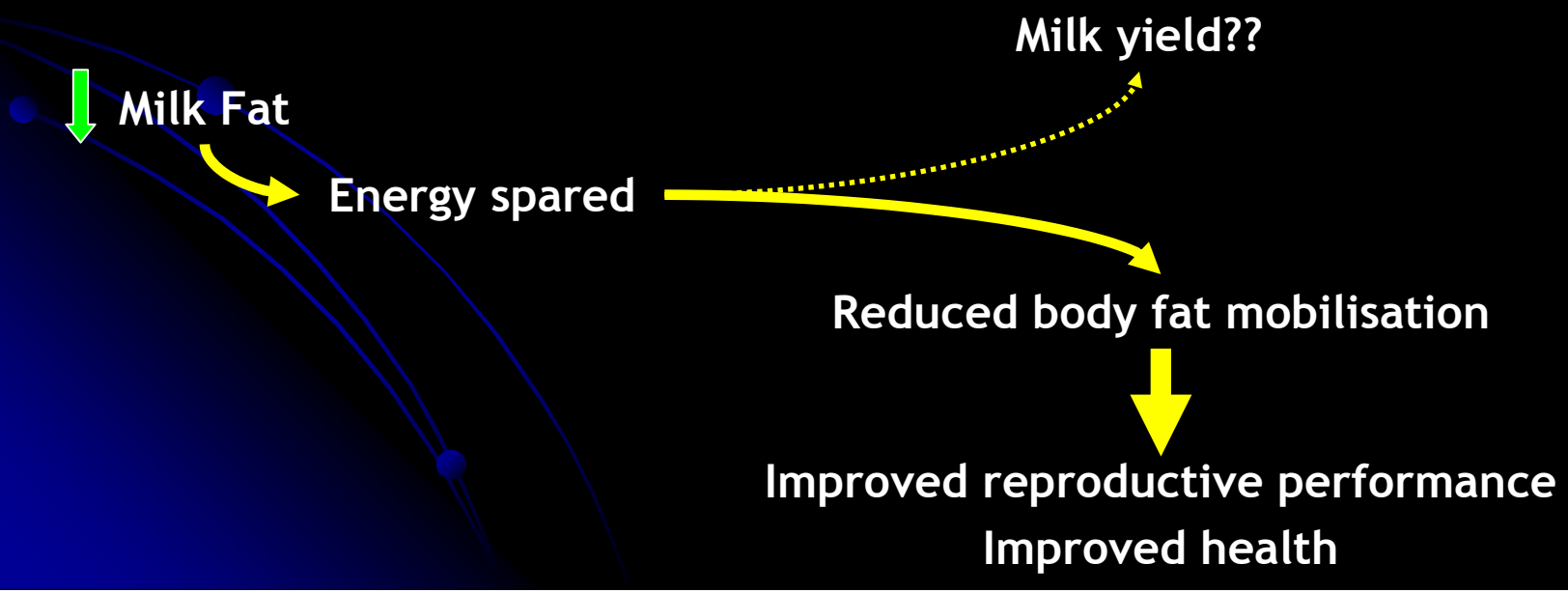
- 40 beef heifers + 120 dairy heifers
- Full surgery
- Individual feed spaces

Dairy Cow Reproduction - Moorepark

Heat detection/Submission rate (RMIS 5397)

- Heat detection aids
- Automated heat detection at pasture (activity)
- Oestrus and ovulation synchronisation
  - FTAI
  - Reverse slippage in MCD

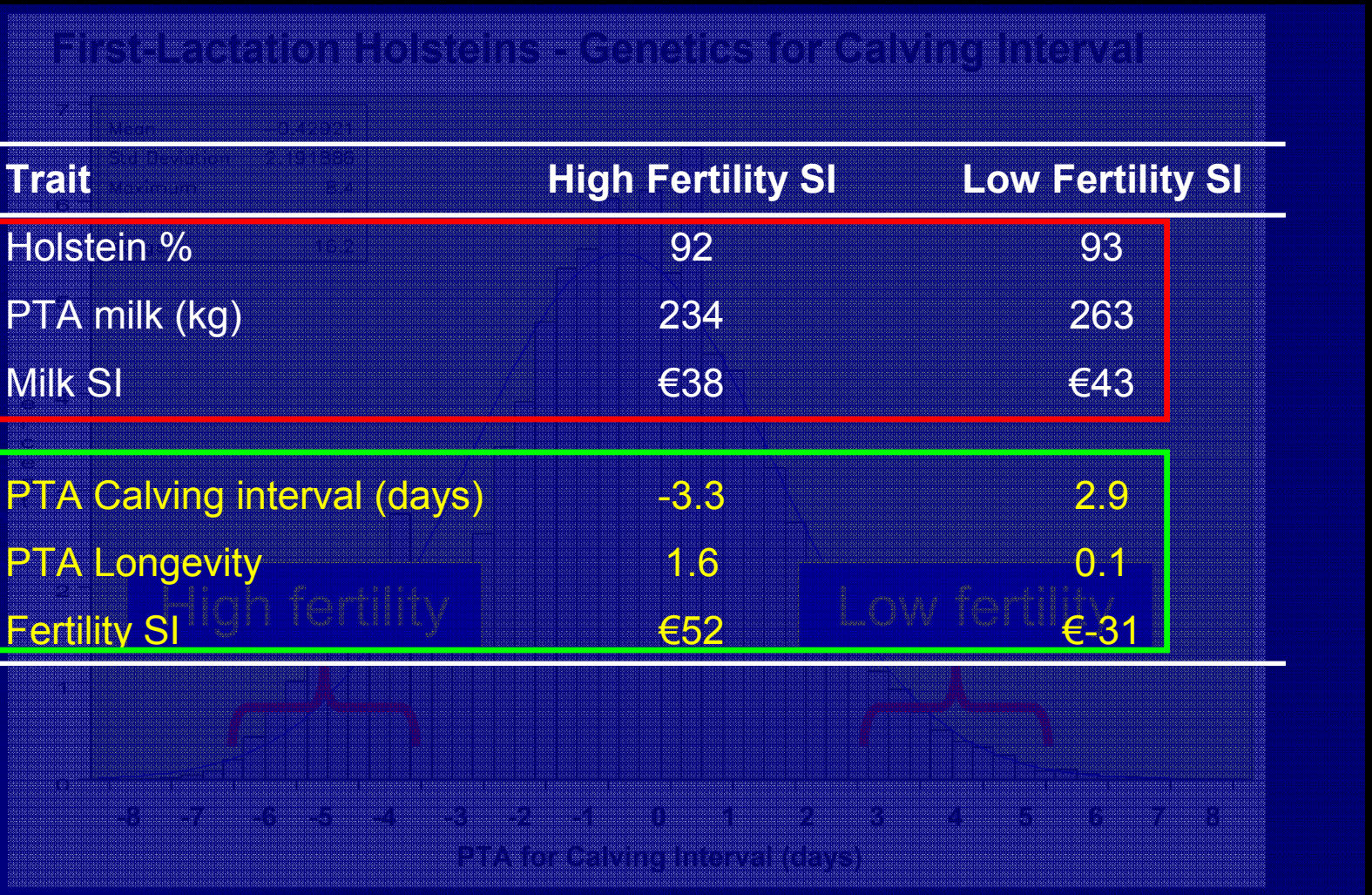
Nutritional approaches to improve fertility - CLA (RMIS 5890)



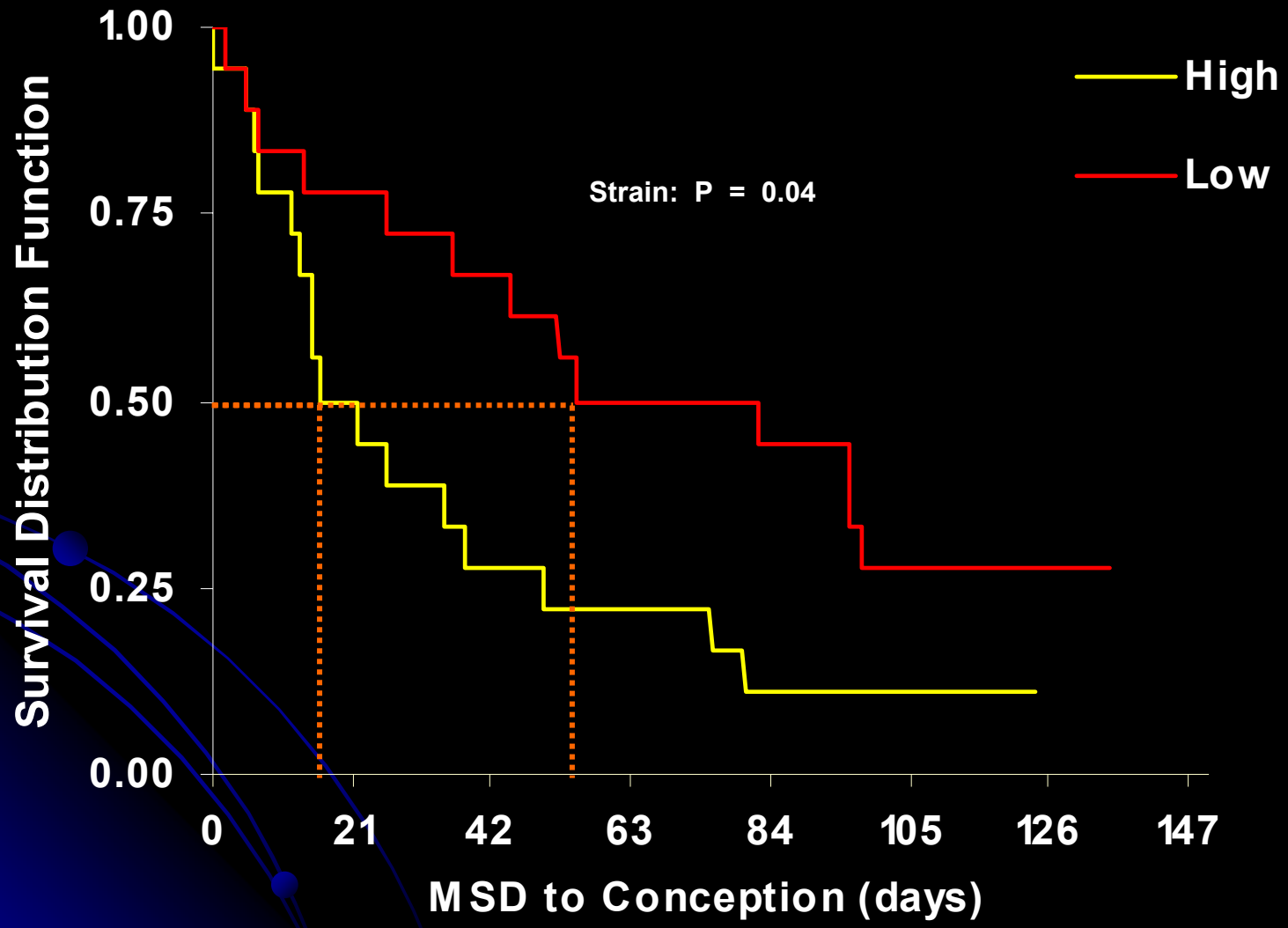
Dairy Cow Reproduction – Moorepark

High and Low fertility genetic model

Trait	High Fertility SI	Low Fertility SI
Holstein %	92	93
PTA milk (kg)	234	263
Milk SI	€38	€43
PTA Calving interval (days)	-3.3	2.9
PTA Longevity	1.6	0.1
Fertility SI	€52	€-31



Survival analysis



Ongoing work 2009

- MY, DMI, EB, BCS change
- Examine oestrus cycle (ovarian and hormonal changes)
- Challenges (e.g., IVGTT, GnRH challenge)
- Collect oocytes and embryos
- Collect biopsies of liver, adipose and muscle
- Uterine lavage

Resources

- Personnel
  - Research staff – 1
  - Walsh Fellows - 3
  - Technicians – 0 Field tech, shared use of MDPRC lab techs
- Animals
  - High and low genetics for fertility model
  - Different dairy breeds and crossbreeds
  - Access to commercial farms for field trials
    - Fully automated feeding system 500 cow herd
- Animal facilities and techniques
  - Fully automated feedshed (~70 cows)
  - Metabolism stalls (12 cows)
  - Tissue biopsies, OPU, embryo flushing, uterine lavage
  - Access to molecular lab facilities (L. Giblin - MFRC)

Future dairy cow research?

- What are the underlying physiological differences between high and low fertility lactating cows?
  - Must do more than look at SNP's
    - Identify novel genes and regions of DNA
    - Transcriptome of various body tissues
    - Proteomics/metabolomics approaches
  - Identify traits to select for improved fertility
    - BCS
    - Lower peak yield and improved persistency
    - Early resumption of cyclicity (P4) and observed oestrus (CSI)
  - Identify elite cows in the national herd
    - Generate potential AI sires using MOET
    - Reduce generation interval