

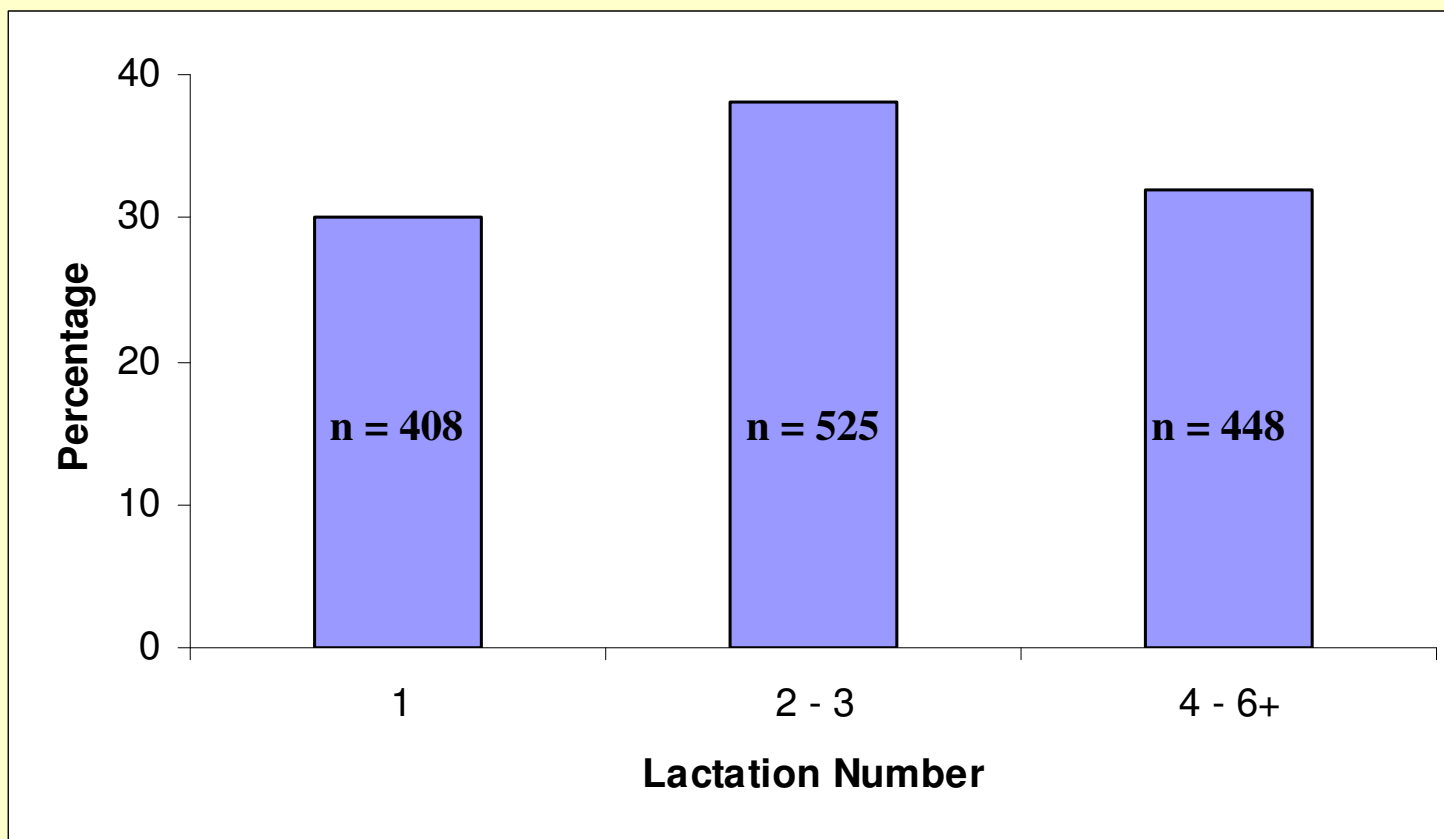


*Factors affecting heifer survival and fertility
on commercial dairy farms*

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Proportion of cows in herd according to lactation number (data from 8 UK herds, 2004)



Average number lactations for all milk recorded cows
in UK = 3.05 (Holstein UK, 2004)

Summary of losses in dairy cows – up to birth

Stage of life	Starting No.	% died	Reasons
Insemination	100		
Fertilization	90	10%	Fertilization failure, wrong time AI
Preg at 24d	54	40%	Early embryo loss
Preg at 2 mo.	43	20%	Late embryo loss
Late pregnancy	41	5%	Abortion
Alive at 24h post partum	38	8%	Perinatal mortality
Live Heifer	19	50%	Male calves

Summary of losses - 2

Birth to start of first lactation

Stage of life	Starting No.	%died/ culled	Reasons
Live Heifer	19		
Alive at 1 month	18	5%	Neonatal mortality and freemartins
Alive at 15 month	16	7%	Calf and juvenile mortality
Pregnant as heifer	15	3%	Conception failure
Calved successfully	15	5%	Fetal loss/abortion
Start first lactation	14	3%	Maternal death at calving

Perinatal Mortality in the UK

(Stillbirths and mortality in first 24 h of life)

Esslemont & Kossaibiti (2002): Monitored 52 herds over 10 year period:
Mean mortality 7.8%

RVC trial (2004-5): *Monitored all calves born on 19 herds over 2 month period, n = 1047 births: Mean 7.9% (range 3 – 14% between herds)*

Variable	Odds ratio	P	Proportion of calves
Calving assistance	4	0.001	Assisted: 19.1% Unassisted: 5.6%
Twin	3	0.001	Twin:18.5% Single: 7.0%
Dam parity	0.4	0.001	Multiparous: 5.6% Primiparous: 12.1%

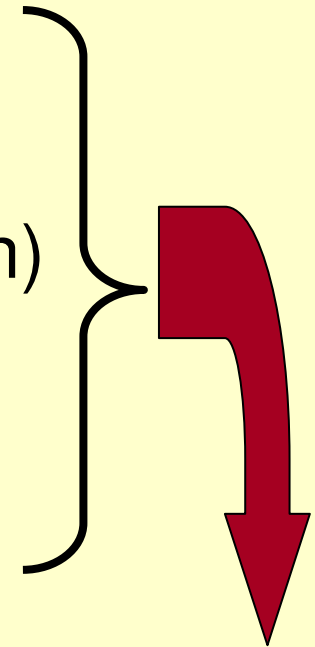
Neonatal and Calf Mortality

data from 509 heifers from 19 farms

	Timing	Mean	Herd Range
Neonatal	24h-1 month	3.4%	0-12%
Calf	1-6 months	3.2%	0-29%
Juvenile	6-15 months	3.5%	0-21%

Influences on neonatal and calf mortality

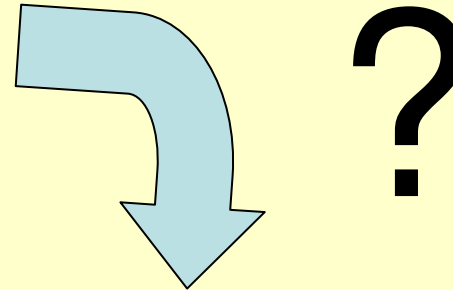
- Colostrum feeding
- Milk feeding (type, temperature, amount)
- Housing (ventilation, bedding, pen design)
- Weaning management
- Vaccination
- Size/maternal parity



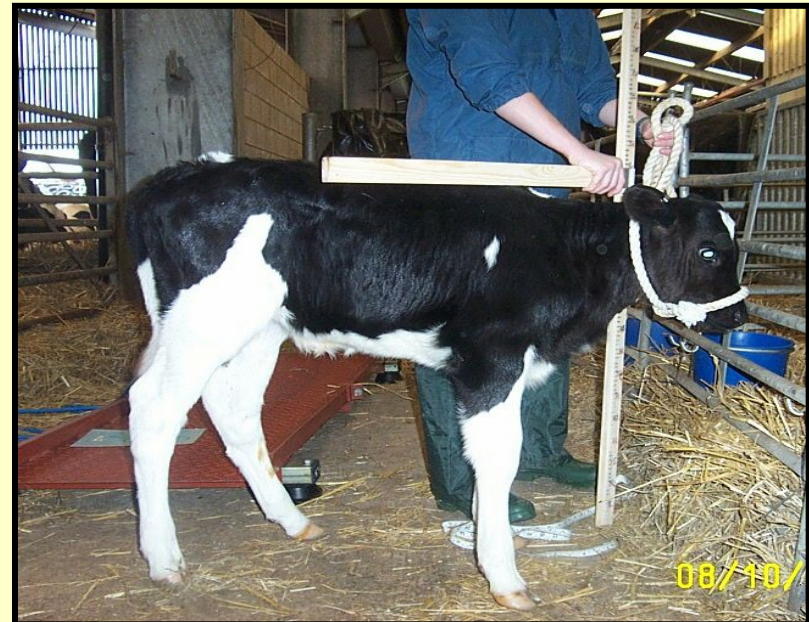
Likelihood of contracting:

- Enteric disorders
- Pneumonia

Is there evidence for pre-natal programming in the dairy cow?

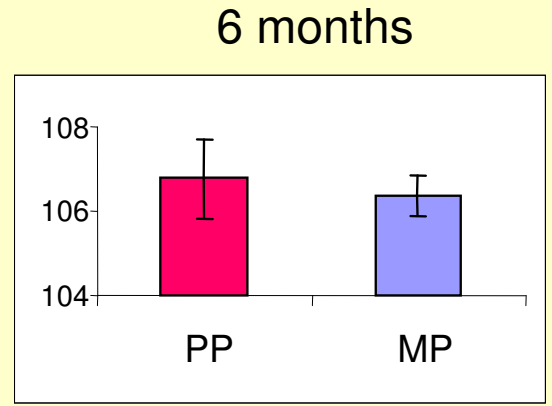
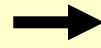
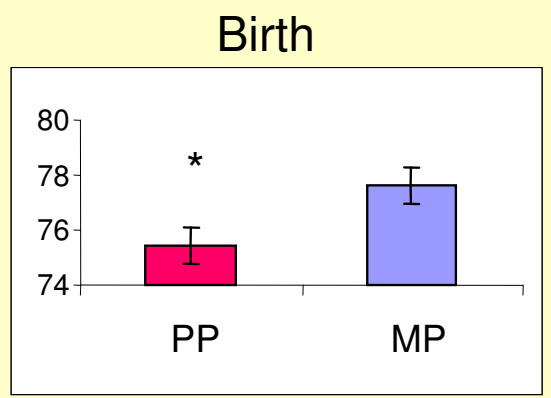


Mortality	PP	MP	P
Perinatal	12.1%	5.6%	0.001
Neonatal	5.9%	3.1%	0.12

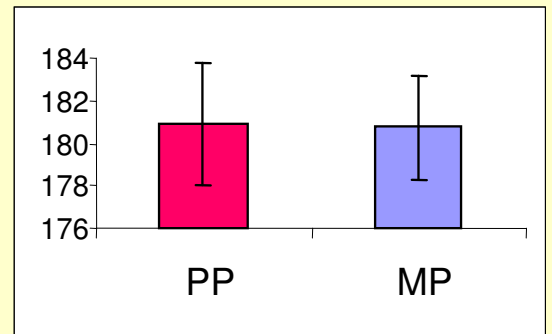
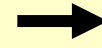
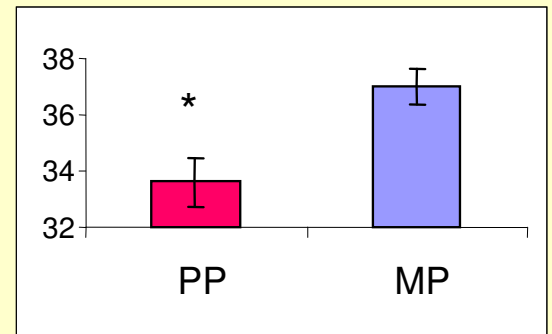


Effect of maternal parity on size of calf at birth and 6 months of age

PP n=40
MP n = 69



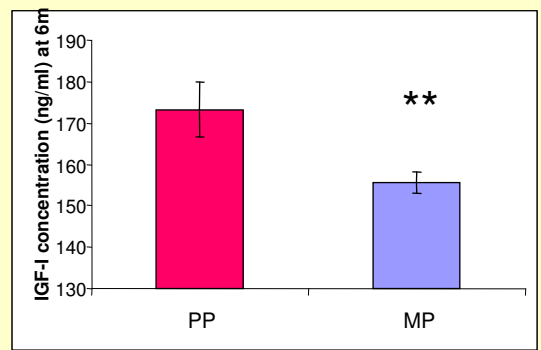
**Height
(cm)**



**Weight
(kg)**

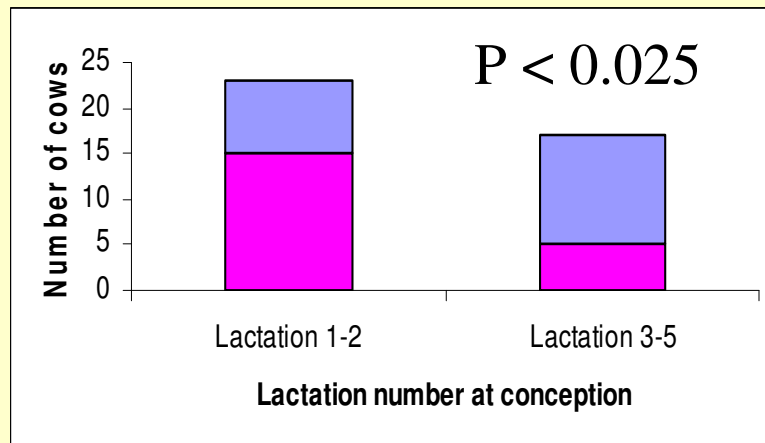
Offspring of PP dams are:

- smaller at birth
- exhibit catch-up growth
- this is associated with higher circulating IGF-I

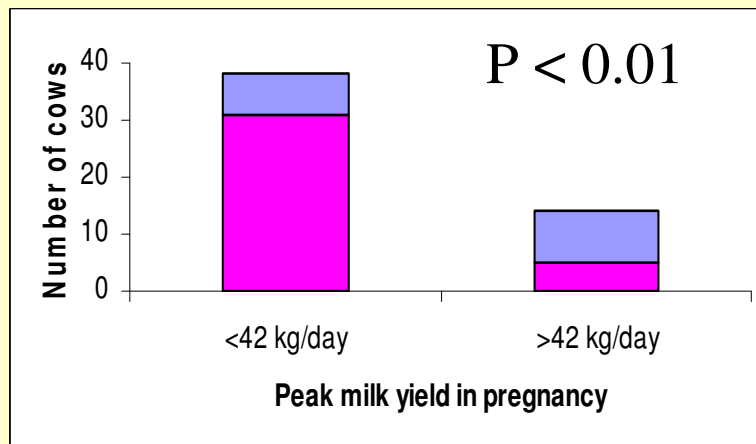


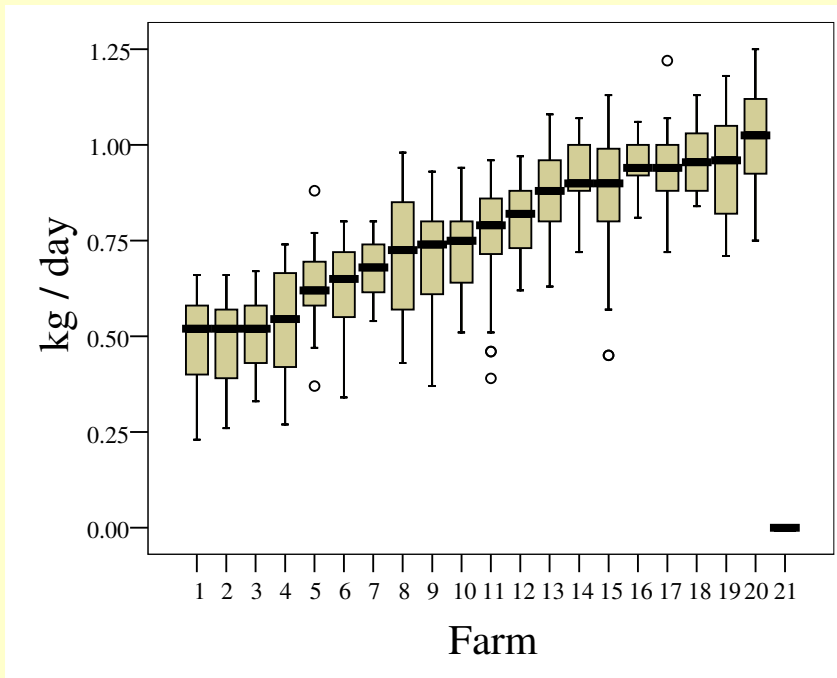
**IGF-I
(ng/ml)**

Effect of maternal age and peak milk yield in multiparous cows on the birth weight of their calves

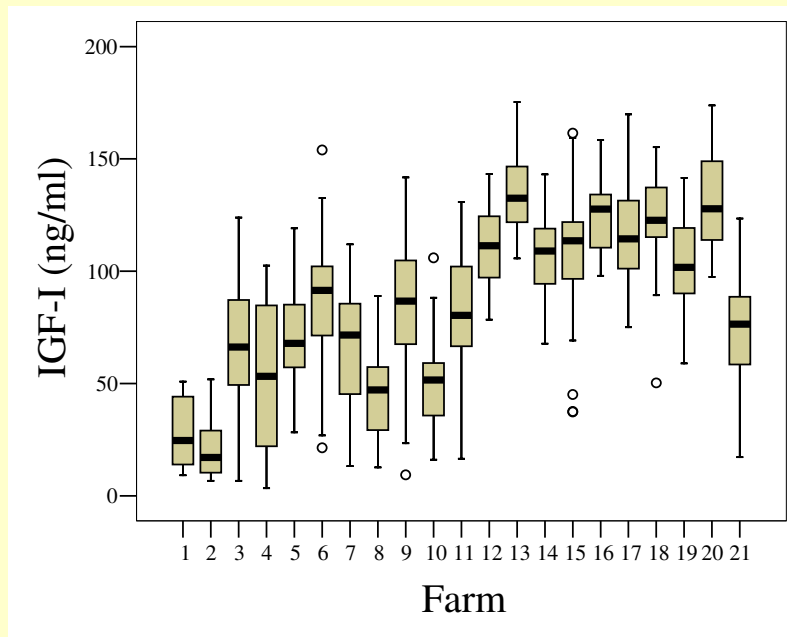
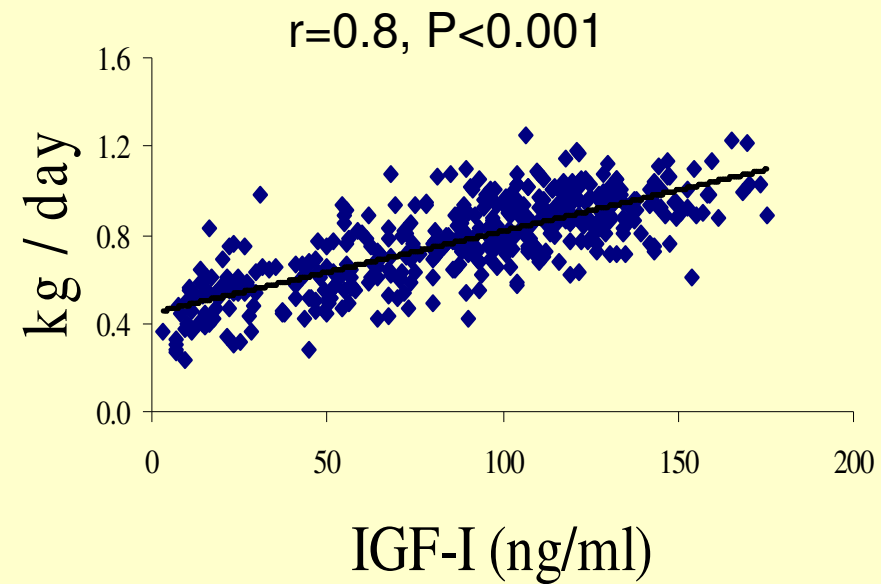


- Low BW (mean 32 kg, n=20)
- High BW (mean 42 kg, n=20)





Growth rates between 1-6 months and IGF-I at 6 months of calves on different UK farms



Calf sizes and growth patterns are very variable and relate to the IGF-I concentration!

Summary

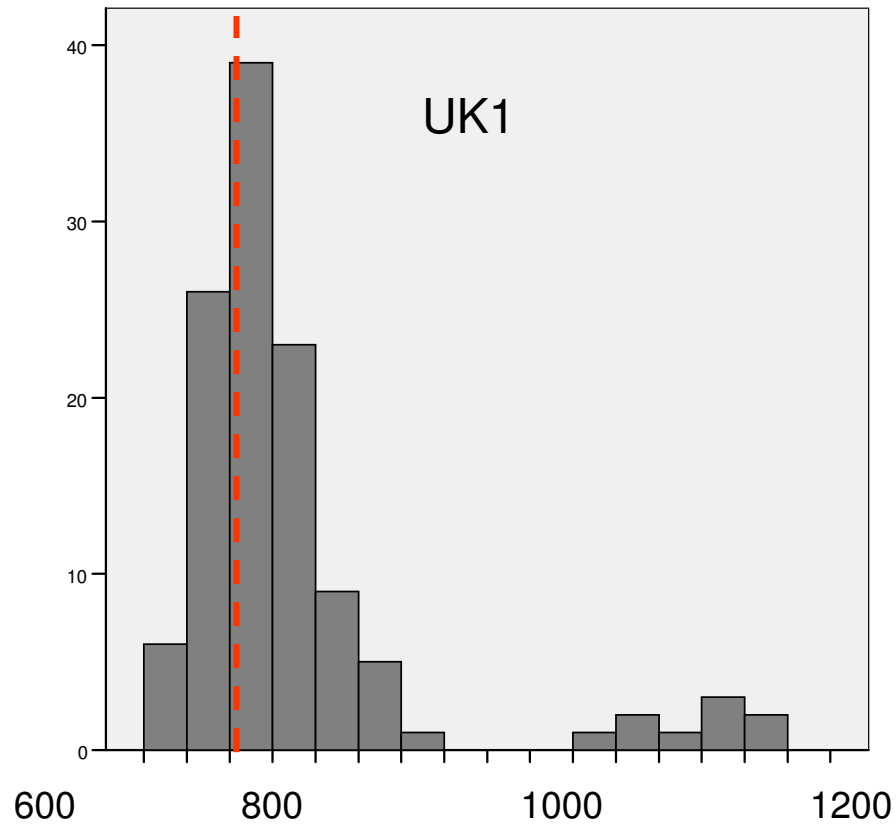
- Heifer rearing methods are very variable on UK farms
- Many potential replacement heifers never become productive
- There is often little veterinary input during the rearing process
- In practice, growth rates of individual animals on a farm vary considerably

Age at first calving



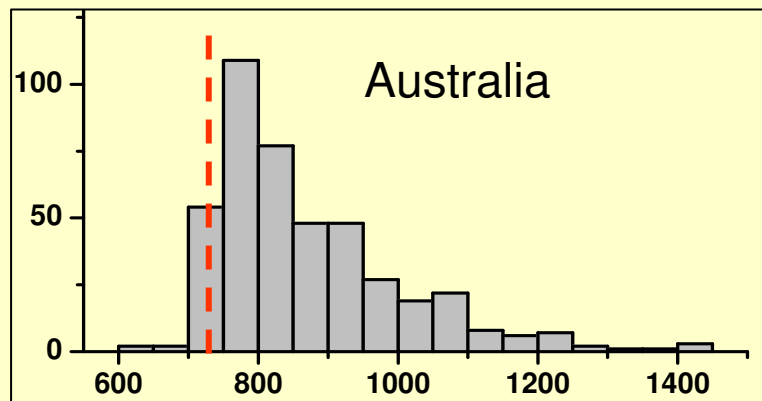
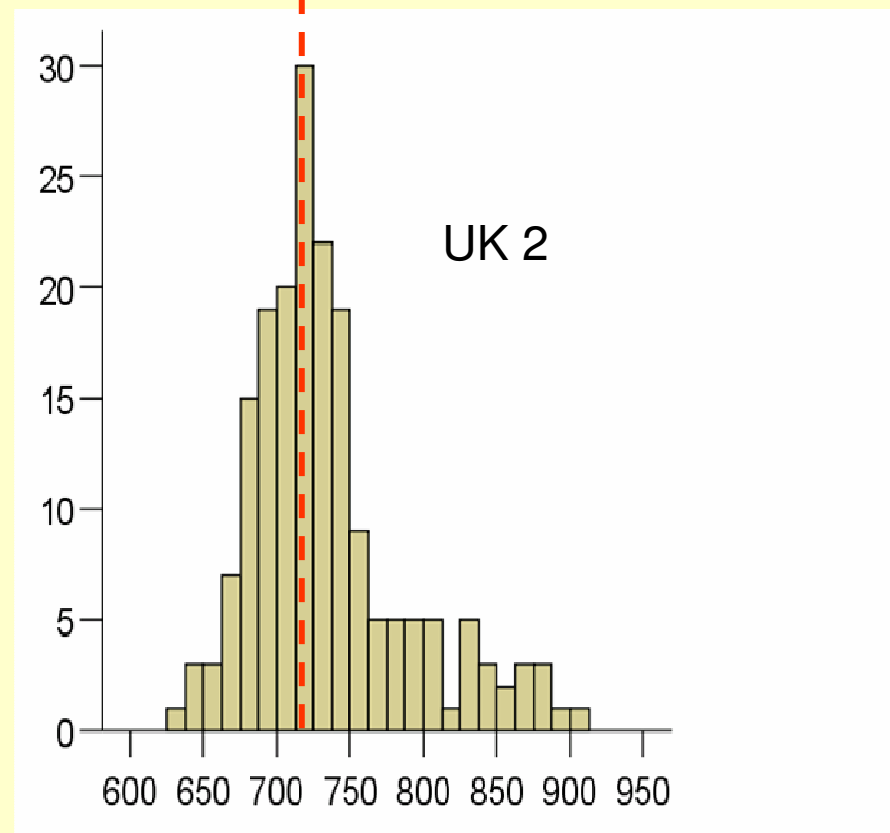
Question:

What is the optimum age and weight at first calving for maximum lifetime economic benefit?



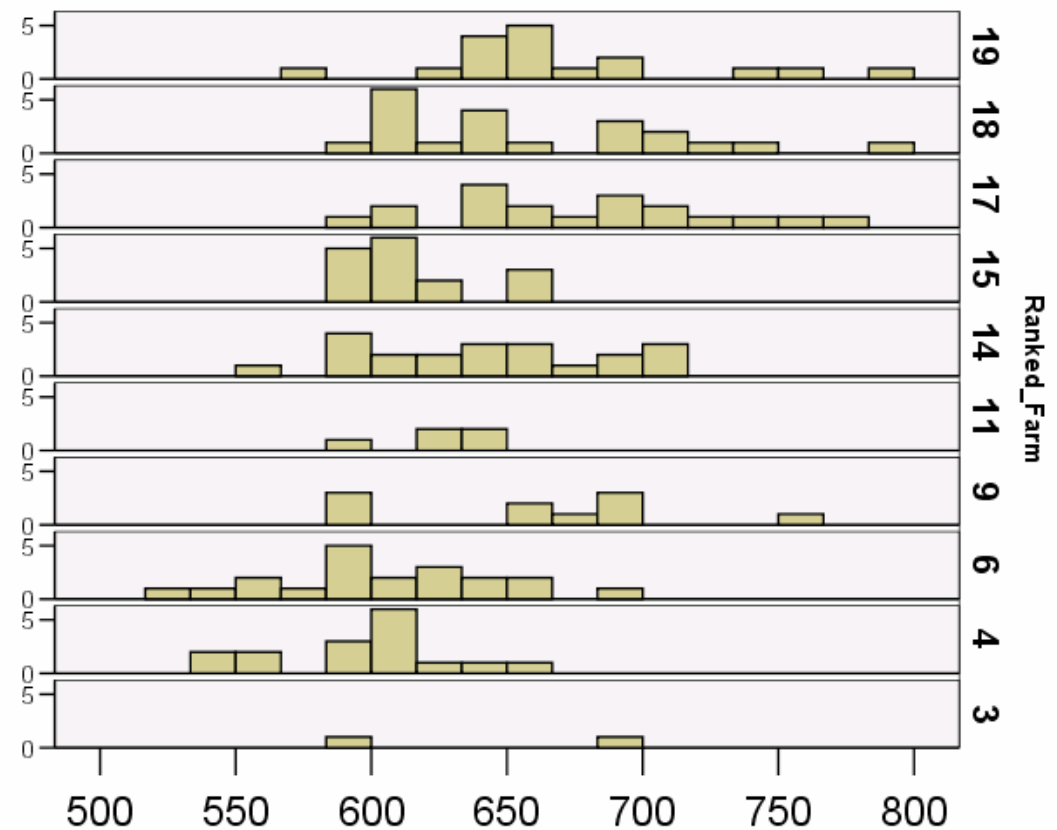
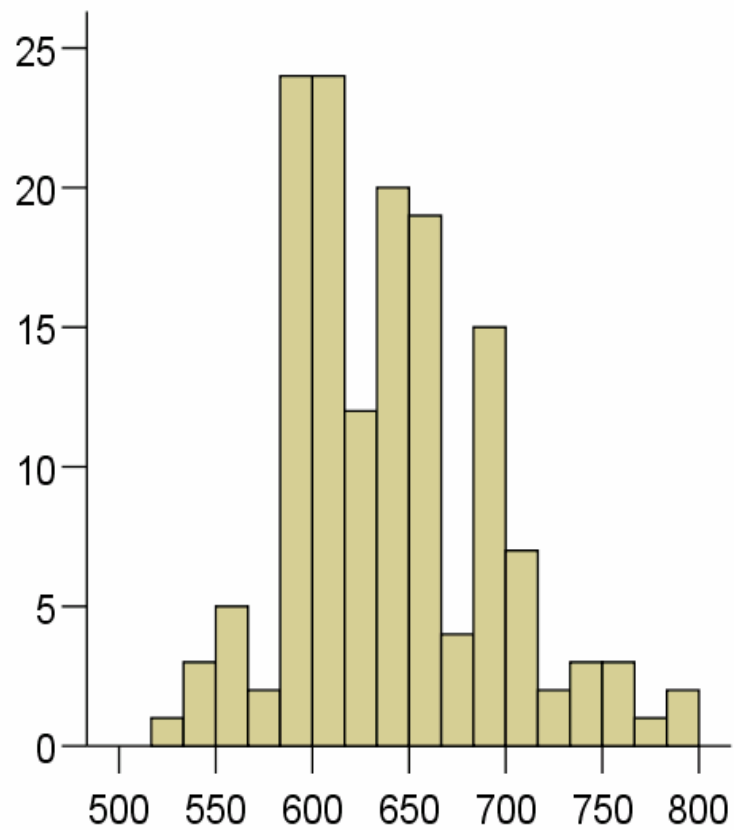
Frequency distributions for age at first calving (AFC) in days

2 years



Body Weight at Calving

n = 147, mean 639 kg, range 518 - 786 kg



kg

Relationship between age at first calving and heifer fertility in UK Holstein Friesian cows

	Age at First Calving			
	22-23 months	24-25 months	26-28 months	32-36 months
n	15	62	32	9
Services per Conception	1.1 ± 0.1^a	1.4 ± 0.1^a	2.4 ± 0.2 ^b	*3.3 ± 0.3 ^c
PD+ to first service	93%	73%	28%	0%
Age at 1st service	410 ± 5 ^c	444 ± 2 ^b	459 ± 5 ^a	456 ± 12 ^{ab}
Age at conception	411 ± 4 ^d	453 ± 2 ^c	502 ± 3 ^b	743 ± 43 ^a

a>b>c>d, P<0.05

* 2.3 ± 0.3 in the first service period and 1.2 ± 0.2 in the second service period.

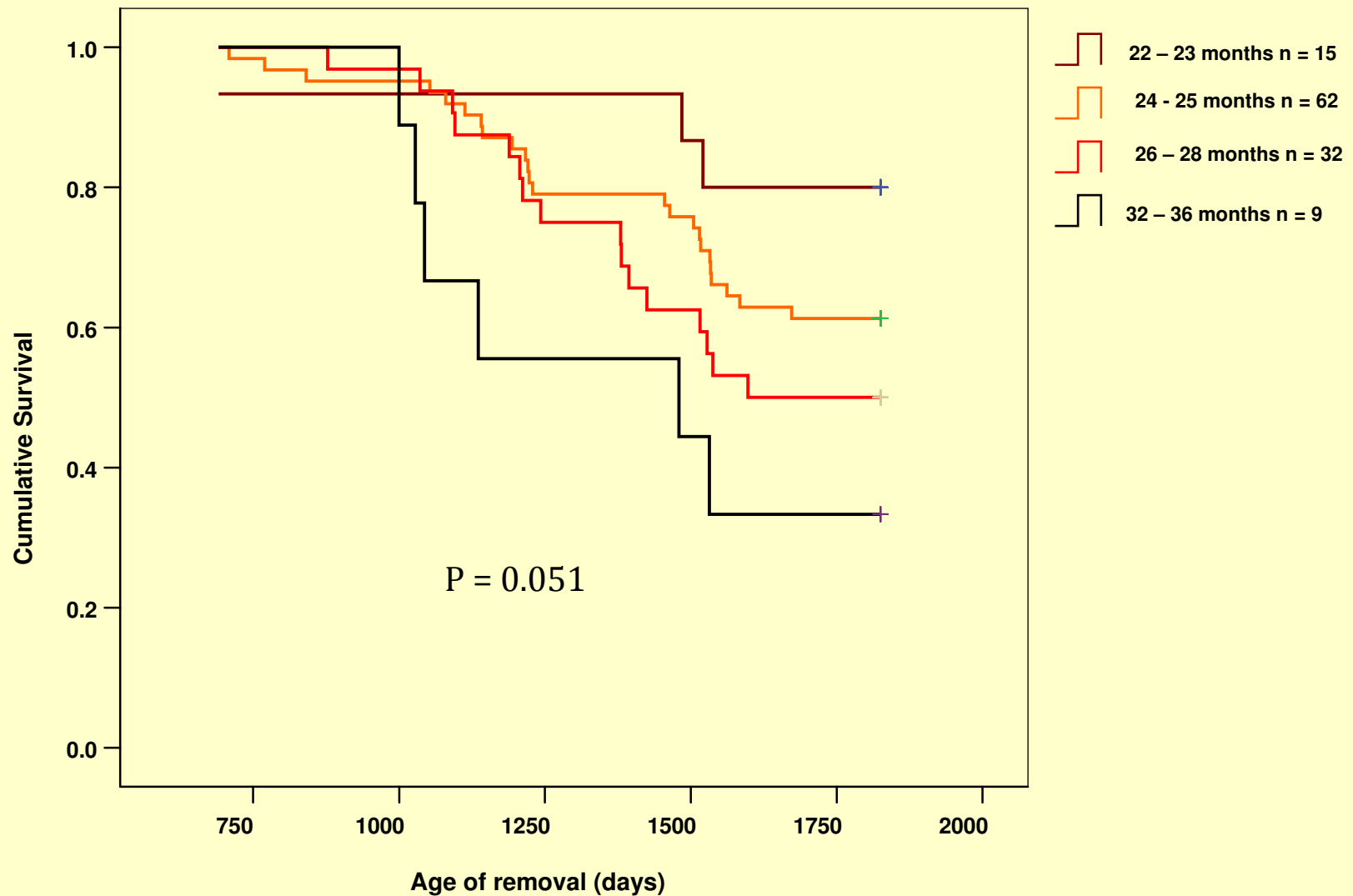
The effect of age at first calving on primi- and multi-parous reproductive performance

	Age at First Calving			
	22-23 months	24-25 months	26-28 months	32-36 months
No. at first calving	15	62	32	9
% calving assistance	17% ^c	16 % ^c	26% ^b	67% ^a
Days to CLA	18.9 ± 1.7 ^b	19.1 ± 1.2 ^b	32.8 ± 4.5 ^a	23.7 ± 1.9 ^{ab}
% abnormal P4 profiles	43% ^b	31% ^a	42% ^b	100% ^c
% conceiving to first service	36% ^a	46% ^a	38% ^a	20% ^b
Services per conception	2.6 ^b	2.2 ^b	2.6 ^b	4.4 ^a
No. at second calving	93%	89%	81%	22%

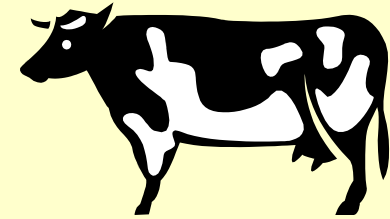
Effect of age at first calving on milk production

	Age at First Calving			
	22-23 months	24-25 months	26-28 months	32-36 months
Number	15	62	32	9
1st Lactation 305d Yield Kg	7643 ± 234	8514 ± 195	8020 ± 222	8550 ± 226
1 st Lactation Peak Yield Kg	30 ± 1.1	33 ± 1.0 ^a	31 ± 0.9	26 ± 3.8 ^b
Total DIM for 5 years	620 ± 49 ^a	588 ± 24 ^a	530 ± 30 ^a	290 ± 91 ^b
Total 5 year Milk Yield Kg	24711 ± 2357 ^a	21695 ± 1158 ^a	17433 ± 1481 ^b	7872 ± 2676 ^c
Proportion of life in milk	35 ± 3% ^a	35 ± 1% ^a	33 ± 1% ^a	17 ± 5% ^b

The effect of age at first calving on survival



AFC Conclusions



- Calving animals less than 2 years of age does not reduce reproductive performance or milk productivity therefore could increase profit through reduced rearing costs.
- Those animals showing poor fertility as nulliparous animals continue having a poor reproductive performance and poor productivity.
- Careful reproductive management of nulliparous animals can influence productivity and profitability.

Juvenile predictors of adult performance



Methods

- Recruit newborn calves
- Assess size and metabolic parameters during rearing
- Track from birth through to end of second or third lactation

Assess effects of the following on fertility, production and longevity

- Genotype
- Heifer rearing regime
- Age and weight at start of first lactation

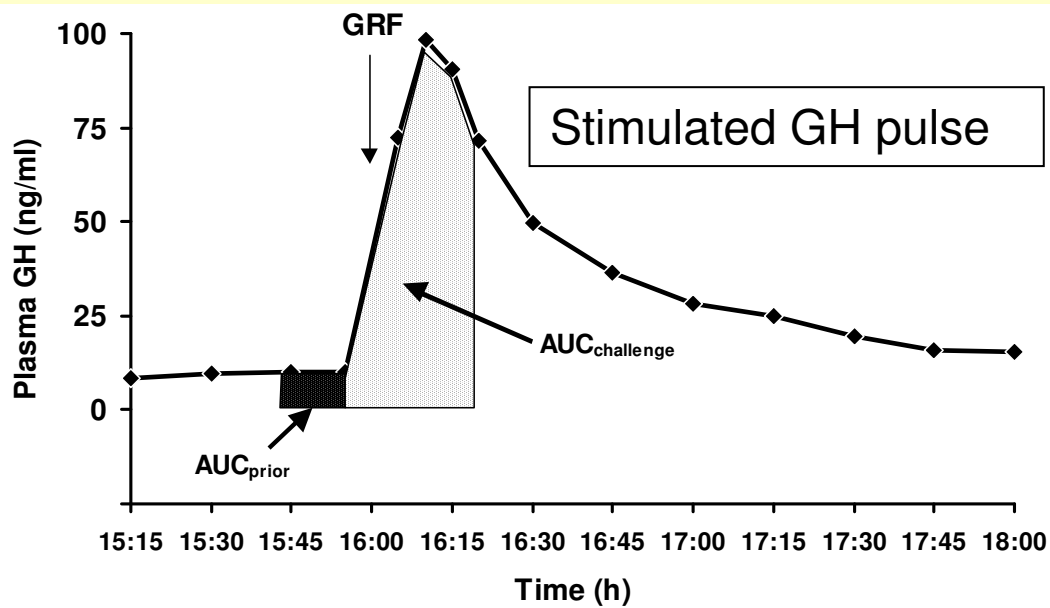
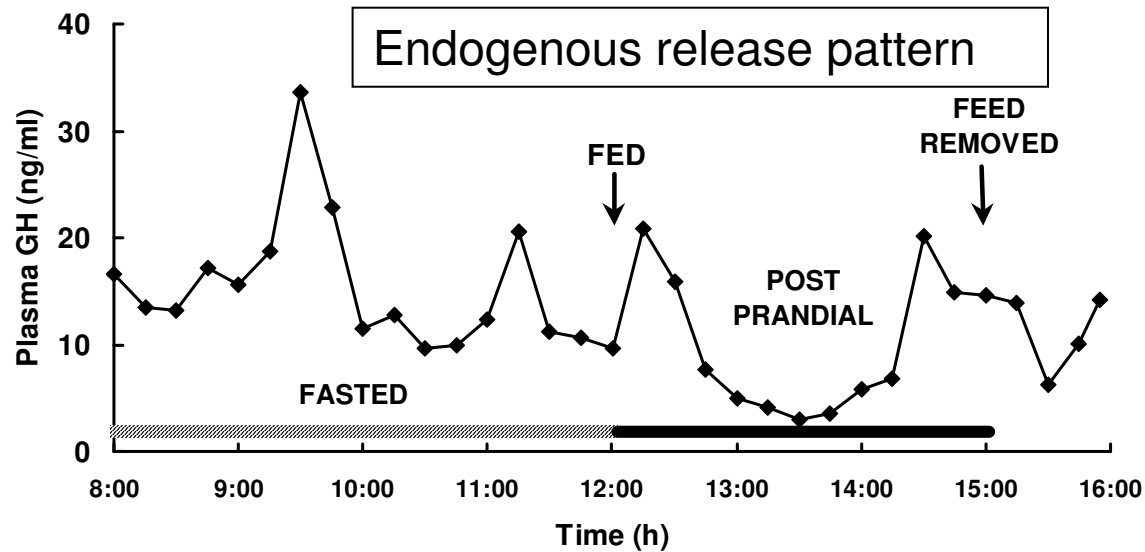
Characteristics of maiden heifers which failed to conceive

Size at 9 months	Conceived n = 92	FTC n = 8	P
Weight (kg)	259 ± 2.4	238 ± 10.5	0.05
Height (cm)	115 ± 0.3	111 ± 1.4	0.01
CR length	154 ± 0.7	145 ± 3.4	0.01

FTC calves were significantly smaller at 9 months

Cows which fail to conceive in first lactation

Factor	Conceived n = 81	FTC n = 13	P
As maiden heifer			
Services per conception	1.6 ± 0.1	2.2 ± 0.3	0.05
Age at conception (days)	462 ± 4	485 ± 13	0.03
Pre-calving			
BCS	2.3 ± 0.06	1.8 ± 0.13	0.005
BW (kg)	625 ± 6	593 ± 15	0.04
IGF-I (ng/ml)	159 ± 4	123 ± 11	0.001
In first lactation			
Proportion normal P4 profiles	72%	23%	0.01
Milk yield AUC wks 8-20	333 ± 8	273 ± 18	0.01



Assessment of GH profile at 6 months in relation to future performance

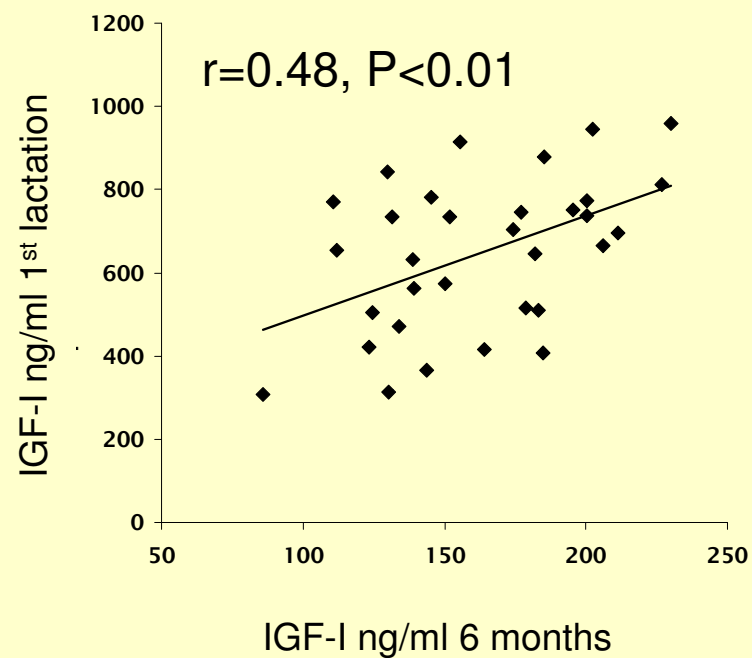
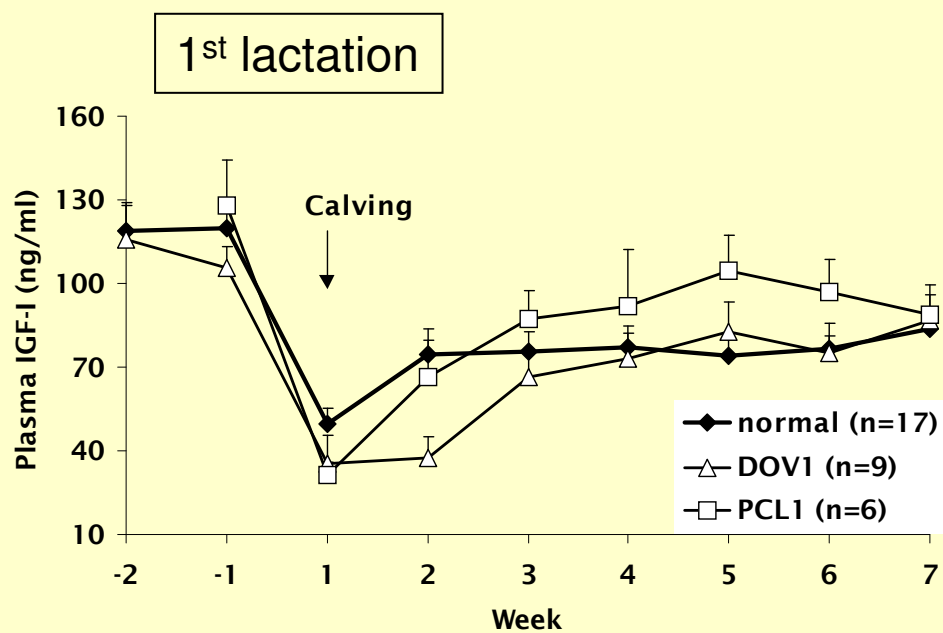
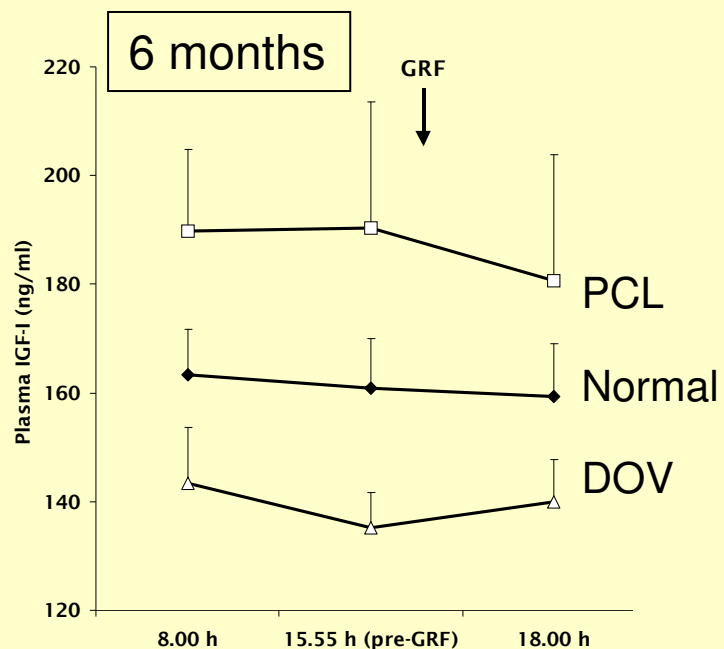
*Taylor et al. (2006)
Domestic Animal
Endocrinology 31,
1-18*

Correlation coefficients between the GH release in response to a GRF challenge in pre-pubertal dairy heifers and their subsequent milk production parameters

	n	Lactation parameter	GH peak10 r
1 st lactation	38	Peak yield (kg/day)	0.18
		305 d yield (kg)	0.16
		Milk energy 4 months (MJ)	0.43 ^{**}
Lactations1-3	23	305 d yield kg	0.06

Taylor et al. (2006) Domestic Animal Endocrinology 31, 1-18

Pre-pubertal IGF-I and fertility in 1st lactation



Taylor et al. (2004) JOE 180, 63-75

Summary of factors affecting lifetime performance

	TOP	AVERAGE	POOR	WORST
Calf growth	High	Average	Poor	Variable
Heifer fertility	1.1 S/C	1.5 S/C	2.5 S/C	3+ S/C
AFC months	21-23	24-25	26-30	30+
PP cow fertility	Average	Good	Average	Very poor
1 st lactation yield	>8000 kg	>7,500 kg	>6,000 kg	<6,500 kg
Survival to 5 yrs	80%	60%	50%	30%
Total milk in 5 yrs	24,000 kg	22,000 kg	17,000 kg	8,000 kg

Acknowledgements



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Barney Jones



**All the co-operating
farms and people
who have helped
with sample
collection**

