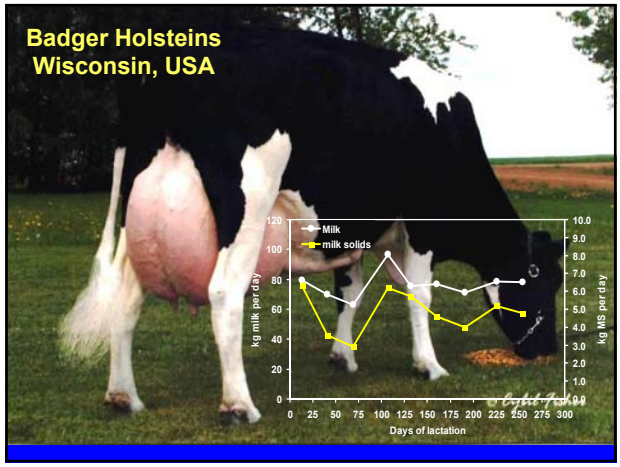
A CHALLENGE

Managing the Fertility and Health
Of
High Producing Dairy Cows

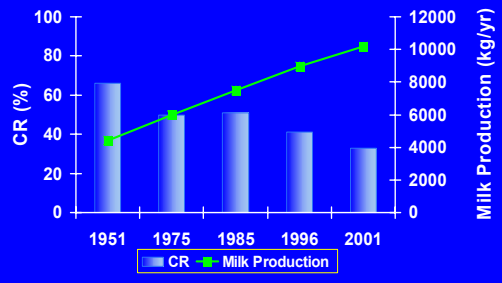
K.L.Macmillan
University of Melbourne



Milk Yield, Health and Fertility

- Milk yield increases have been impressive consequences of the "internationalisation" of genetic improvement
- This has been combined with improved cow nutrition for production
- Yet, declines in cow health (as reflected by reduced lactations/cow/lifetime) are also occurring in most industries
- Major causes are associated with peri-parturient diseases, udder health and lower fertility

Milk Production and Fertility in Dairy Cows (NE USA)



Reproduction in High-Producing Herds

- Summaries of reproductive records for herds of different levels of production suggest negligible effects of milk production on reproductive efficiency. (Lucy, JDS 2001).
  - Nebel and McGilliard, JDS, 1993.
  - Stevenson, Hoard's Dairyman, 1999.
  - Morton, InCalf, 2004.
- The improved reproduction in high-producing US herds probably reflects better feeding, healthier cows, and better reproductive management. (Lucy, JDS 2001).

Risk Factors for Conception

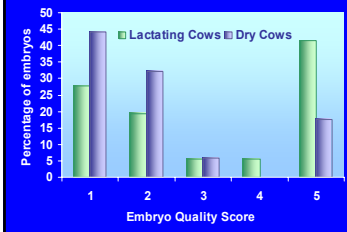
First 60-d Milk Yield (kg)	Hazard Ratio
≤ 1582	1.00
1583 - 1891	0.99
1892 - 2195	1.01
2196 - 2541	1.01
> 2541	0.92

Source: Gröhn and Rajala-Schultz, 2000

The "fertility decline" would seem to be "genetically linked" to the changes associated with selecting for higher milk yield. Fertility changes are much less in non-lactating cows and in heifers.

Embryo Responses: Dry vs. Lactating Cows

Response	Dry	Lactating
Fertilization Rate	89.5%	87.8%
% Grade 1-3	82.3%	52.8%



Embryos from lactating dairy cows are inferior to embryos from dry cows as early as 5 days after ovulation!

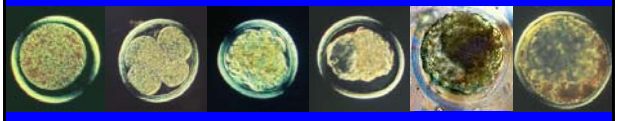
Criteria for Determing Pregnancy and Early (EEM) vs Late (LEM) Embryonic Losses

Status	Day 0	Day 21-24	Day 35
Pregnant	P_4 < 3.5[a] ng/ml	P_4 > 5 ng/ml	PSPB +
EEM / Non-FERTILIZ.	P_4 < 3.5 ng/ml	P_4 < 5 ng/ml	2nd Service/ Non-Preg
LEM	P_4 < 3.5 ng/ml	P_4 > 5 ng/ml	PSPB -/ Non-Preg

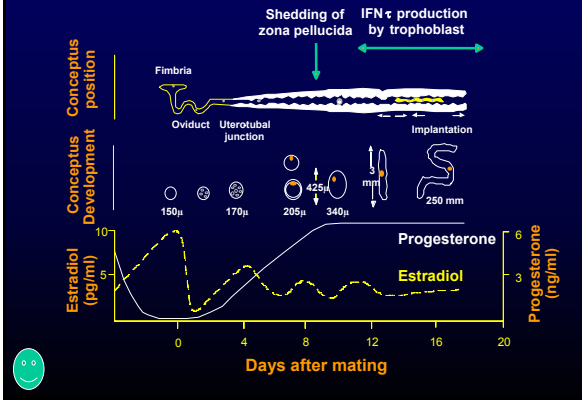
Pregnancy Rate and Early (EED) vs Late (LED) Embryonic Death in Lactating Dairy cows

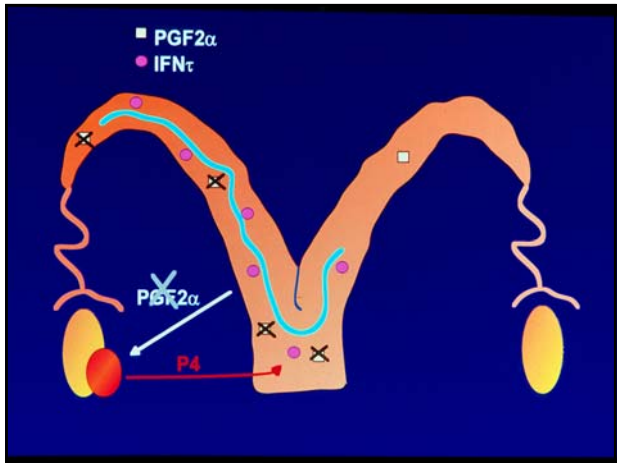
Pregnancy Rate	EED	LED
42.7% (559/1395)	31.6% (441/1395)	14.7% (209/1395)

Embryo Development



Bovine Peri-Implantation Events





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Rate of Embryo Loss from Days 27 to 45 in "Pregnant" Holstein Cows

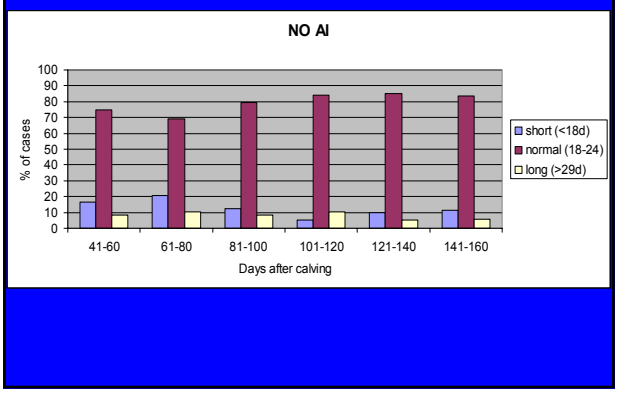
Study	Cows	Test days	Interval	% loss
1	195	28 & 42	14	18
2	139	27 & 45	18	21
3	1503	31 & 45	14	13
4	203	28 & 45	17	16
5	360	31 & 45	14	11
6	220	27 & 41	14	10
7	176	31 & 45	14	10
8	167	28 & 39	11	11
Average	2971	27 to 45	11 to 18	13

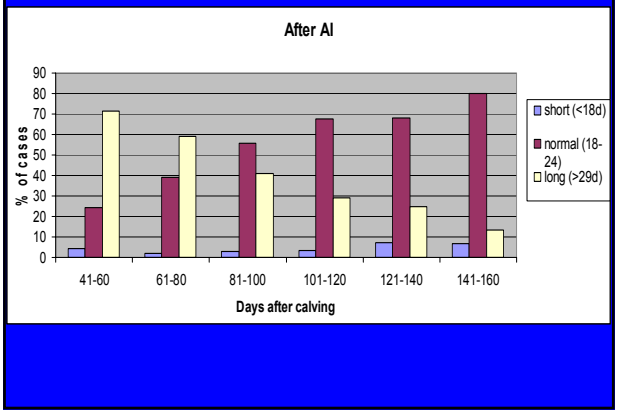
Rate of Embryo & Foetal Loss from Day 28 up to Day 98 in "Pregnant" Holstein Cows

Study	Cows	Test days	Interval	% loss
1	211	32 & 74	42	14
2	171	28 & 90	62	17
3	1601	28 & 98	70	20
Average	1981	28 to 98	42 to 70	18.8

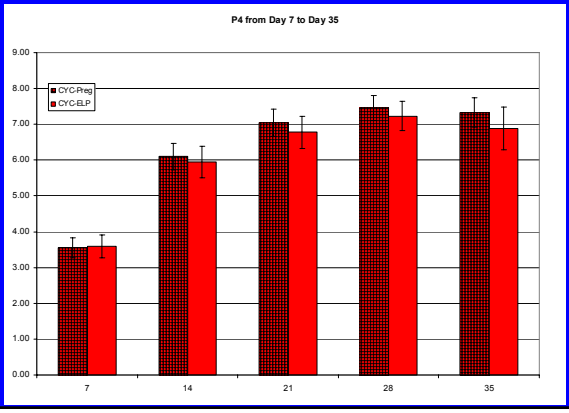
Why are the embryos dying?

- Abnormal genes? *Unlikely*
- Abnormal uterine environment? *Likely*
- But the energy requirements of the embryo are minimal !!
- *Is there a conflict between uterine/embryo requirements and udder demands for lactation?*
- When the embryo dies after Day 17, the cow does not show oestrus for a prolonged period





Results (progesterone, CYC)



The decline in fertility could be linked to other health issue

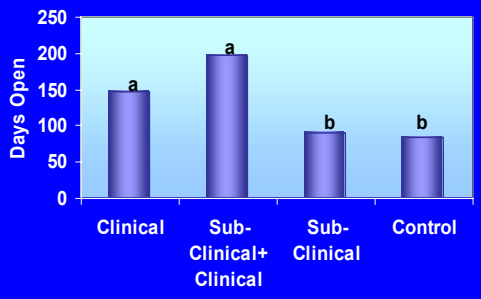
Cow Health and Fertility

Condition	*Odds Ratio*	*Conc Rate*	*Range*
Normal (healthy)	1.00	50	40 – 60
Chronic metritis	0.63	32	1 – 23
Acute metritis	0.68	34	6.5 – 8.3
Retained placenta	0.72	37	4.5 – 8.6
Ketosis	0.90	46	7.4
Lameness	0.83	43	<1 – 4
Ovulatory dysfun.	0.71	36	2 - 9

Effect of Mastitis on Risk of Abortion in Dairy Cows

Factor	Adjusted Odds Ratio	95% Confidence Interval; P ≤ 0.05
Mastitis		
No	1.0	
Yes	2.7	1.3 - 5.6

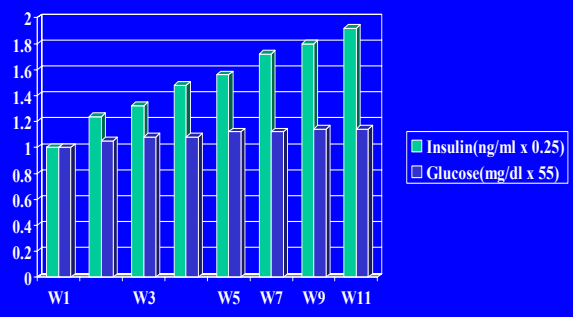
Mastitis During The Breeding Period



What hormonal changes have occurred with selection for increased milk yield ?

- Somatotrophin (bST) concentrations have increased
- Insulin concentrations have decreased
- IGF-I concentrations have decreased
- BOH, urea and NEFA have increased
- Glucose has hardly changed

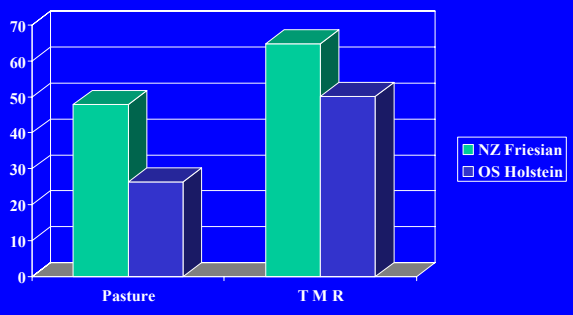
Understanding High GM Holsteins (Spicer et al., 2002)



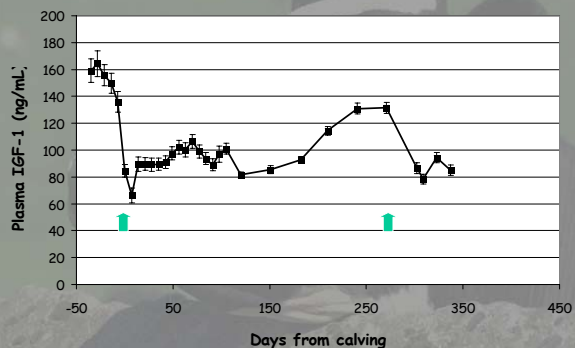
IGF-I is a potentially useful indicator of energy balance and energy partitioning.

It may be a useful "genetic marker" for yield and fertility, especially in pasture-fed herds.

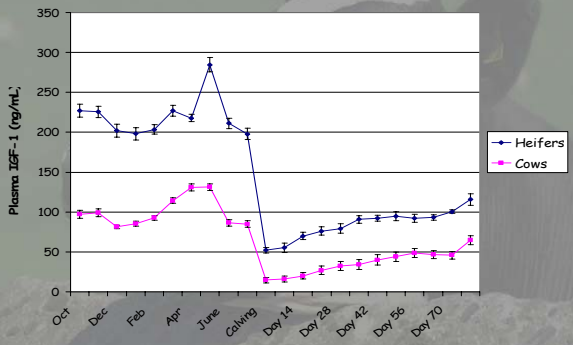
Insulin-like Growth Factor-1; IGF-1



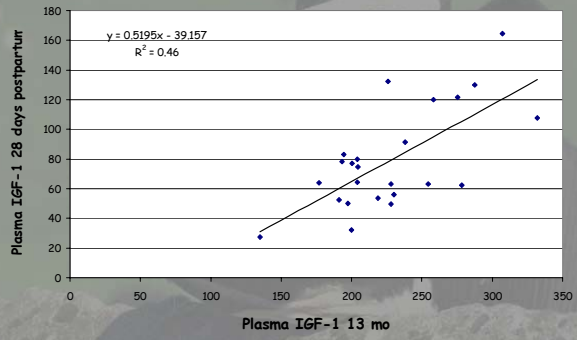
Entire lactation IGF-1



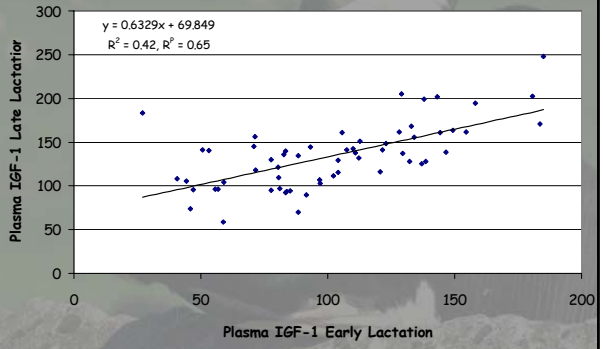
Effect of age



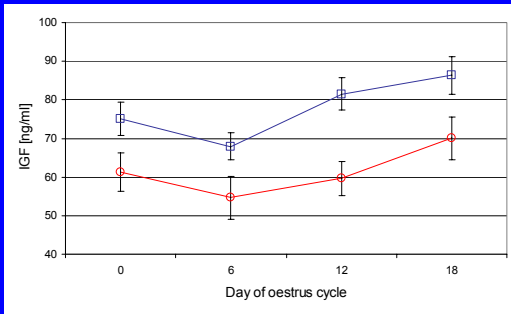
Heifer repeatability



Repeatability within season

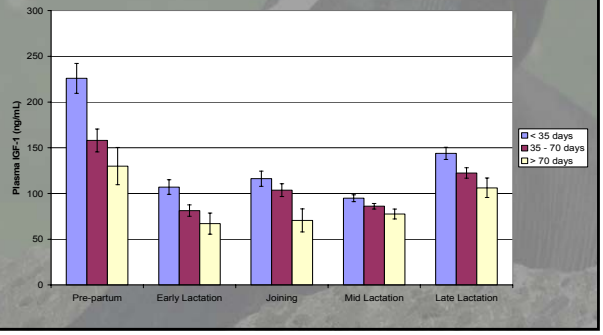


IGF- Results (AA vs CYCLING)



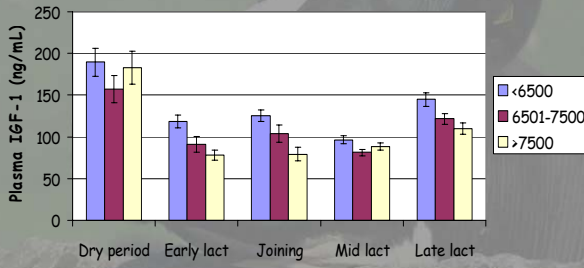
Relationship with fertility

- Interval to first ovulation



Relationship with Production

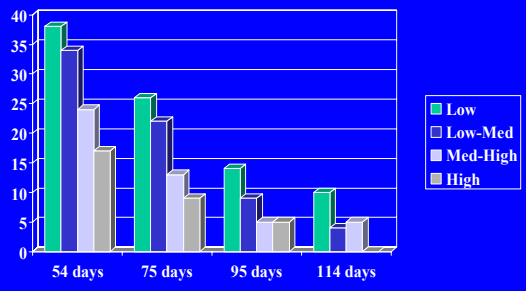
- annual milk yield



Reproductive performance is also linked to milk composition.

The cows within a herd with the lowest milk protein % have the poorest reproductive performance

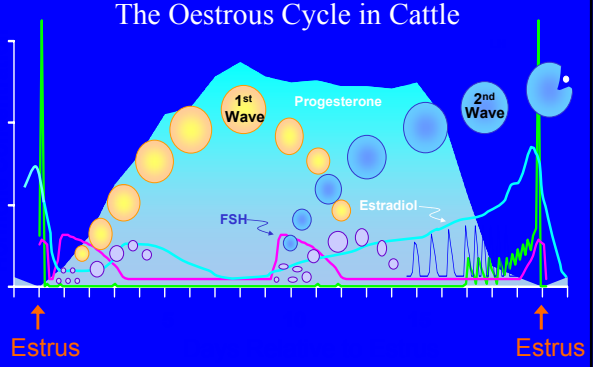
Incidence of Anoestrus x Postpartum Interval x %P



How can we improve cow health and reproductive performance?

Is there a price to pay for higher production?

The Oestrous Cycle in Cattle



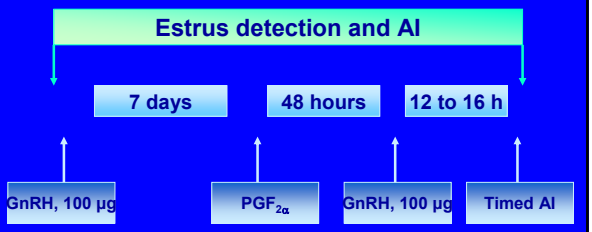
Controlled Breeding Programs

- Controlling follicle development
- Regulating the length of the cycle
- Synchronising ovulation
- Timed AI – no oestrus detection
- Stimulating embryo development
- Early pregnancy testing
- Re-synchronising non-pregnant cows

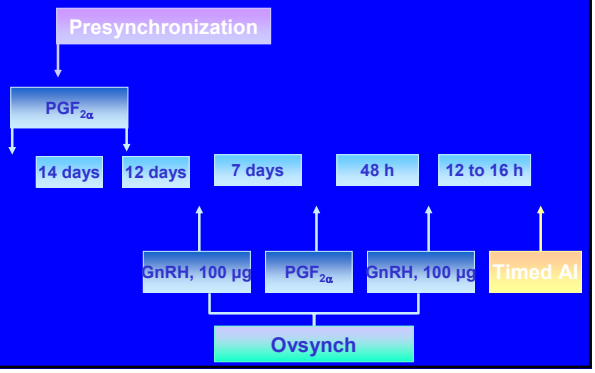
Higher Producing Lactating Dairy Cows

- Larger or same size preovulatory follicles
- Lower oestradiol concentrations
- More multiple follicles and double ovulations
- Lower duration of mounting activity

Ovsynch Protocol For Timed AI

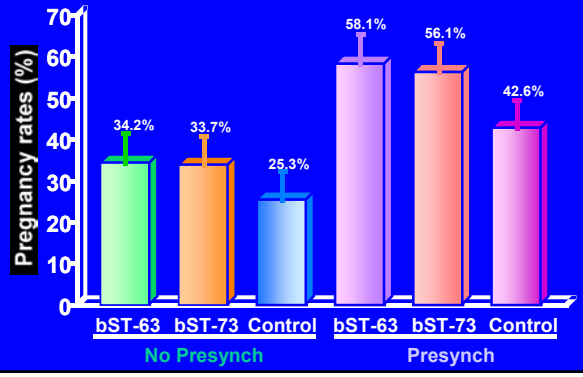


Presynch/Ovsynch Protocol For Timed AI In The First Postpartum Service

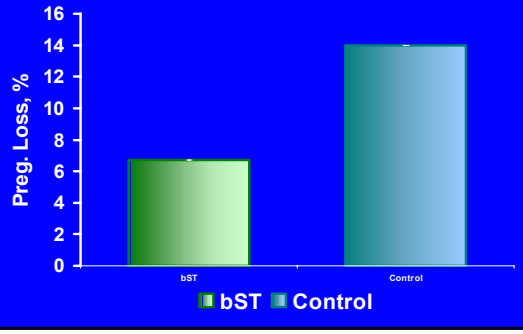


Treatment With bST Associated with Reproductive Protocols Improves Pregnancy Rate and Embryo Maintenance in Lactating Dairy Cows

Pregnancy Rates at 74 d after TAI for Cyclic Cows (LSM + SE; n = 375).



bST Treatment Reduces Losses of Pregnancy Between 31 and 45 d after First Postpartum AI in Cyclic Dairy Cows



Conclusions

- Selection for increased milk yield has also increased energy partitioning towards the udder
- This has been achieved by altering the balance between the “metabolic” hormones
- Although normal reproduction is not “energy demanding” (except in late lactation) it does need a balance in these metabolic hormones
- Rapidly mobilising body tissue in early lactation can come at a price
- Given sufficient time to recover from the energy demands of early lactation, fertility levels have scarcely declined


Sheri Martin