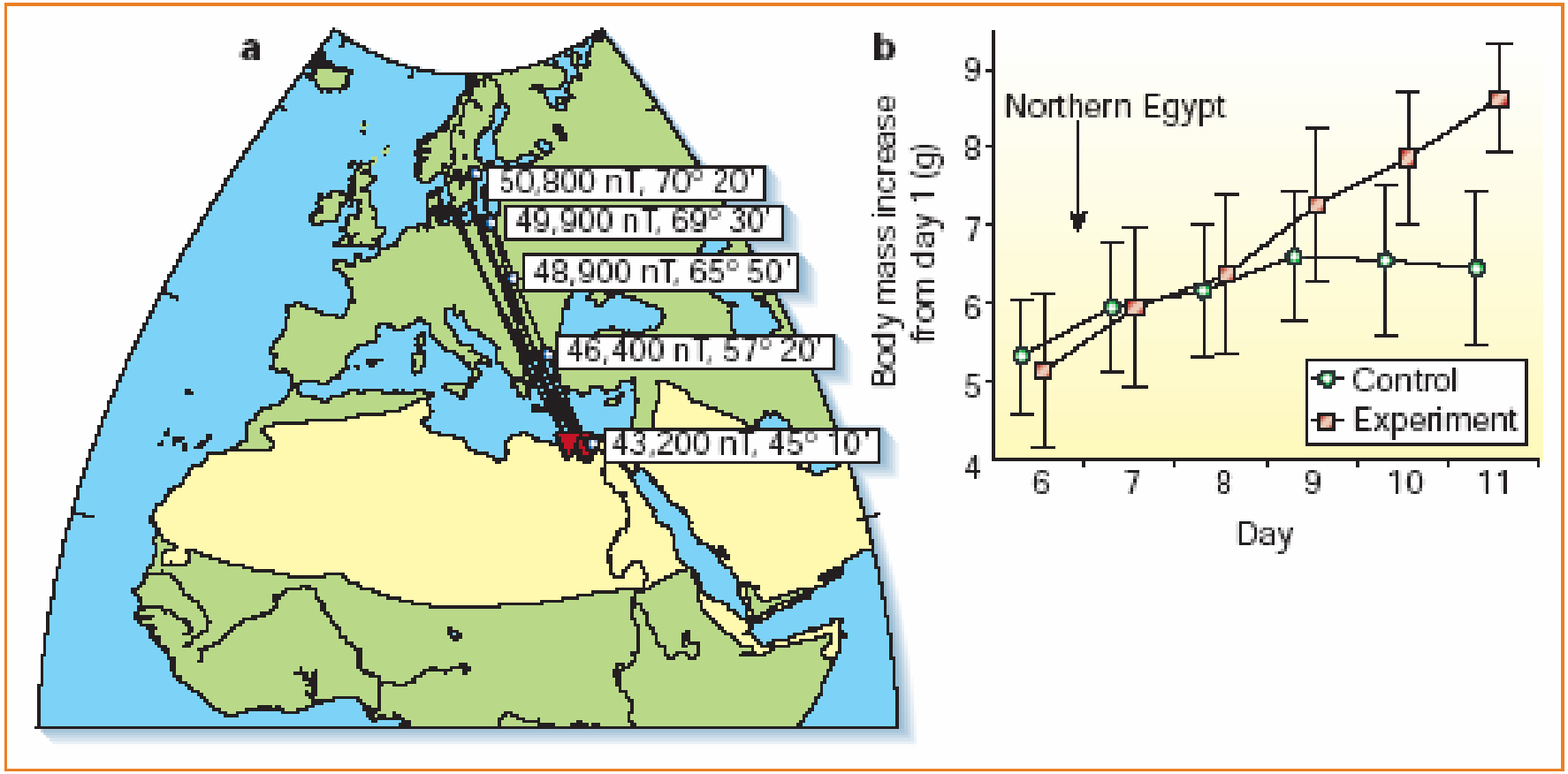
# The four "C"s of nutritional management: Creating Consistency, Coping with Challenge

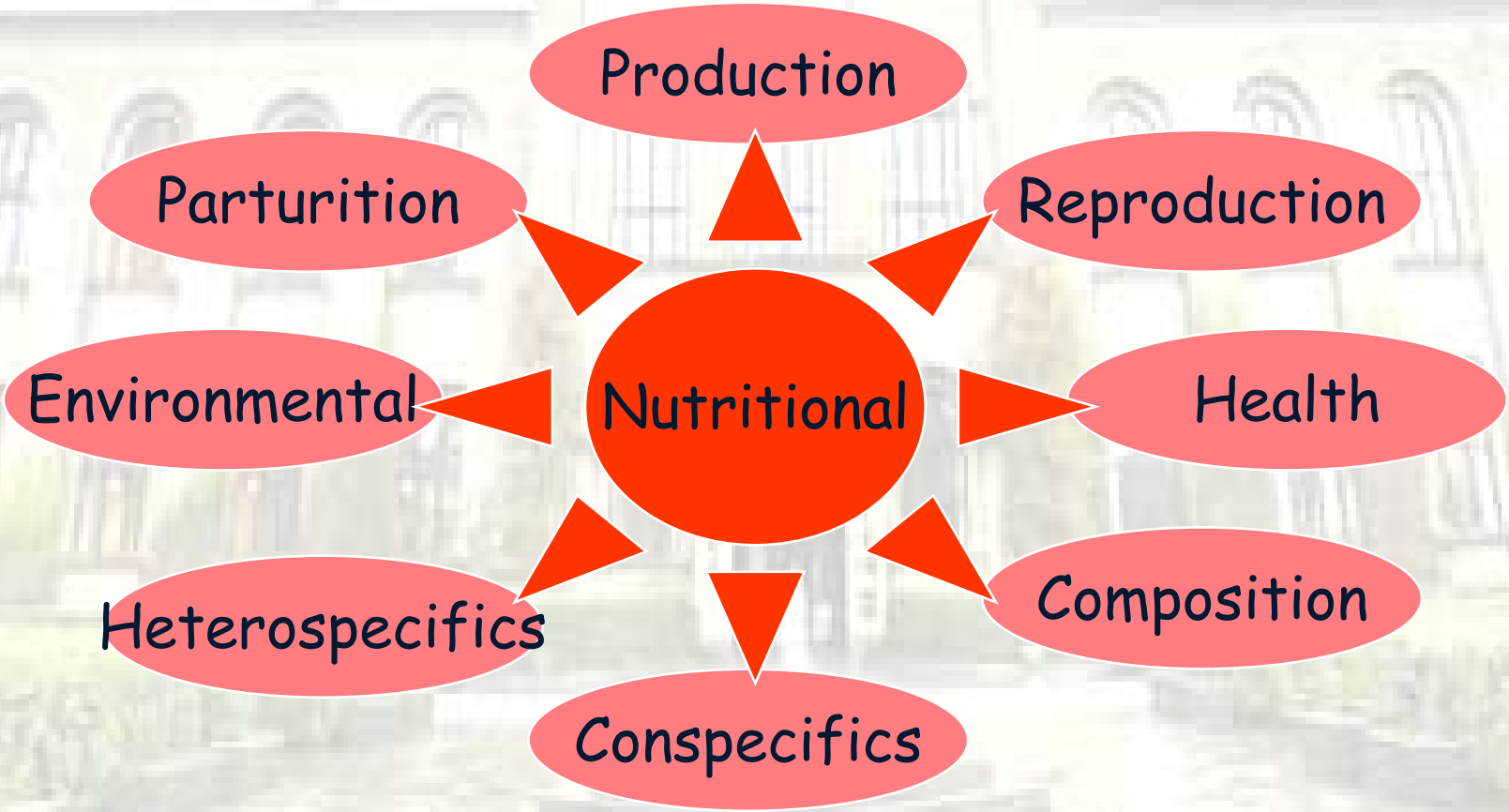
Chris Knight

chkn@life.ku.dk

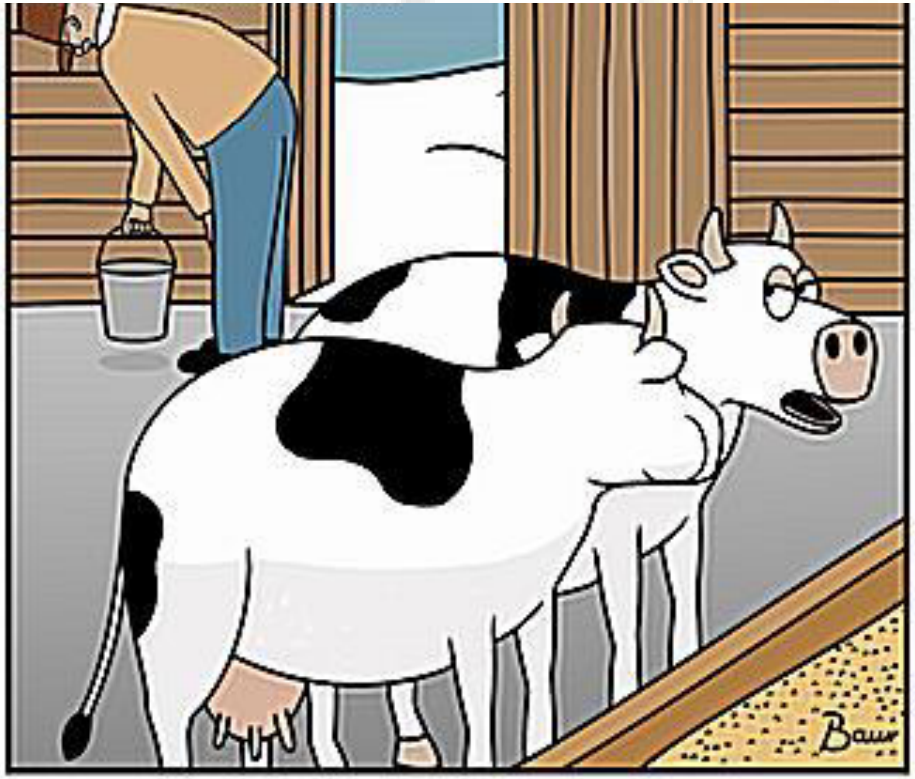
# Nutritional Consistency and Challenge



# Challenges facing the dairy cow



# Why now?




"SO HELP ME FRANCINE, IF HE DOESN'T WARM HIS HANDS THIS TIME, THERE'LL BE TROUBLE!"

Positive effect of selection

- Surviving infancy
- Seasonal food supply
- Water conservation
- Temperature extremes
- Growth
- Competition
- Disease

- Reproduction

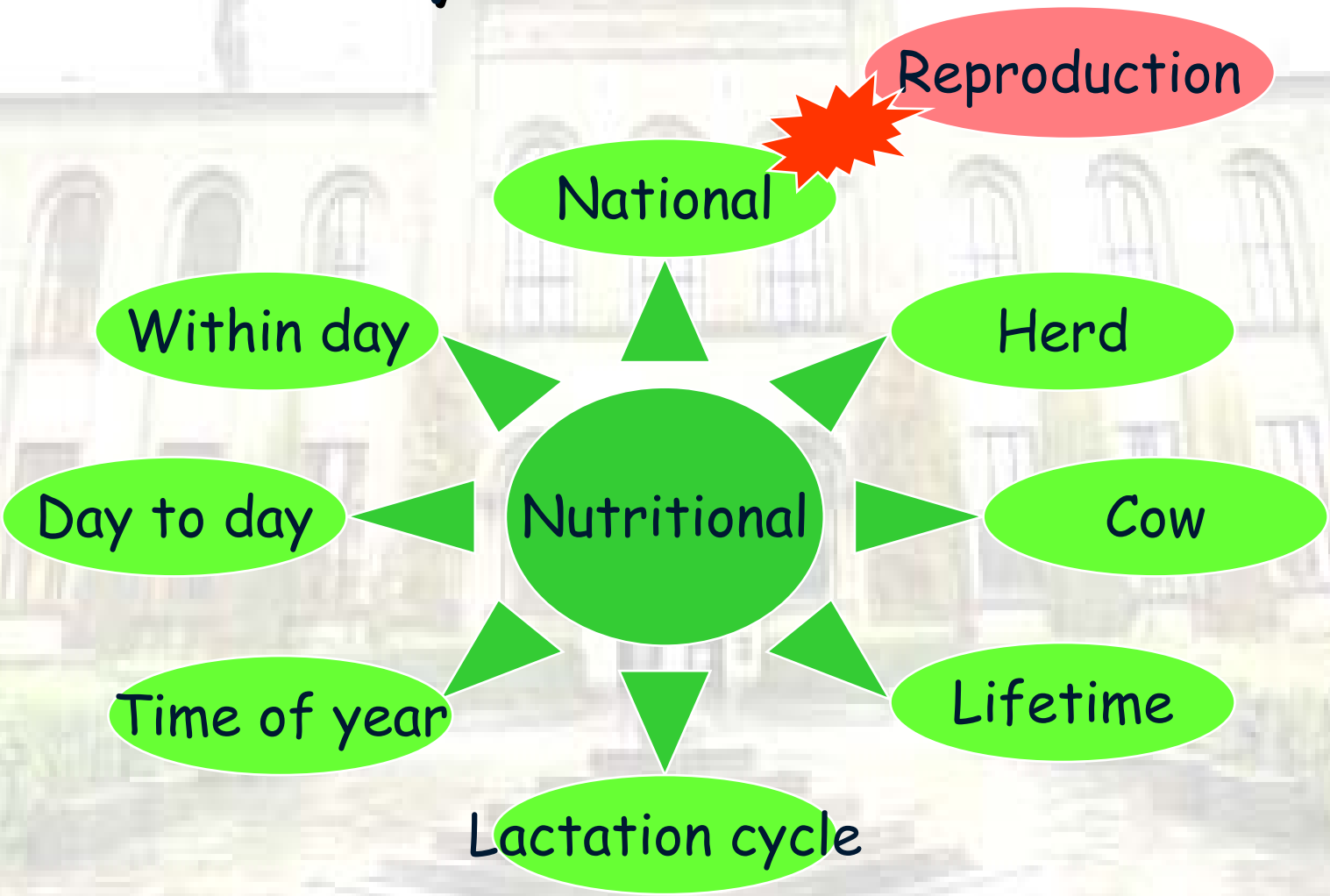
- Predation

- Artificial

- Excessive production
- Management transitions
- Poor housing
- Economic decision making
- Specialist products

Negative effect of selection

# Consistency



# National instability

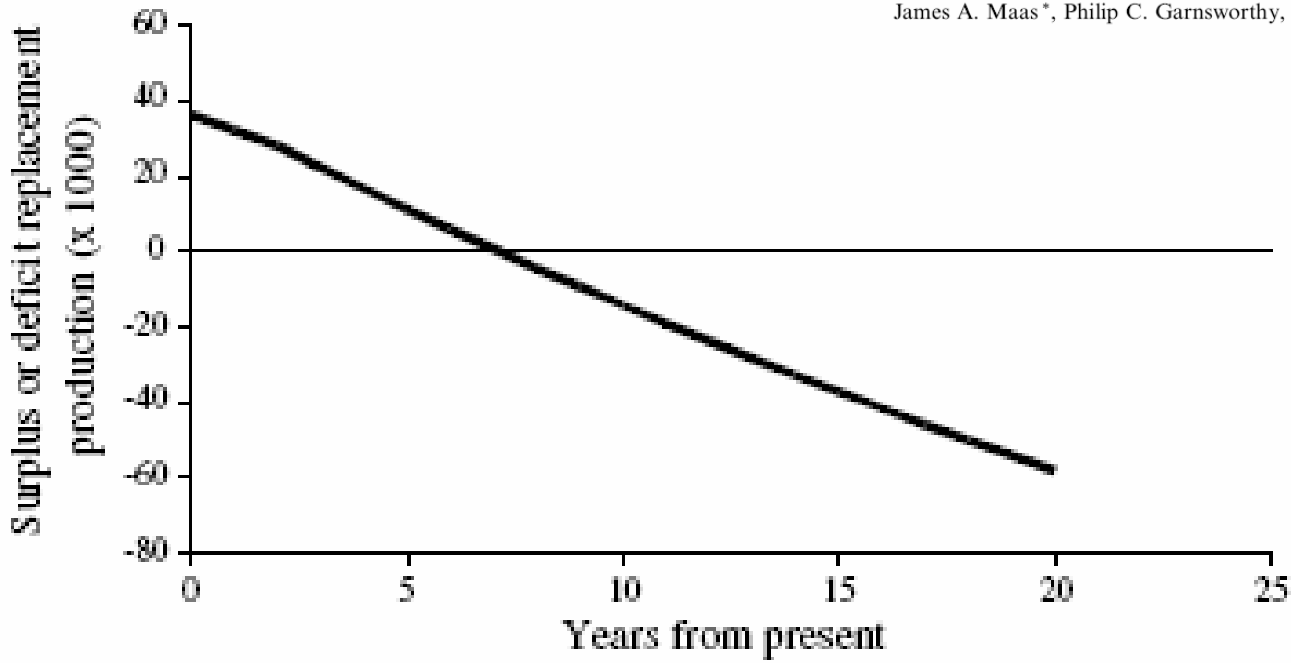
ELSEVIER

Available online at www.sciencedirect.com
ScienceDirect
The Veterinary Journal xxx (2008) xxx–xxx

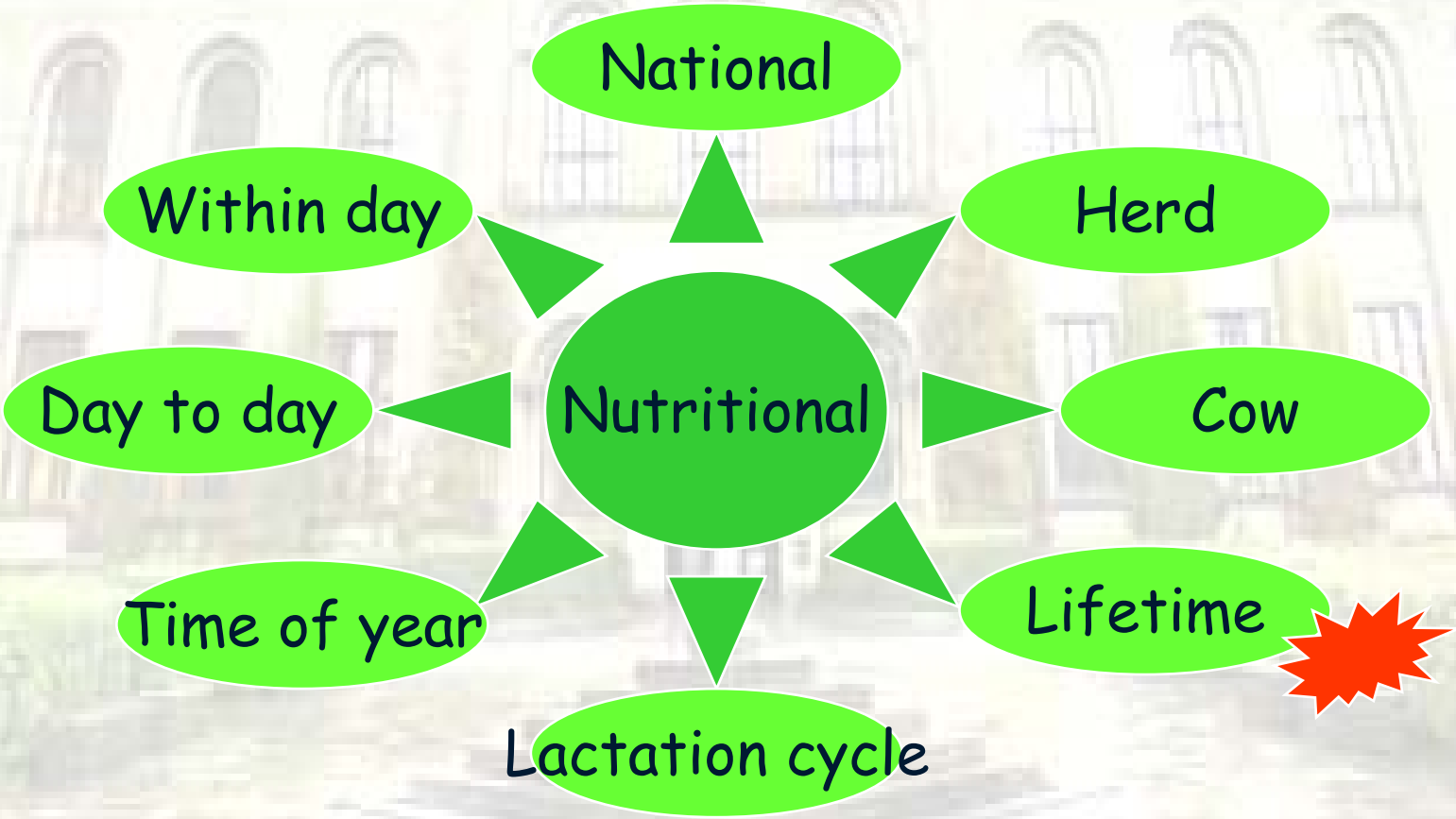
The Veterinary Journal
www.elsevier.com/locate/tvjl

Modelling responses to nutritional, endocrine and genetic strategies to increase fertility in the UK dairy herd

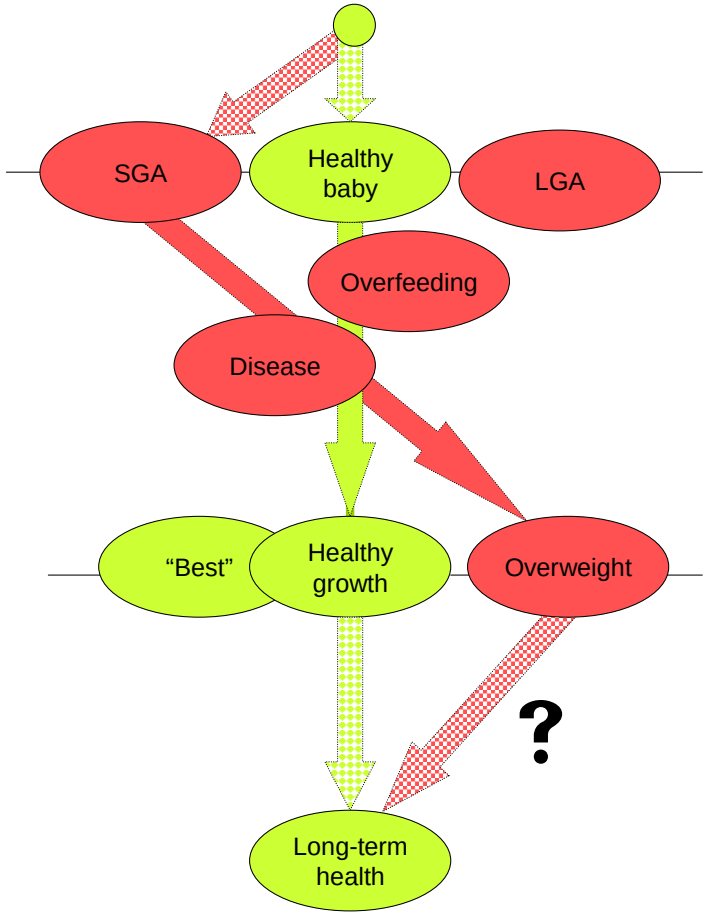
James A. Maas*, Philip C. Garnsworthy, Anthony P.F. Flint



# Consistency



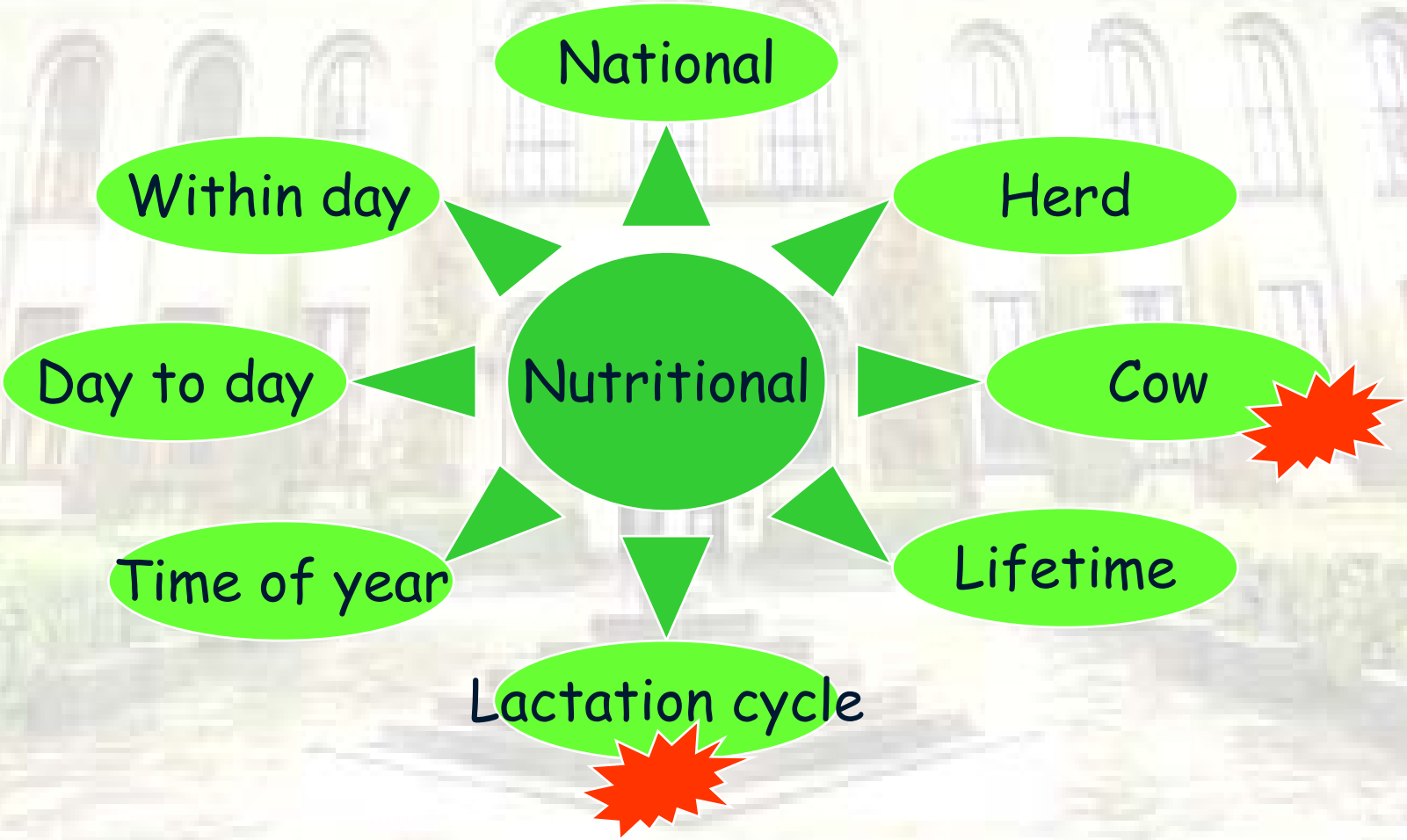
# Nutrition, genetics, growth & development: beyond "production"




Barker:

Fetal undernutrition programmes adult metabolic disease

# Consistency



# Challenges facing the dairy farmer

# The transition period

J. Dairy Sci. 89:1311–1323


## Major Advances in Applied Dairy Cattle Nutrition

**M. L. Eastridge**
Department of Animal Sciences, The Ohio State University, Columbus 43210

Although advancements have been made in feeding practices to minimize the risk of metabolic diseases, the periparturient period continues to present some of the greatest challenges in animal health.

ELSEVIER

Animal Reproduction Science 96 (2006) 212–226

ANIMAL REPRODUCTION SCIENCE

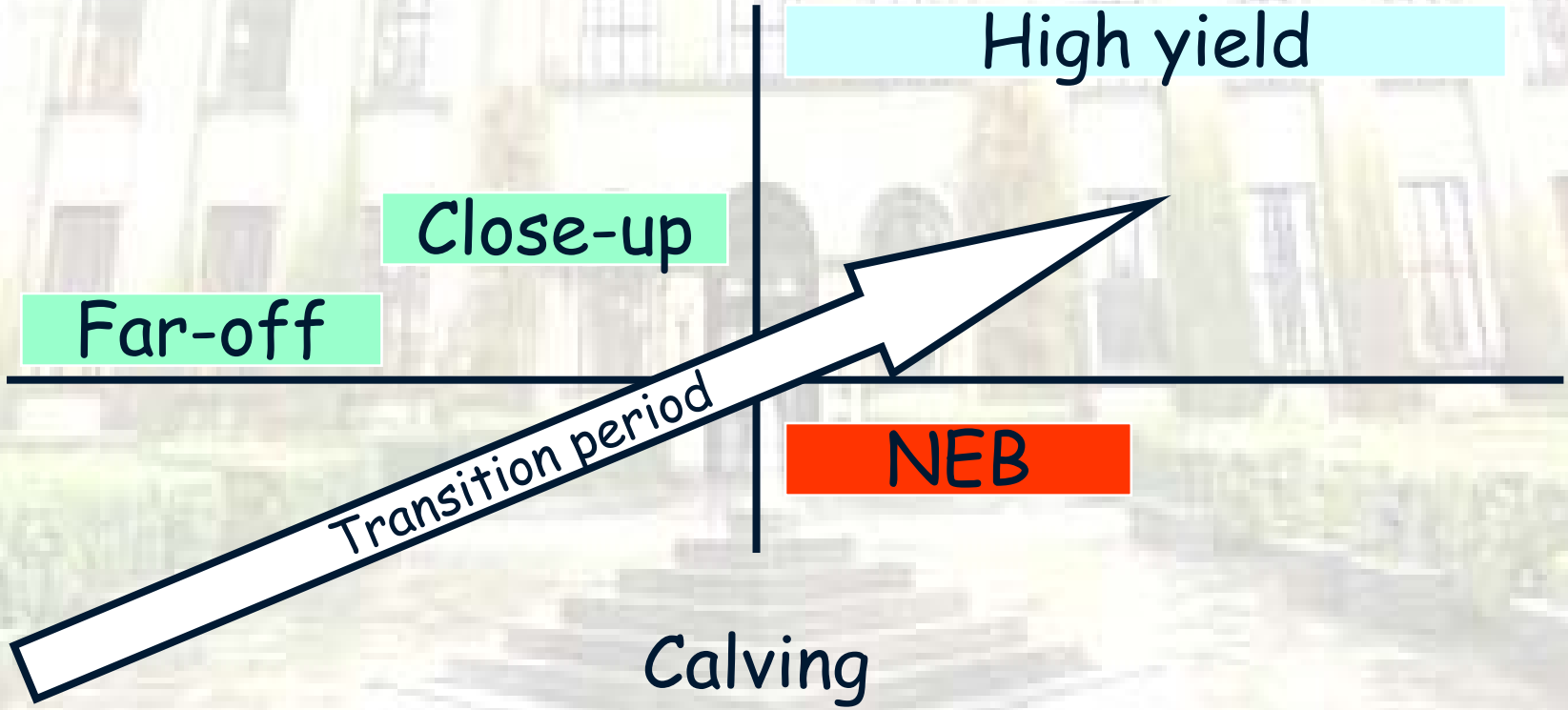
www.elsevier.com/locate/anireprosci

The impact of controlled nutrition during the dry period on dairy cow health, fertility and performance☆

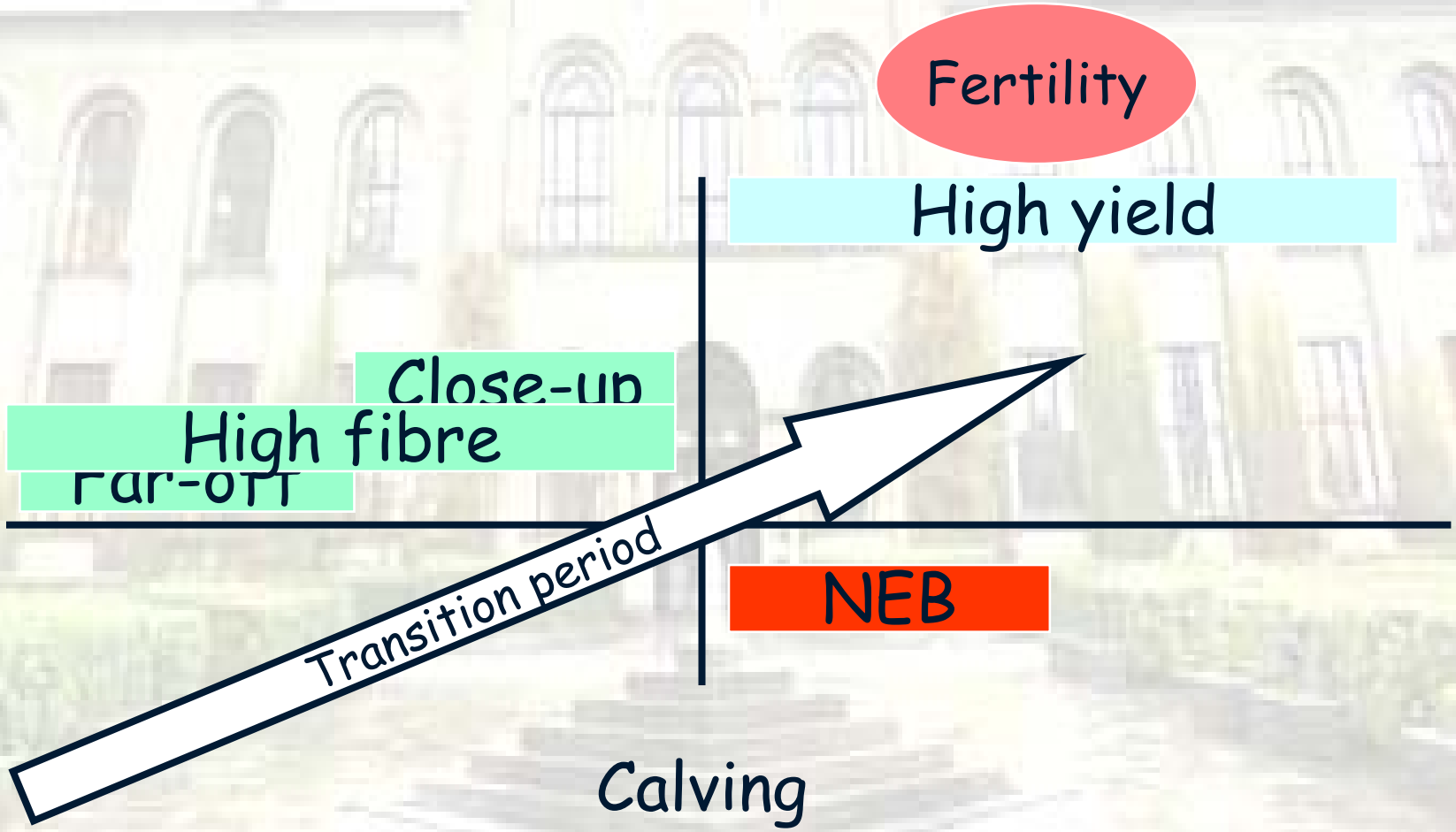
David E. Beever*

Based on this evidence, Mee (2004) concluded that 'Strategies are required to improve or halt the decline in reproductive performance …These approaches must include feeding systems to reduce negative energy balance and maintain body condition'.

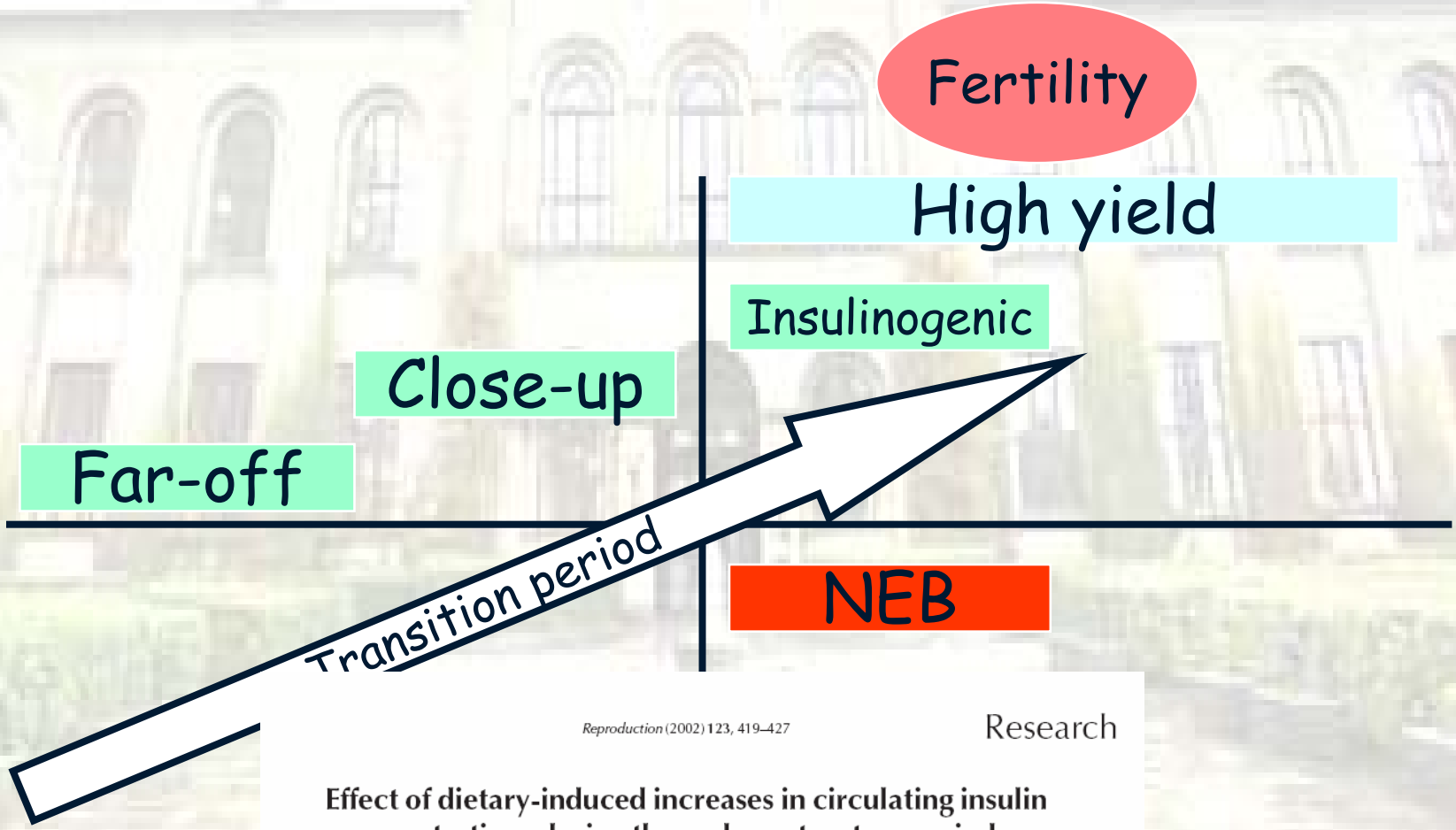
# Transition period



# Transition period, in transition!



# Reproduction diets




*Reproduction* (2002) 123, 419–427

Research

**Effect of dietary-induced increases in circulating insulin concentrations during the early postpartum period on reproductive function in dairy cows**

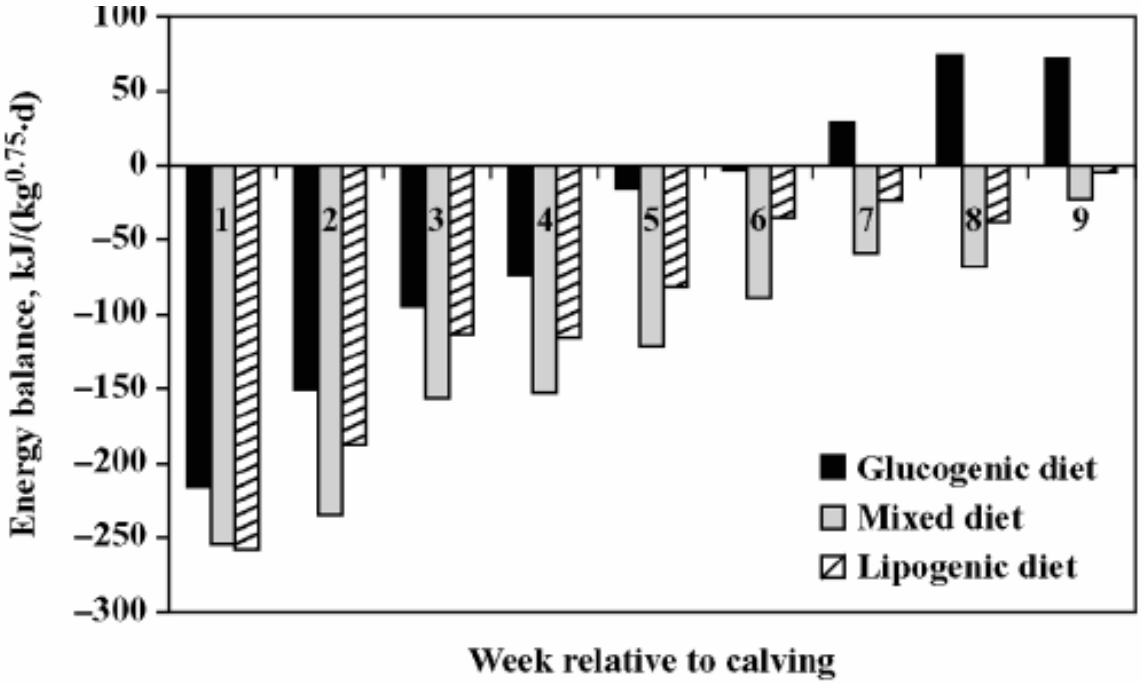
J. G. Gong[1], W. J. Lee[1], P. C. Garnsworthy[2] and R. Webb[2]

# Nutrition/endocrine interactions

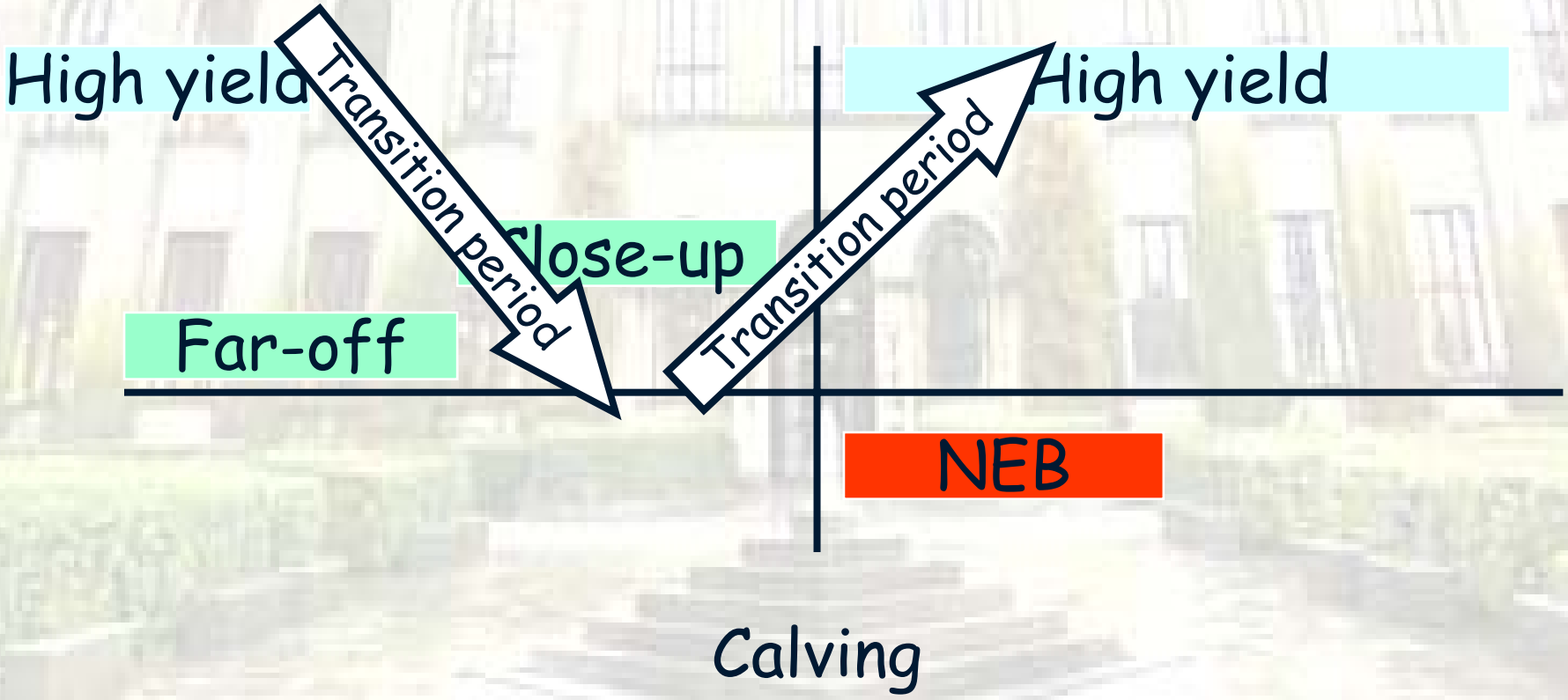
J. Dairy Sci. 90:3397–3409
doi:10.3168/jds.2006-837


## Effect of Glucogenic vs. Lipogenic Diets on Energy Balance, Blood Metabolites, and Reproduction in Primiparous and Multiparous Dairy Cows in Early Lactation

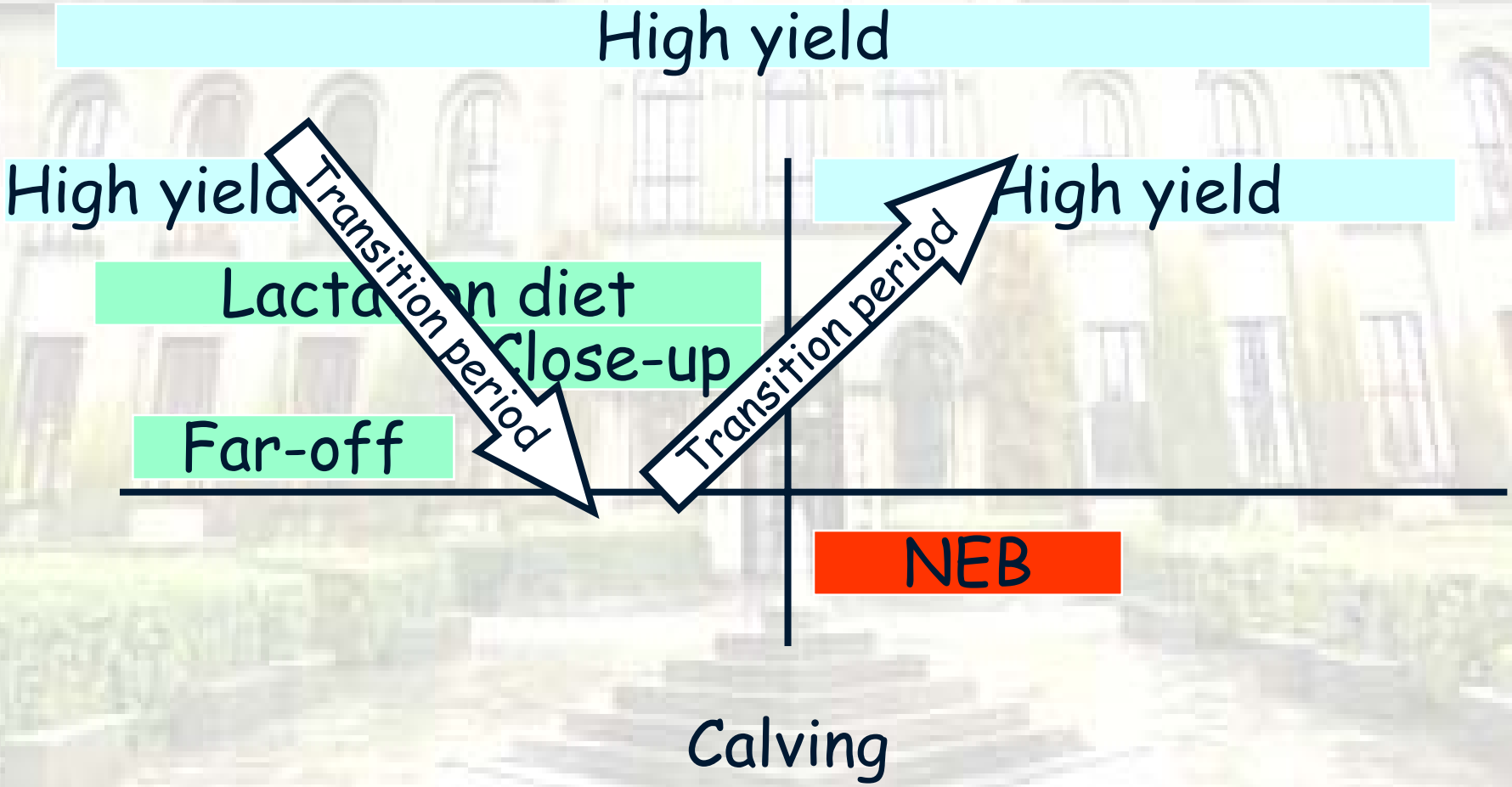
A. T. M. van Knegsel,*†[1] H. van den Brand,* J. Dijkstra,† W. M. van Straalen,‡ R. Jorritsma,§ S. Tamminga,† and B. Kemp*



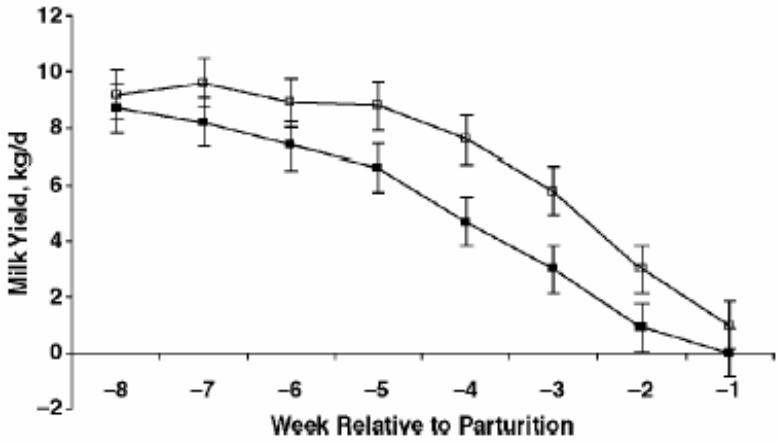
# Transition periods

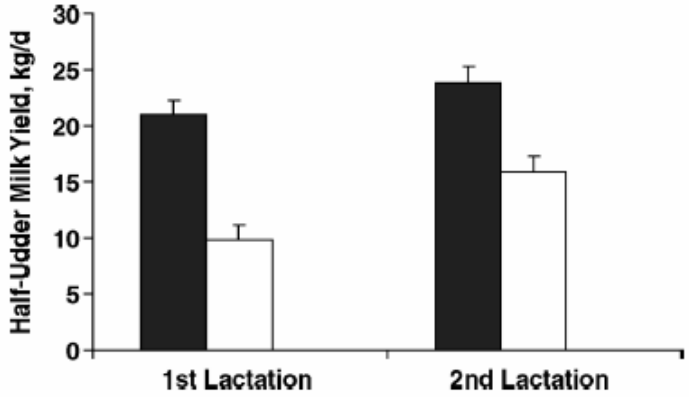


# Continuous lactation



# (Dis)continuous lact



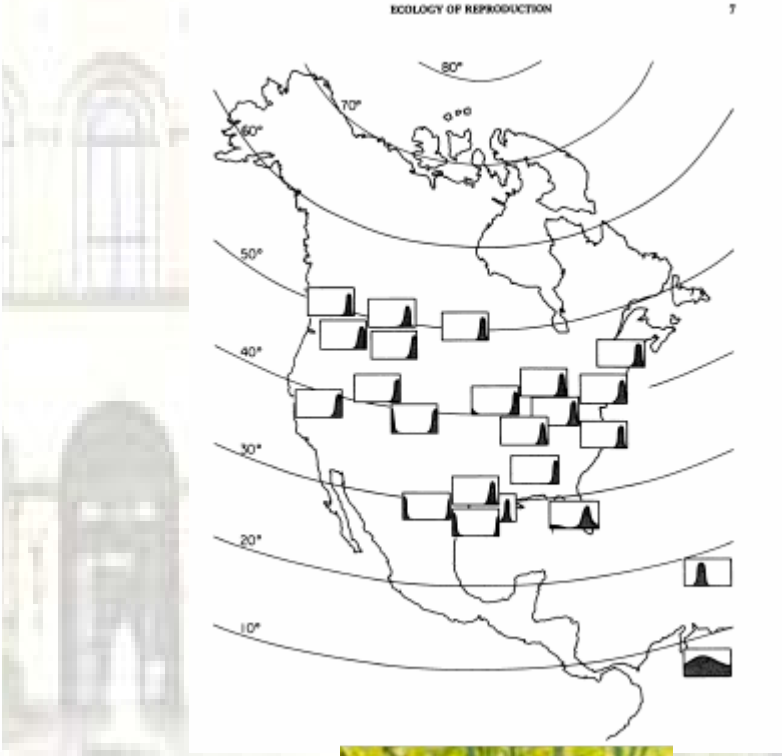

Depressed yield

Effect of continuous milking and prostaglandin $E_2$ on milk production and mammary epithelial cell turnover, ultrastructure, and gene expression[1]

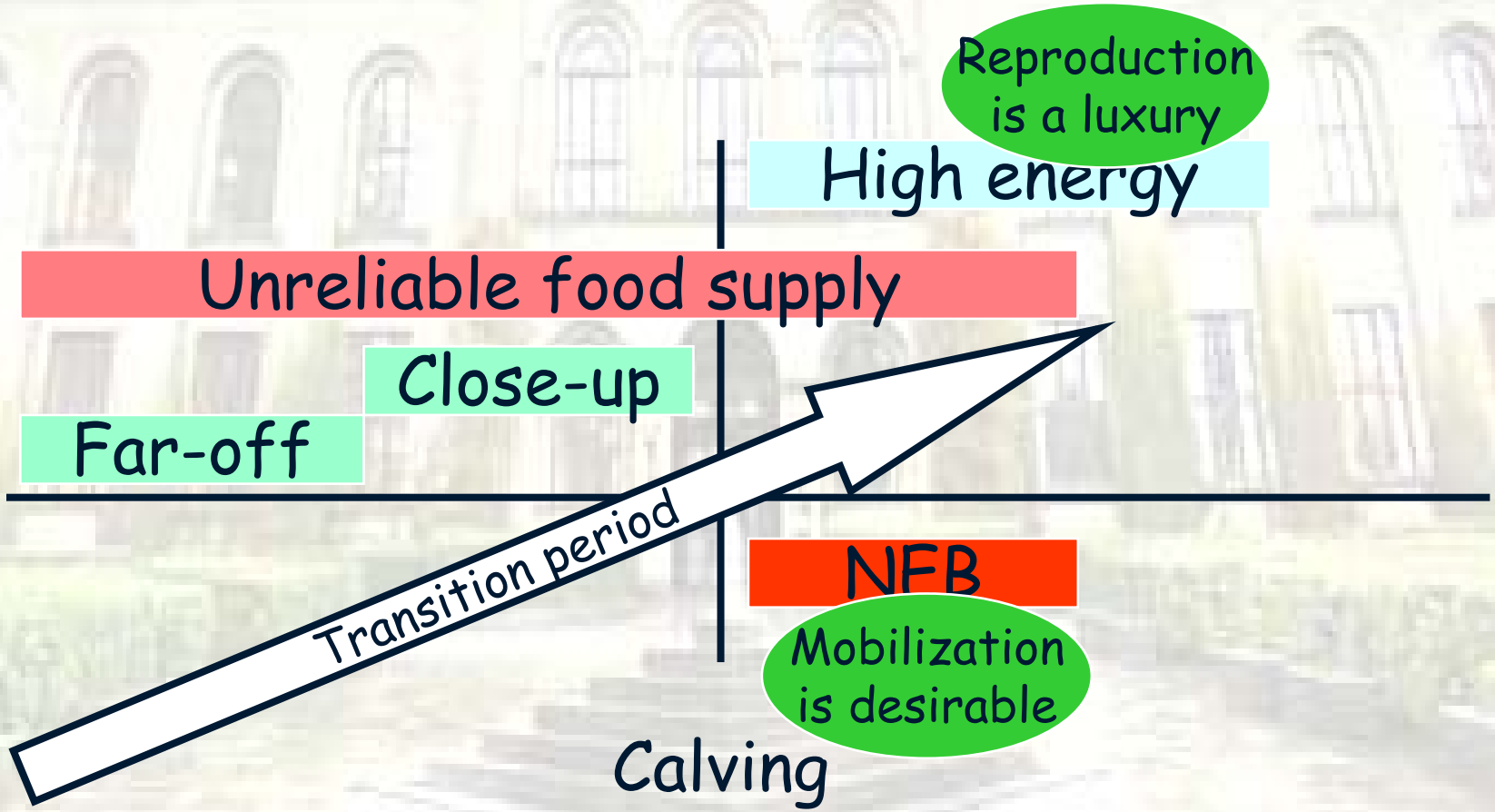
E. L. Annen,*[2] C. M. Stiening,*[3] B. A. Crooker,† A. C. Fitzgerald,*[4] and R. J. Collier*[5]

# Seasonal breeding and food supply

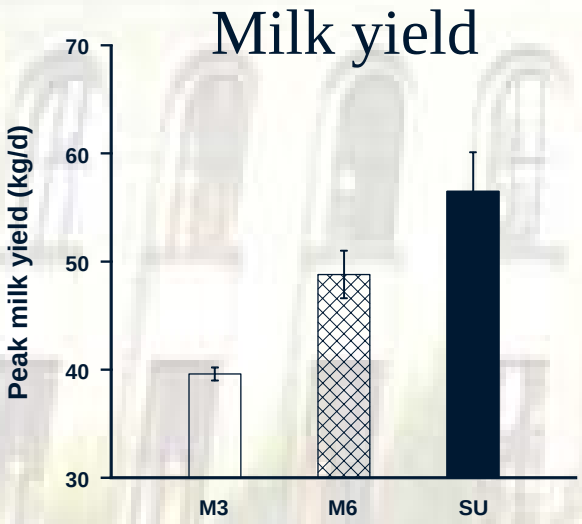
Bronson, FH (1985) Biol. Reprod. 32 1-26

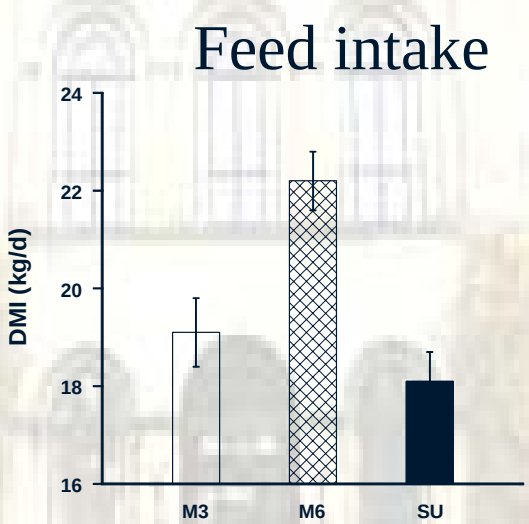



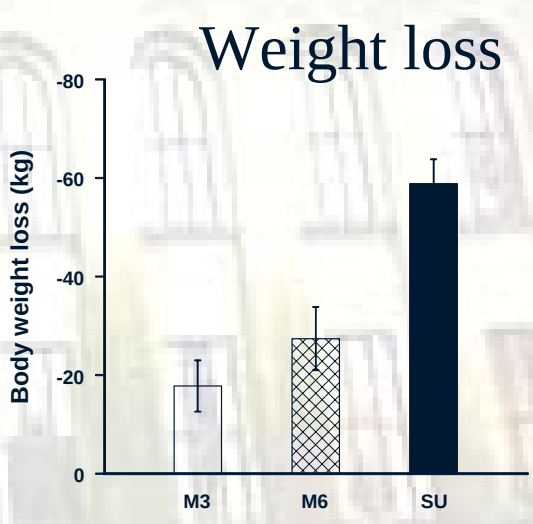

# The cows view of transition?



# Cows are programmed to mobilize



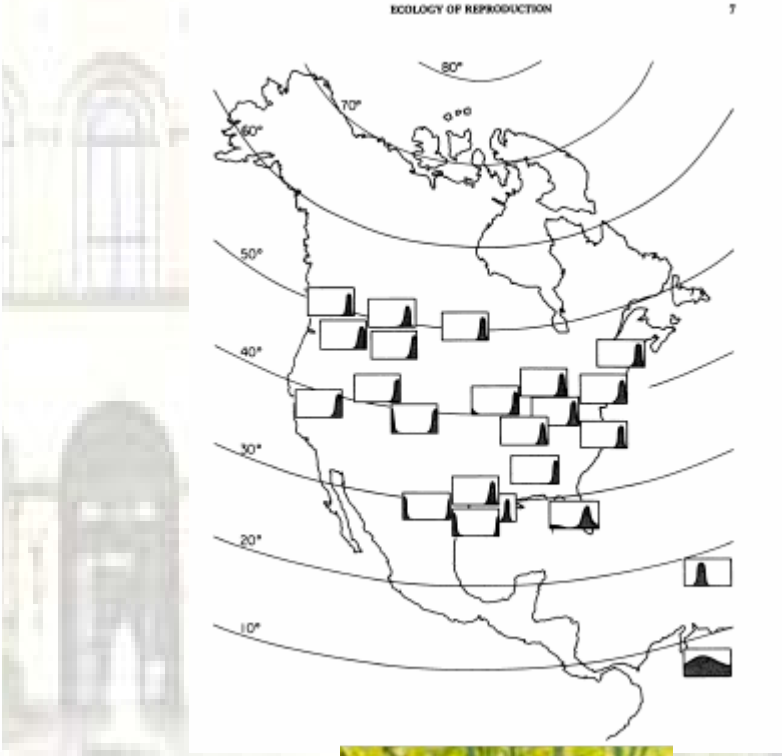



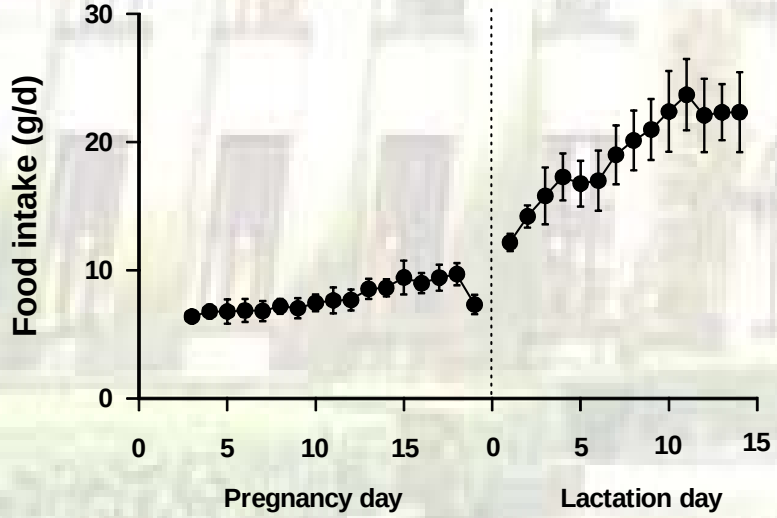

Bar-Peled *et al* (1995) J Dairy Sci **78** 2726-2736

# Seasonal breeding and food supply

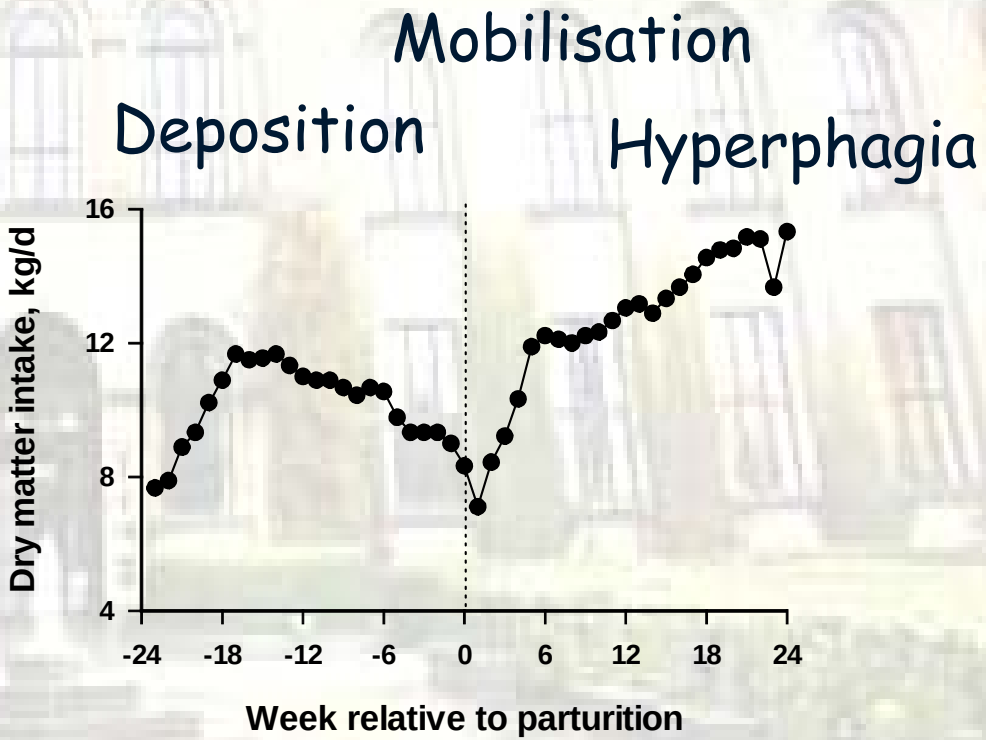
Bronson, FH (1985) Biol. Reprod. 32 1-26


# Food intake patterns



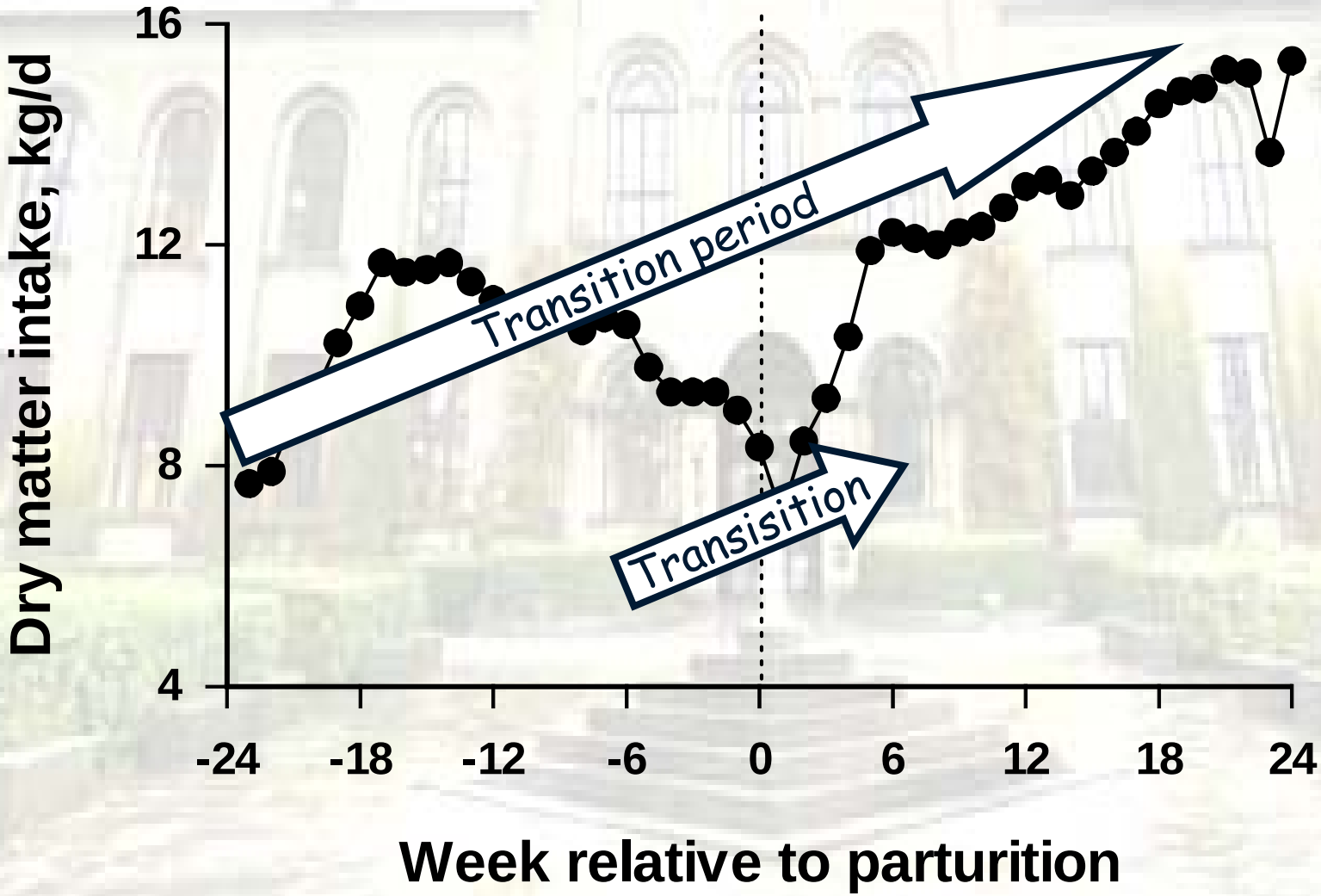

Mice




Heifers

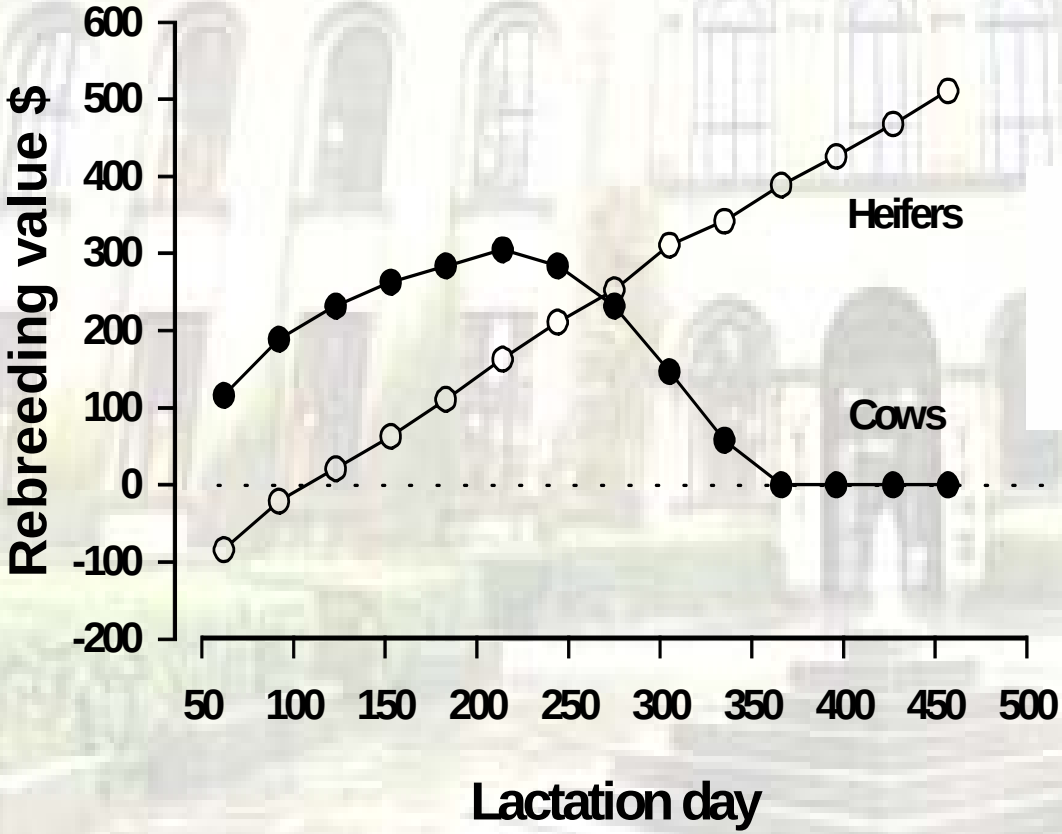
(Data from Ingvarsten)

# So how long is *biological* transition?



# Challenges facing the dairy farmer

# Lactations will get longer!

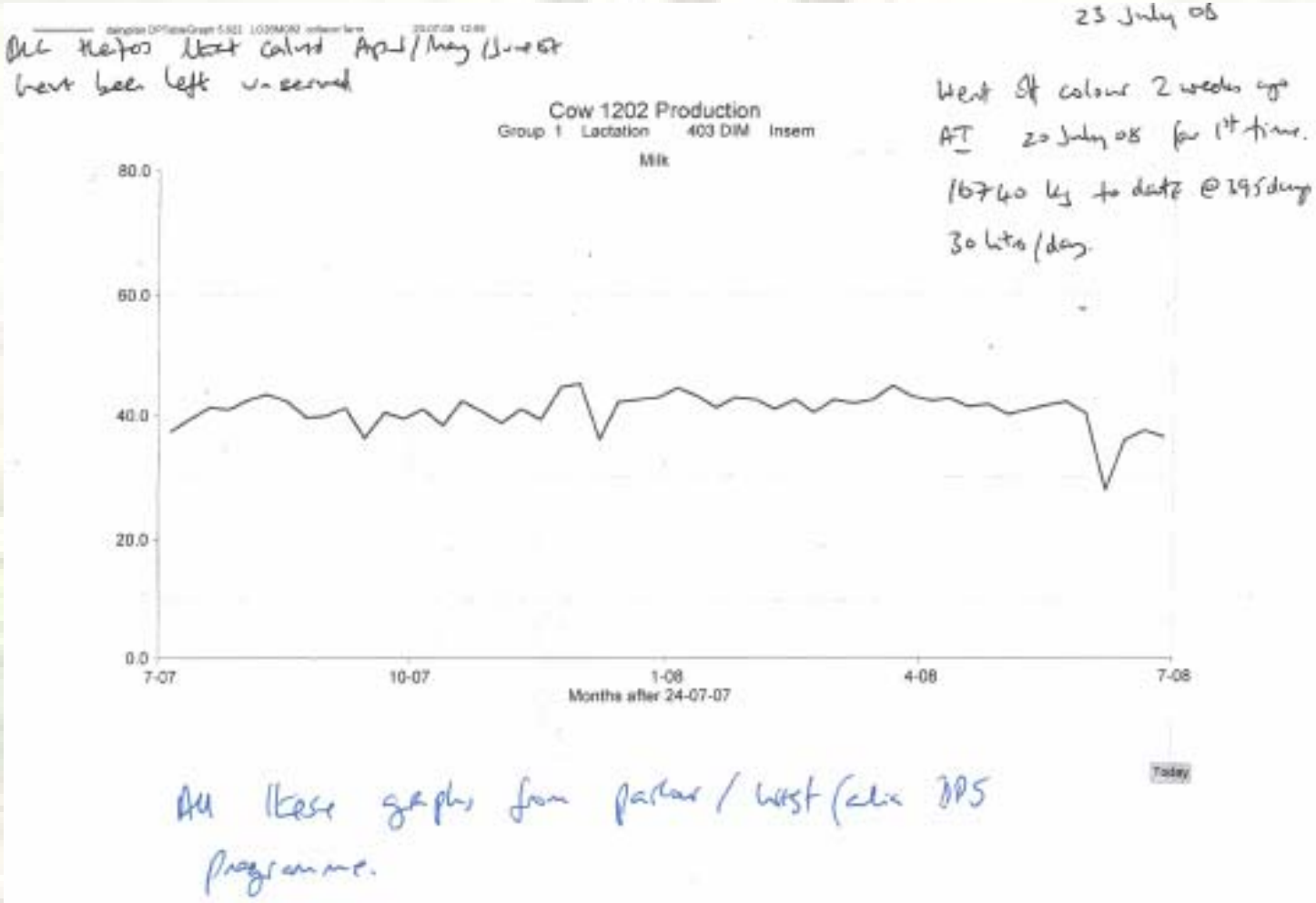



J. Dairy Sci. 89:3876–3885


**Economic Value of Pregnancy in Dairy Cattle**[1]

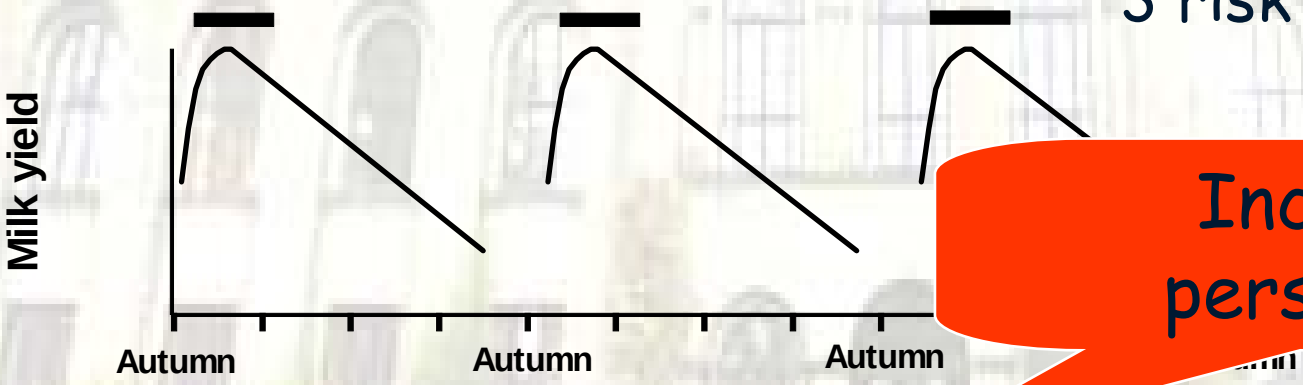
**A. De Vries**
Department of Animal Sciences, University of Florida, Gainesville 32611

# In Europe, farmers may lead the way

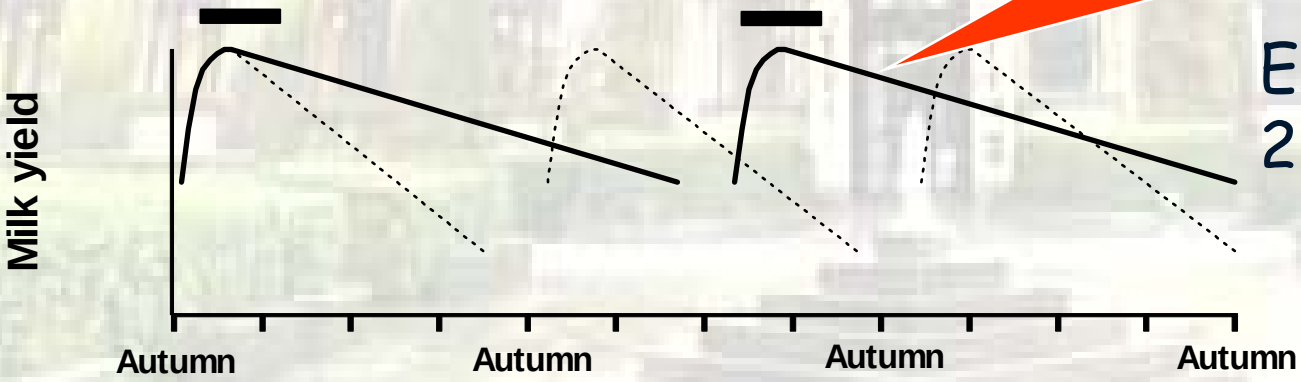


# Extended lactation

Conventional lactation:
3 risk periods

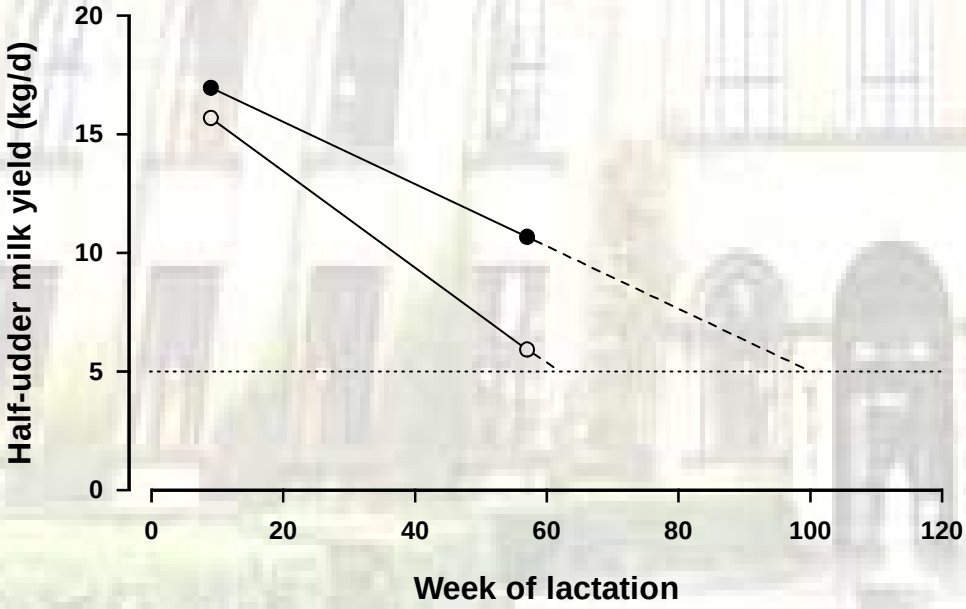


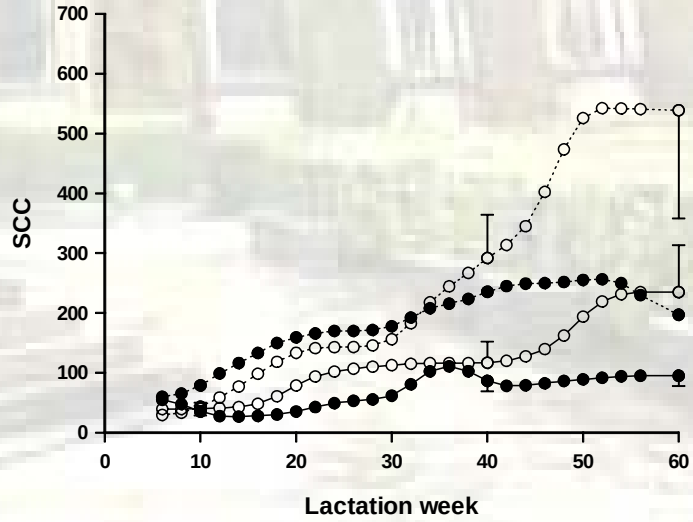

Increased persistency!



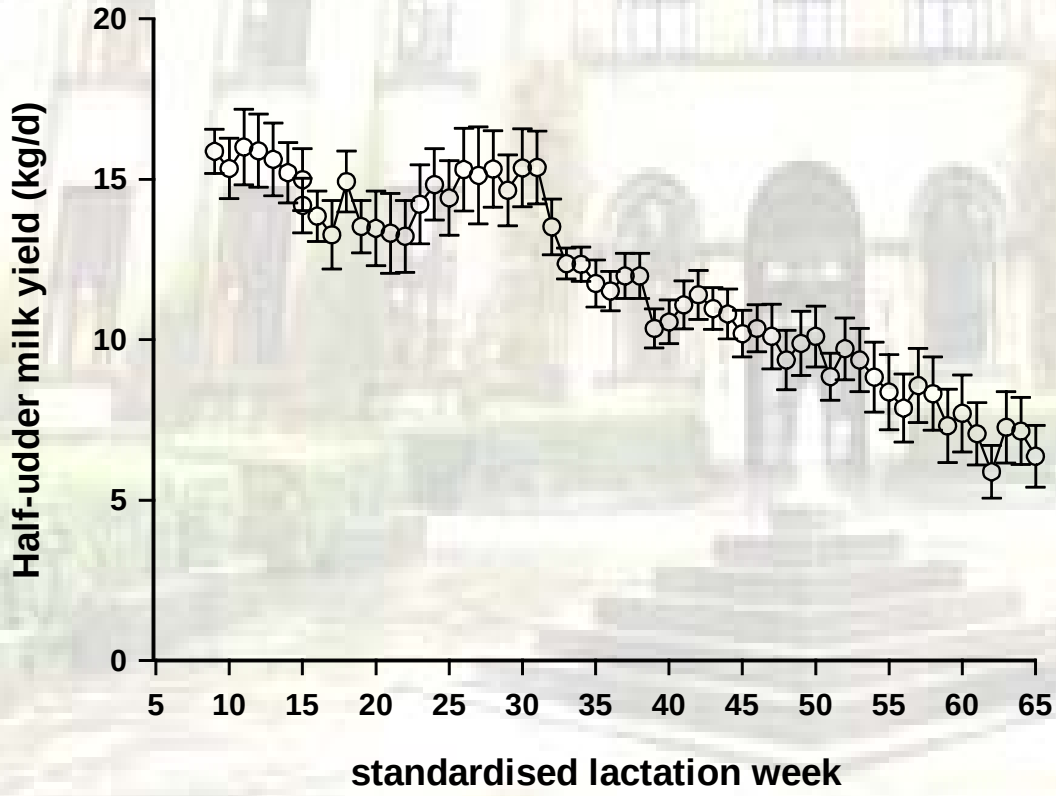

Extended lactation:
2 risk periods

# AMS can enable extended lactation



# Extended lactation will require better nutritional management




- Can sudden yield depressions be avoided?
- Can they be reversed?
- Which is more important, energy or protein?

# Experimental manipulation of protein supply

**Table 1.** The chemical composition (% of DM, unless stated otherwise) of the fish meal cube, feather meal cube and sugar beet pulp used in the experiments.

| | Fish meal cube | Feather meal cube | Sugar beet pulp |
|---|---|---|---|
| DM, % | 86.9 | 88.4 | 87.2 |
| Organic matter | 87.8 | 91.7 | 88.2 |
| Total N | 4.73 | 4.82 | 1.79 |
| Starch | 27.7 | 26.6 | 0.5 |
| Sugars | 6.1 | 7.6 | 21.9 |
| Neutral-detergent fiber | 26.9 | 26.5 | 35.0 |
| Acid-detergent fiber | 6.9 | 8.6 | 20.0 |

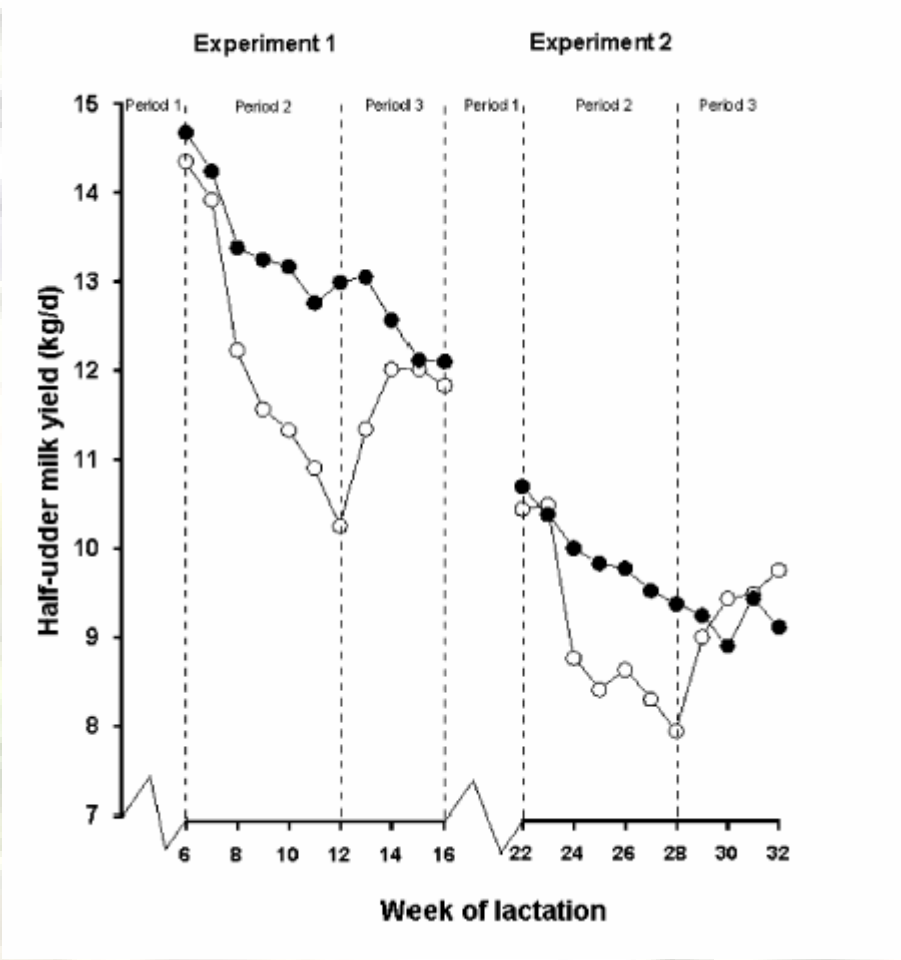
Experimental diet deficient in histidine, methionine and lysine

J. Dairy Sci. 86:1436–1444


## Effects of Changes in Dietary Amino Acid Balance on Milk Yield and Mammary Function in Dairy Cows

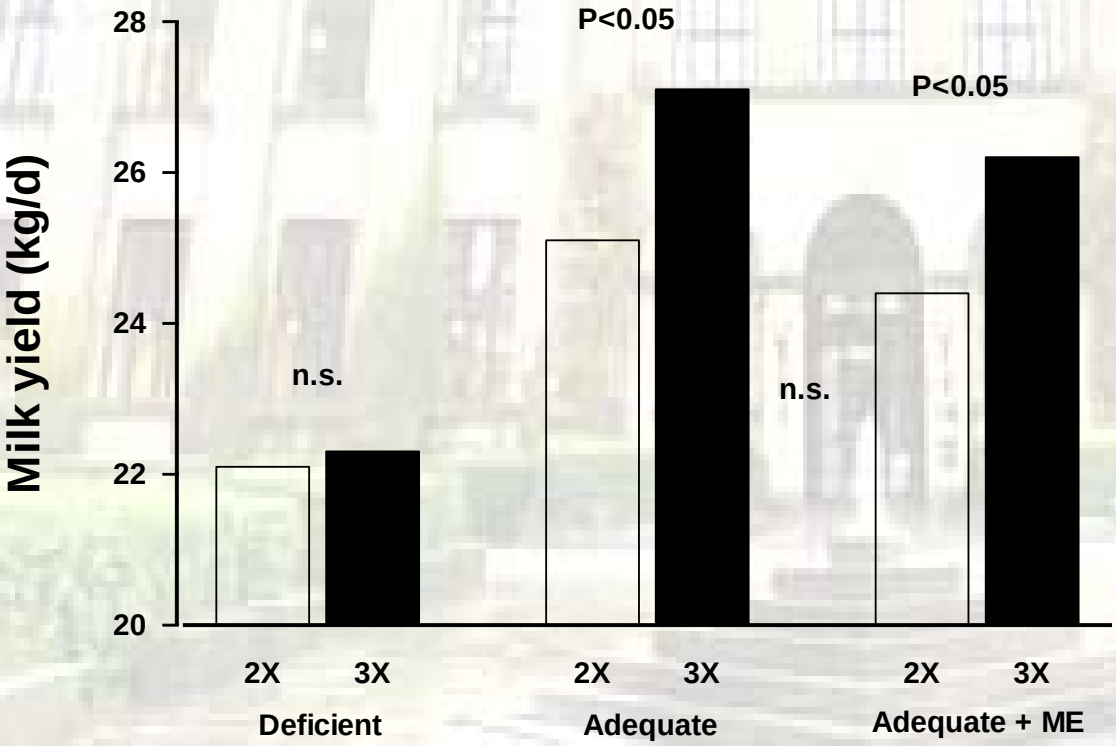
**J. -M. Yeo, C. H. Knight, and D. G. Chamberlain**
Hannah Research Institute, Ayr, KA6 5HL, UK

# Recovery from amino acid deficiency



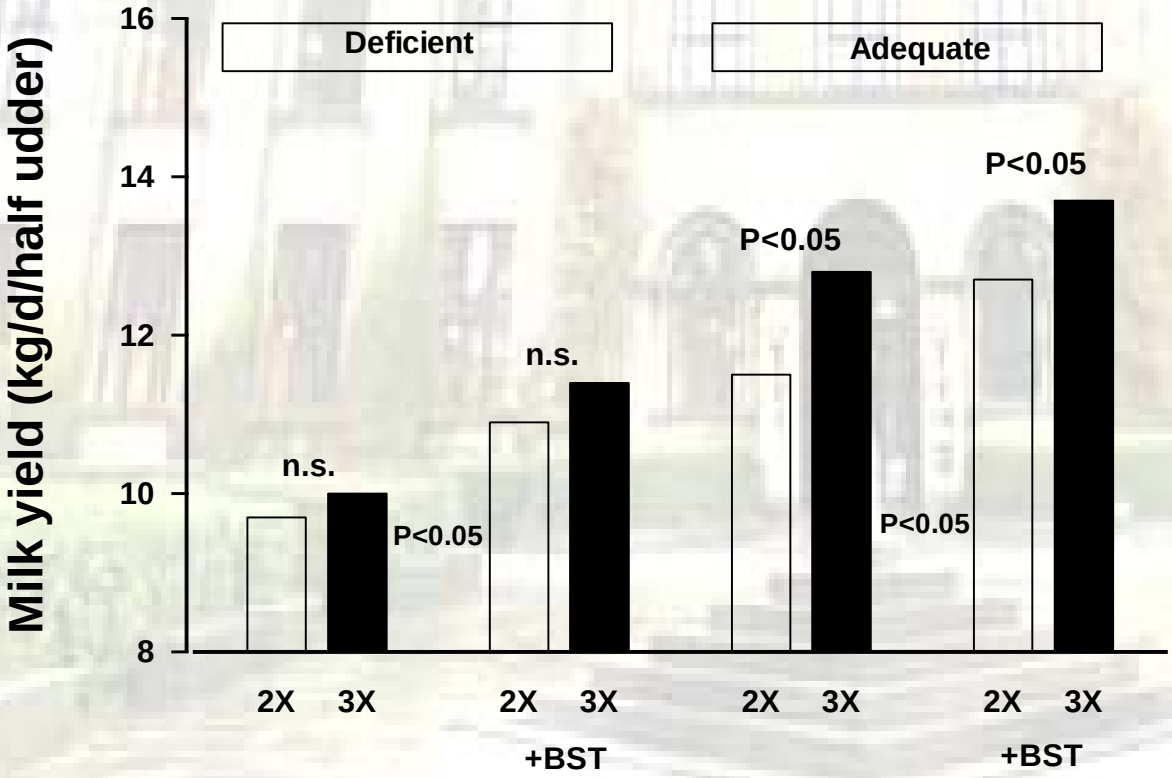

- In early lactation amino acid deficiency compromised milk yield
- There was complete recovery when deficiency ended
- The responses were independent of stage of lactation

# Experimental stimulation of mobilization




- Frequent milking does not stimulate mobilization of body protein

# Mobilization of protein is possible, but strong stimulus required




- Frequent milking effective only with adequate diet
- BST effective irrespective of diet

# Summary

- Short-term lactation inhibition caused by protein inadequacy is reversible
- Perhaps not surprisingly therefore, the cow is reluctant to mobilize protein

- Is the same true for energy?

# The Hannah Research Institute



THE SCOTTISH Farmer

All the news from the Xmas sales

PAGE 18 and 19

December 14, 2002

Ploughing

## Evolution

Institute becomes Trust.
Research contractor becomes research funder.

www. hannahresearch.org.uk

In 2006 the Hannah closed

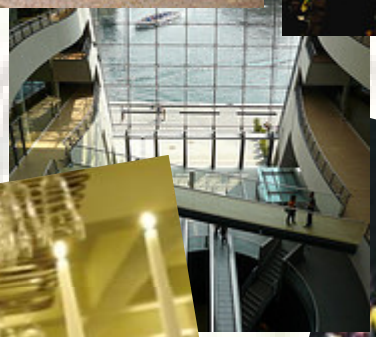
www.strath.ac.uk

# Creating Consistency, Coping with Challenge

Actually, Consistency can become too much of a good thing,
and Challenge can be rather stimulating





VELKOMMEN
CHRISTIANIA
Electronic
Attack









Copenhagen is
wonderful!