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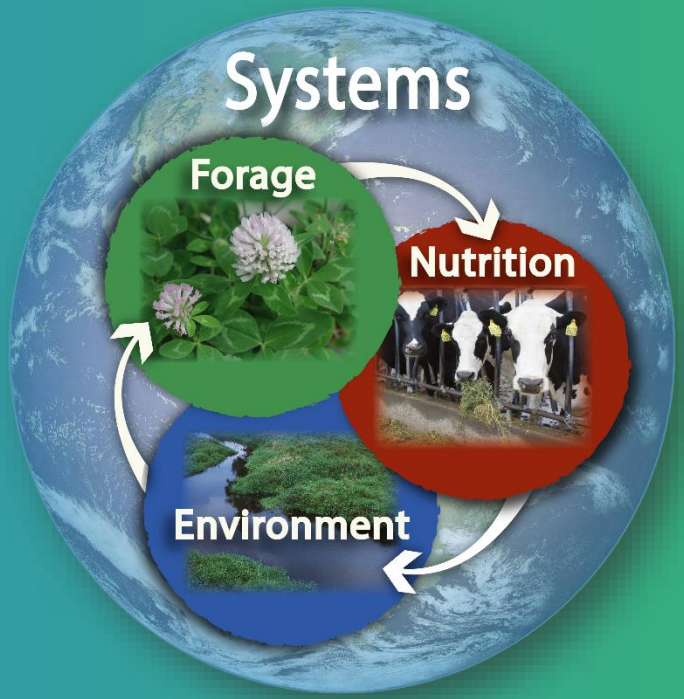
Energy and protein status changes in early lactation and the implications for protein nutrition

Geoffrey Zanton



U.S. Dairy Forage Research Center
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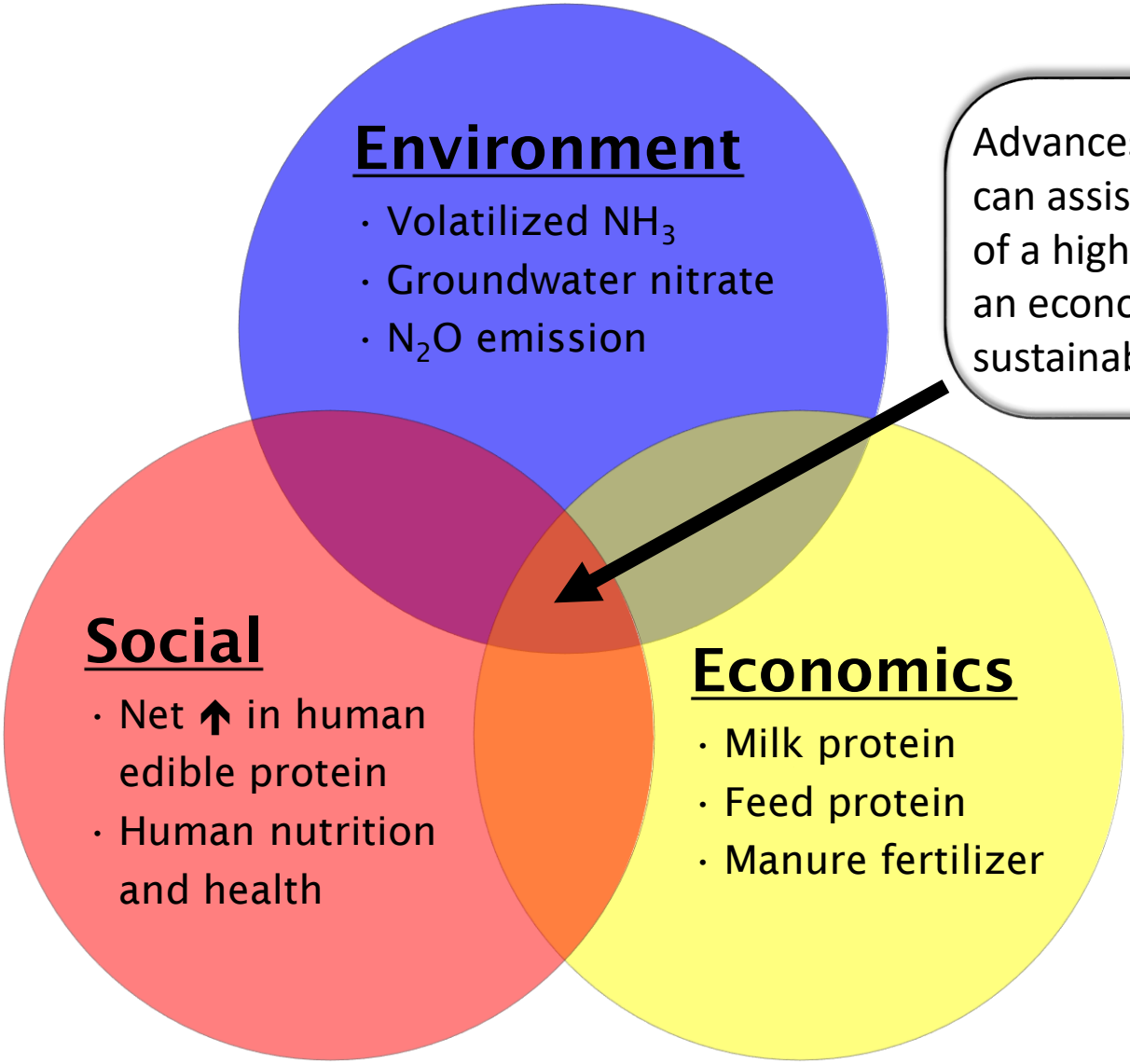
Objective and outline

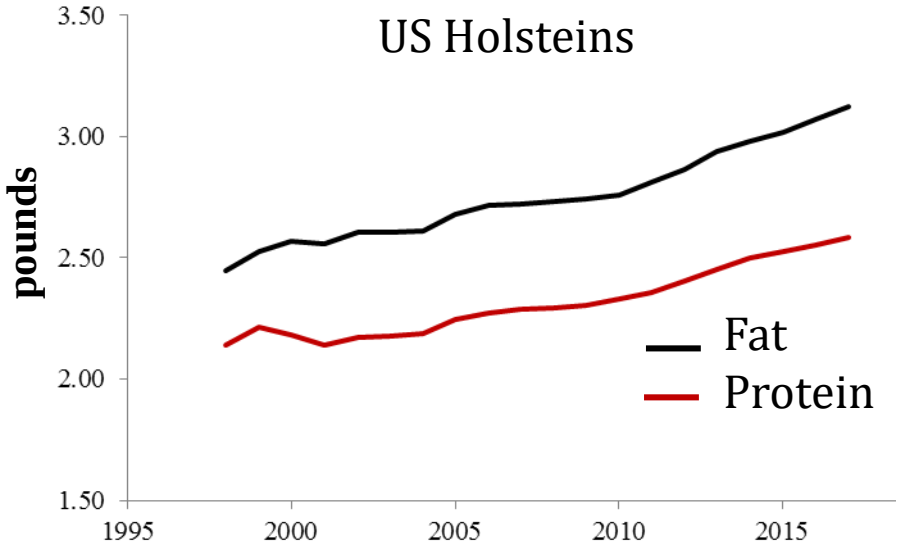
- Discuss changes occurring in early lactation
- Evaluate implication of early lactation body composition changes
- Responses to early lactation protein/AA changes

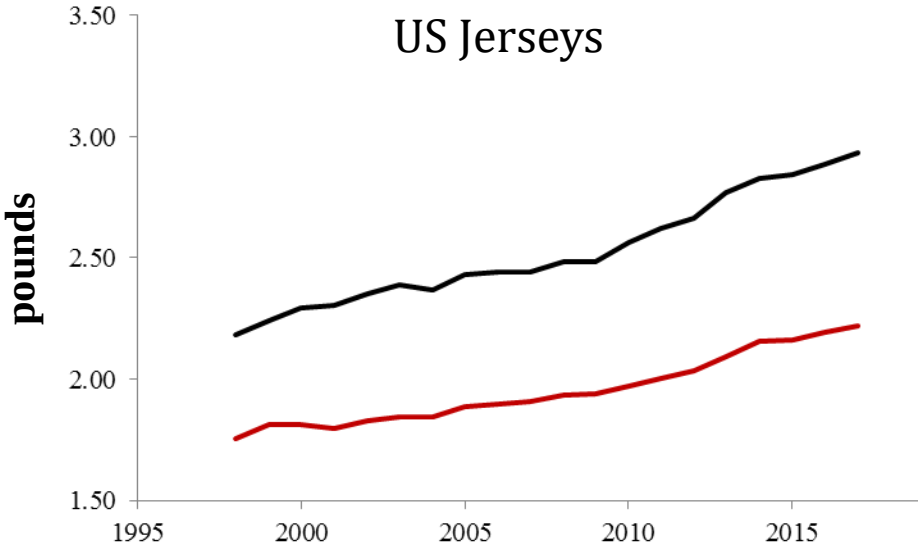
Dairy cow protein and amino acid nutrition has a significant role in sustainable dairying.



Advances in protein and AA nutrition can assist in balancing the production of a high quality food protein source in an economically and environmentally sustainable manner.

Fat and protein production are increasing, but can go further

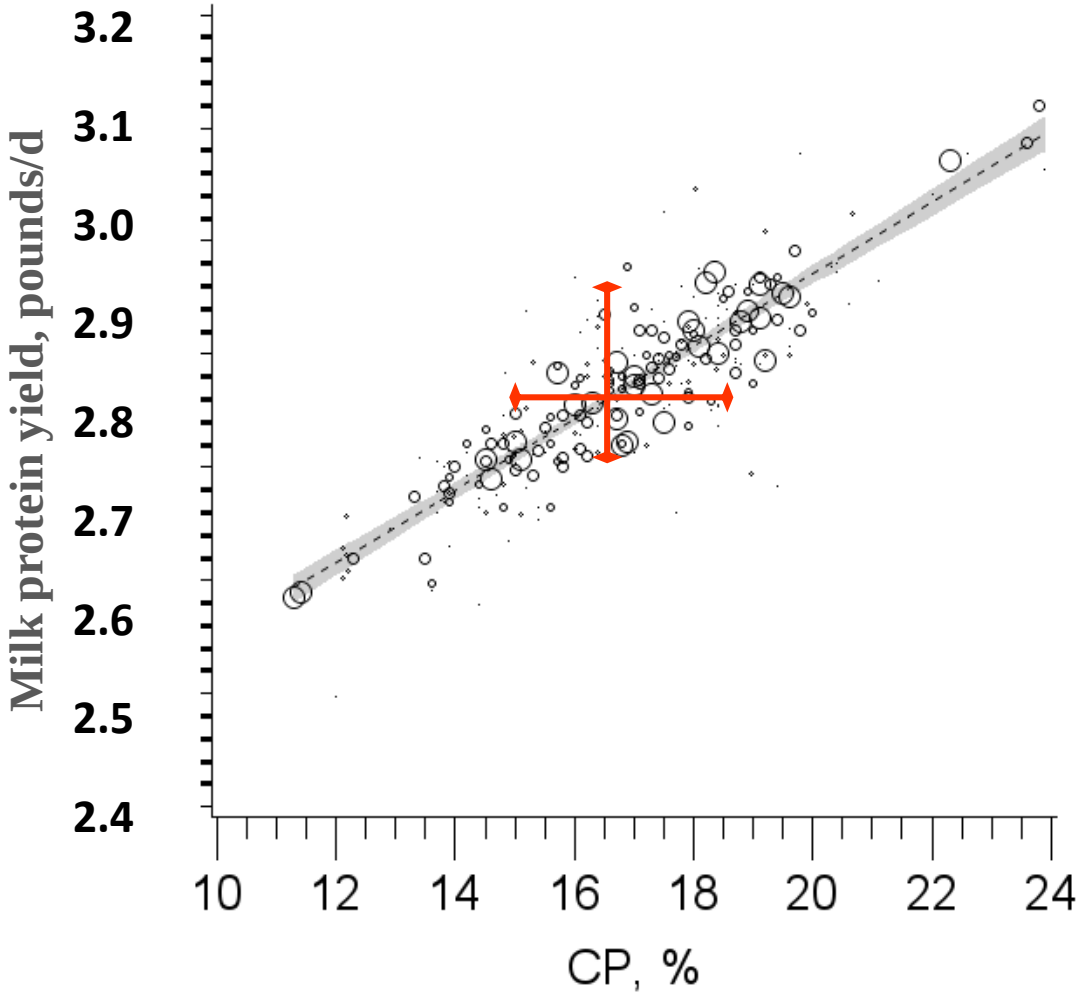




Records	Year	Milk, lbs	Fat, lbs	Prot., lbs	Fat, %	Prot., %
Selz-Pralle Aftershock 3918	2017	214	8.47	6.56	3.96%	3.06%

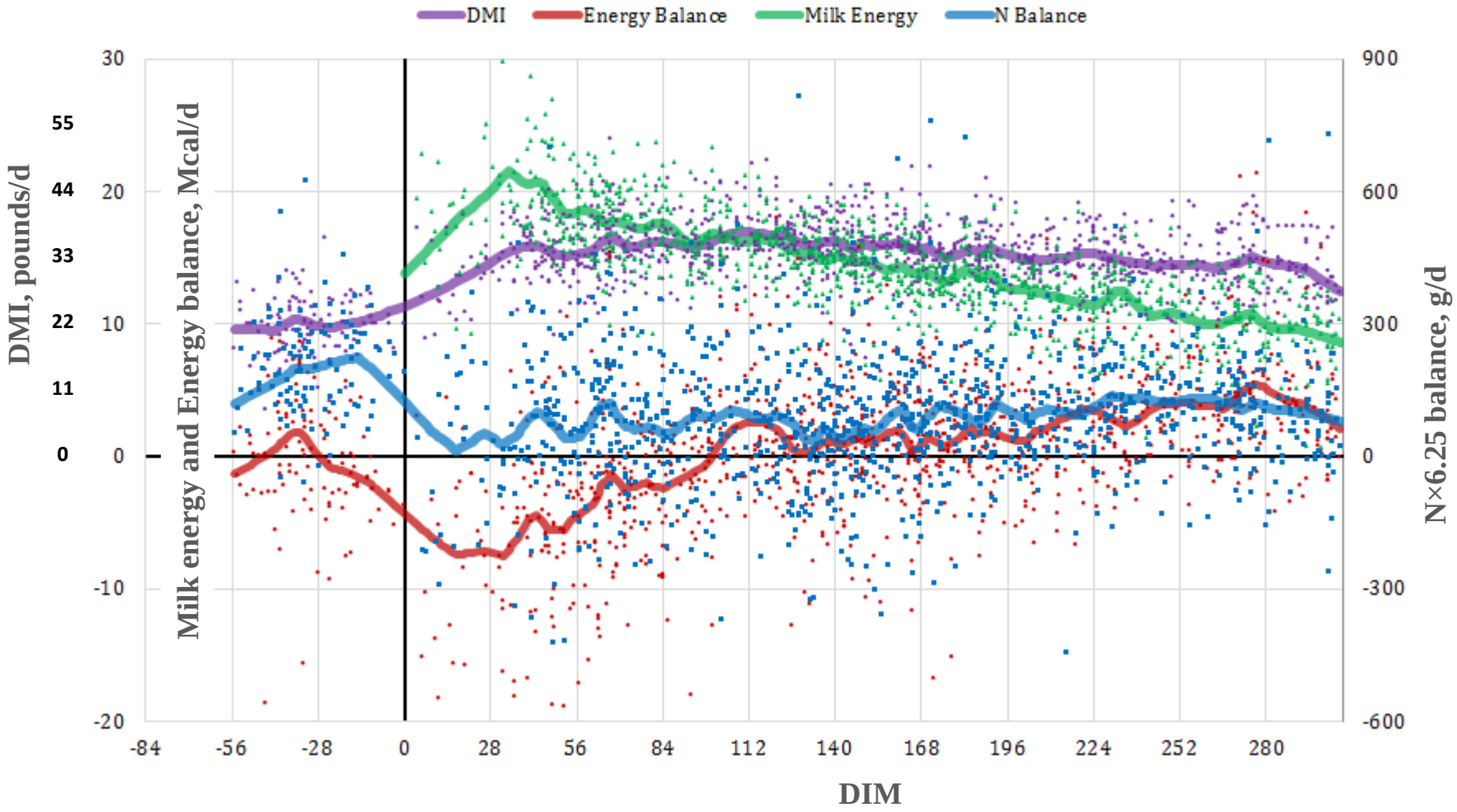
400 Servings of milk!

Variability in the response to protein feeding provides opportunity to reduce CP without affecting production



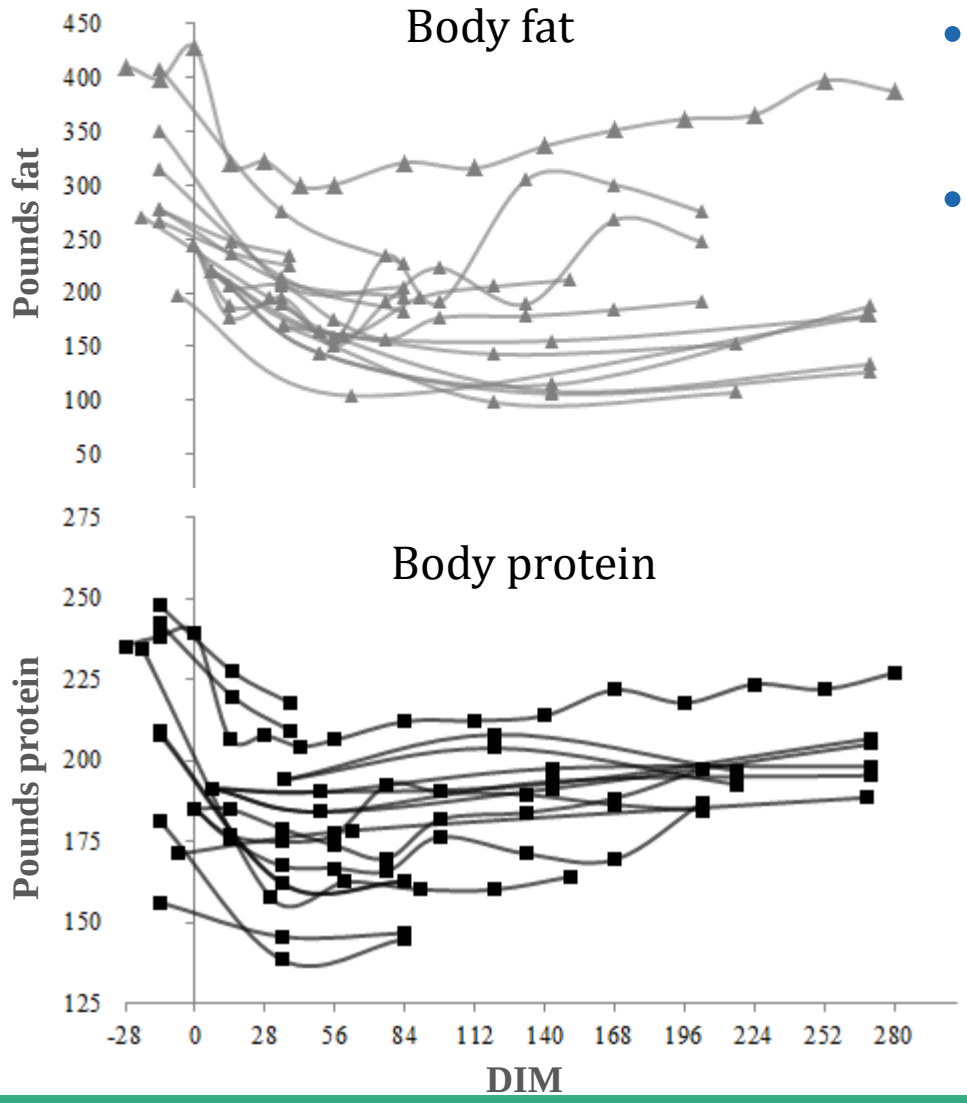
Data from Zanton, 2016

Early lactation is a very dynamic time in the production cycle



Data from National Animal Nutrition Program, 2014

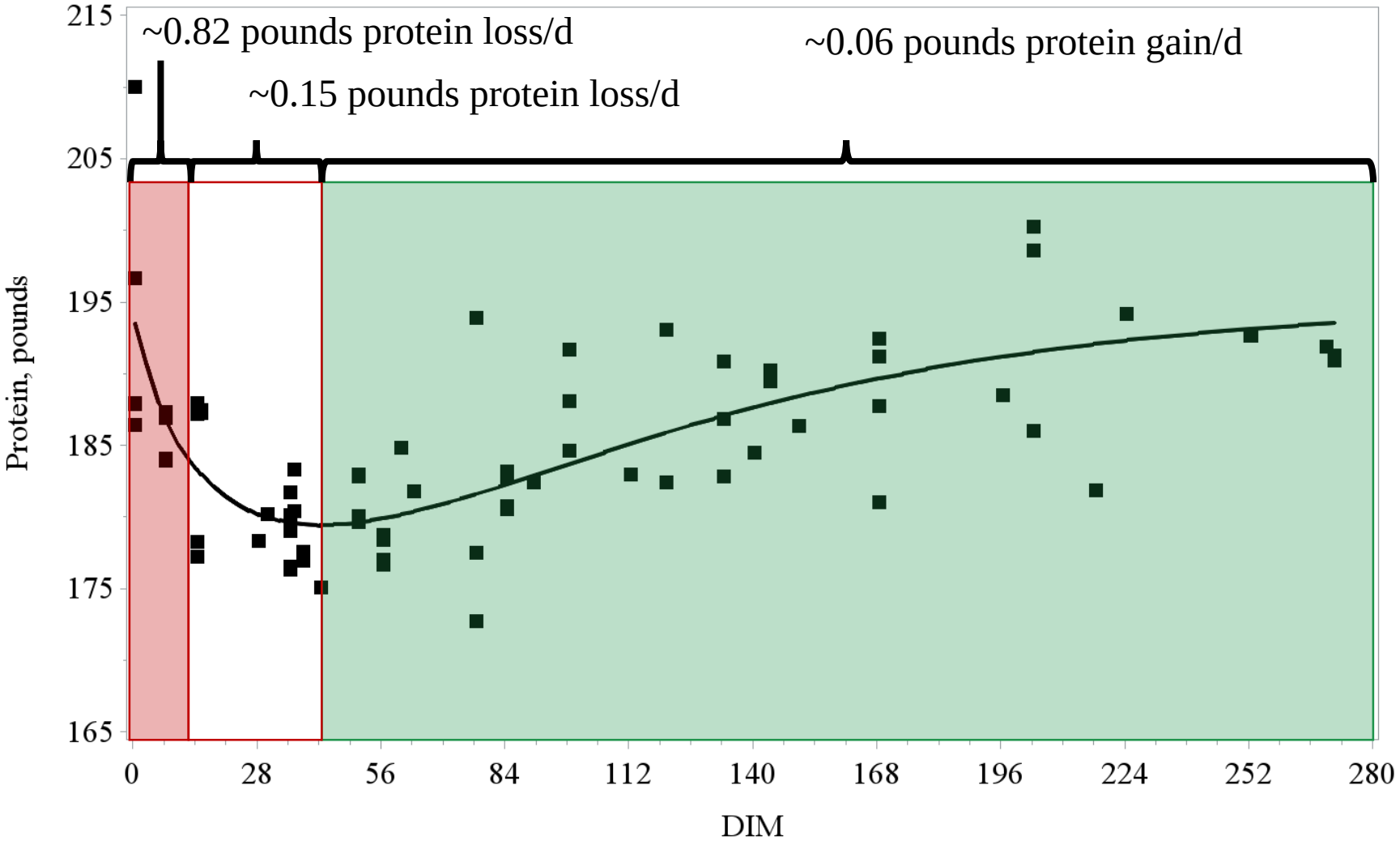
Literature body protein and energy composition changes are variable



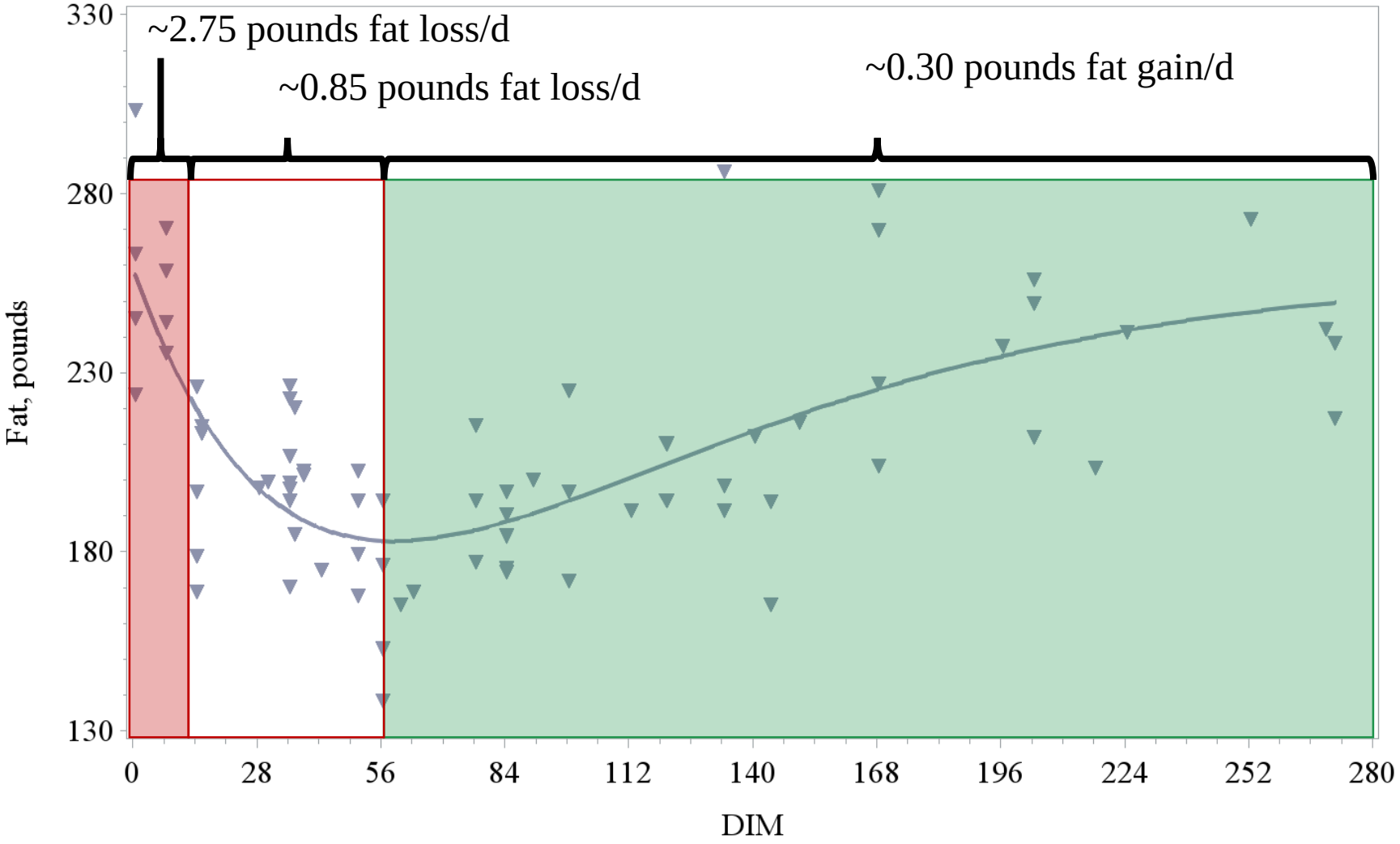
- Average initial BW: 1450±140 pounds (1285, 1712)
- Average reported BW: 1353±106 pounds (1184, 1712)

  - Belyea et al., 1978;
  - Chilliard et al., 1991;
  - McGuffey et al., 1991;
  - Gibb et al., 1992;
  - Andrew et al., 1994;
  - Komaragiri and Erdman, 1997;
  - Komaragiri et al., 1998;
  - Chibisa et al., 2008

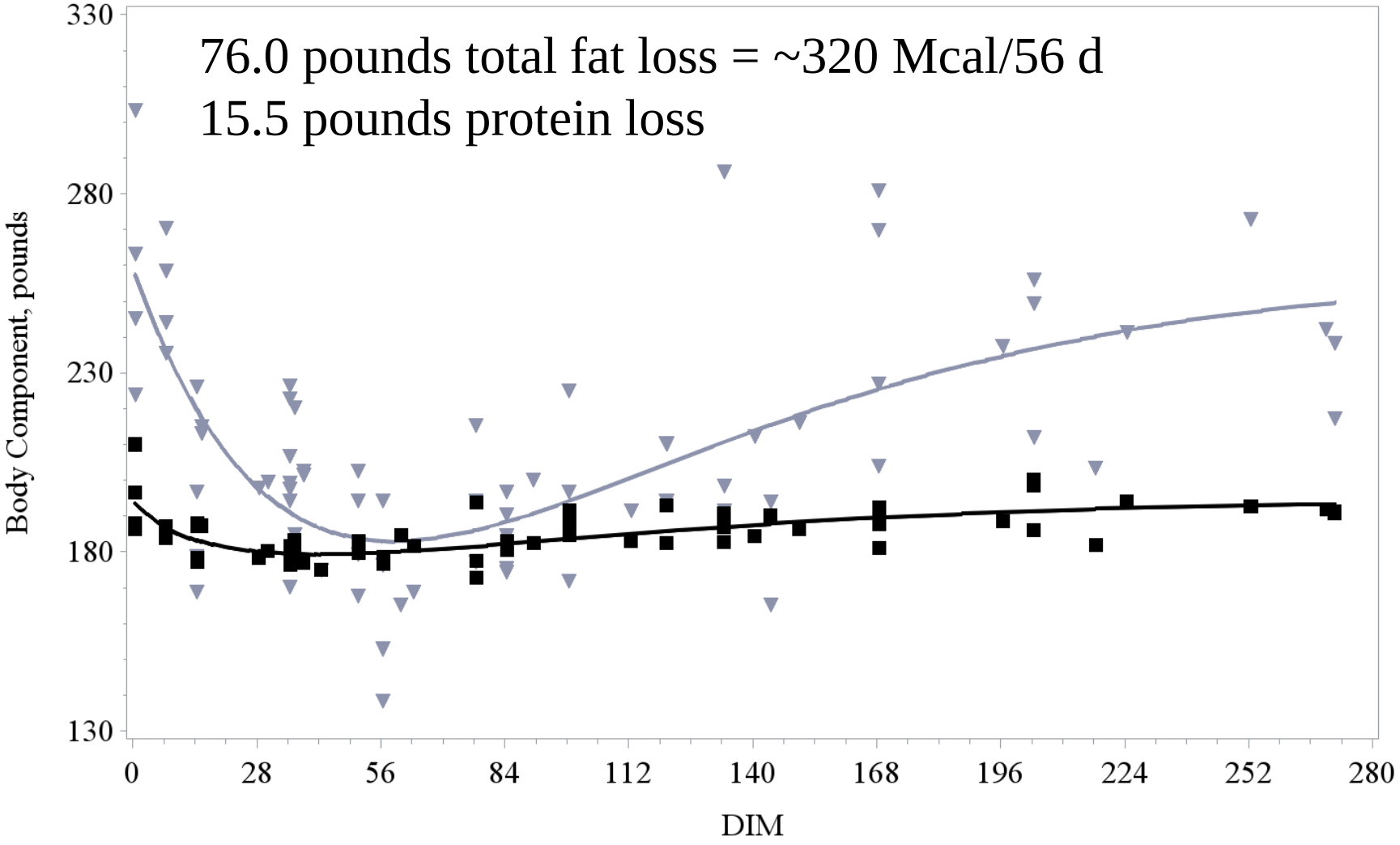
Predicted body protein changes throughout lactation



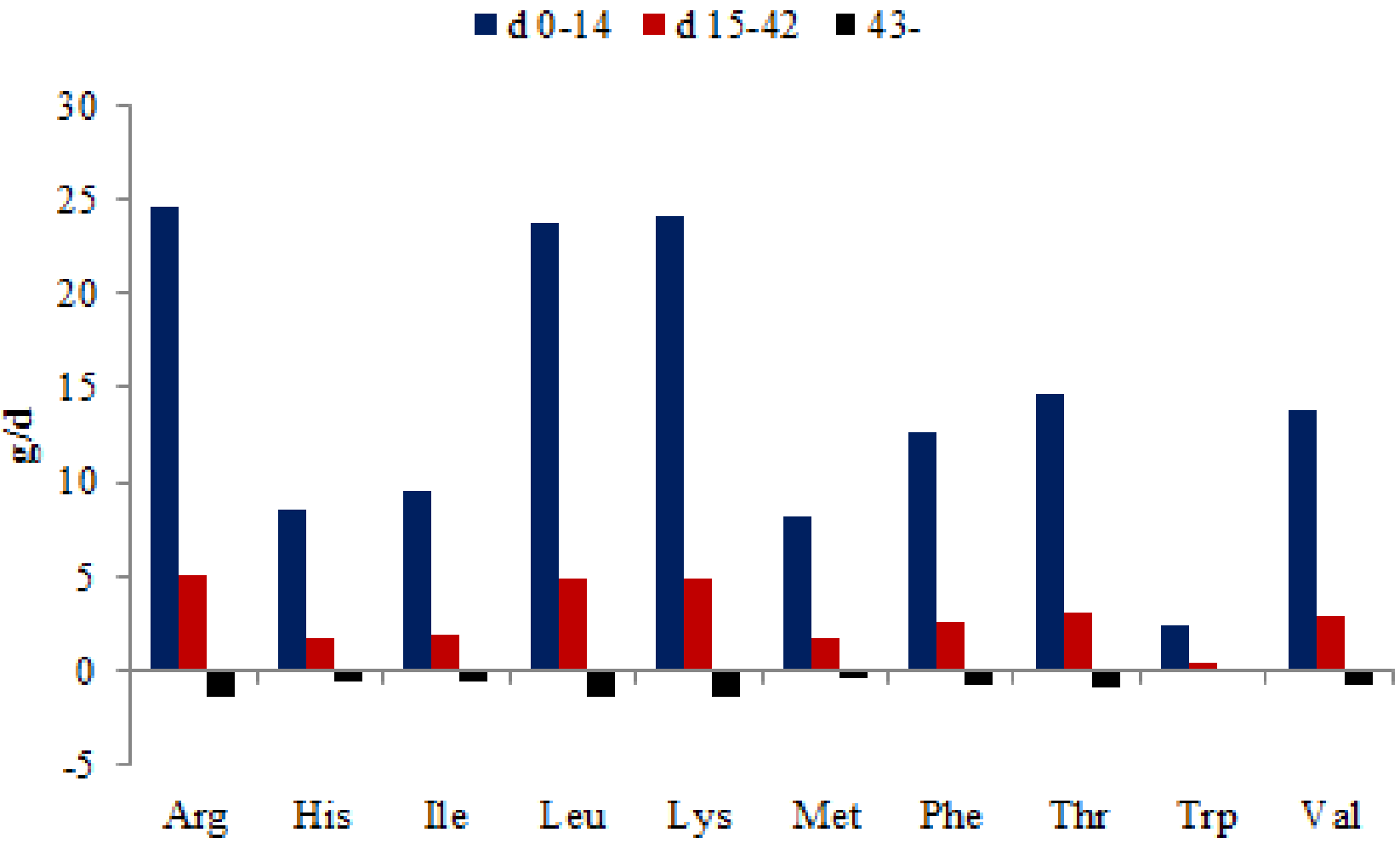
Predicted body fat changes throughout lactation



Body changes in energy exceed those of protein

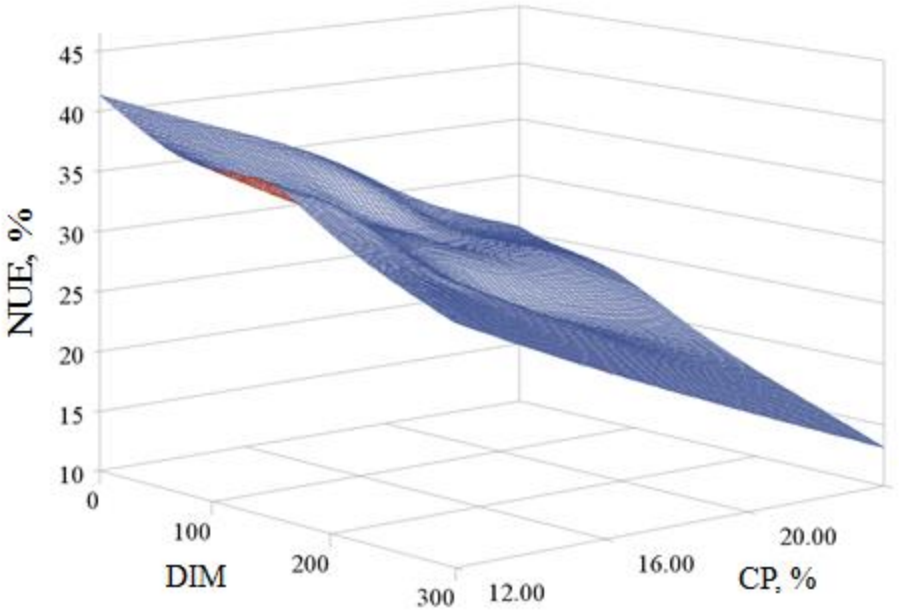


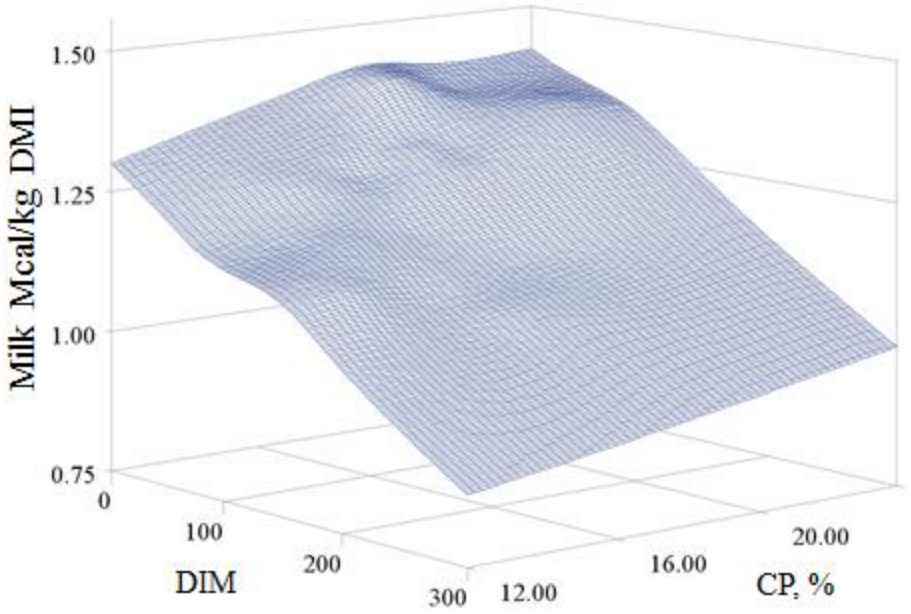
Calculated AA available from (positive values) or required to restore (negative values) mobilized body protein



AA composition of empty body protein from Ainslie et al., 1993

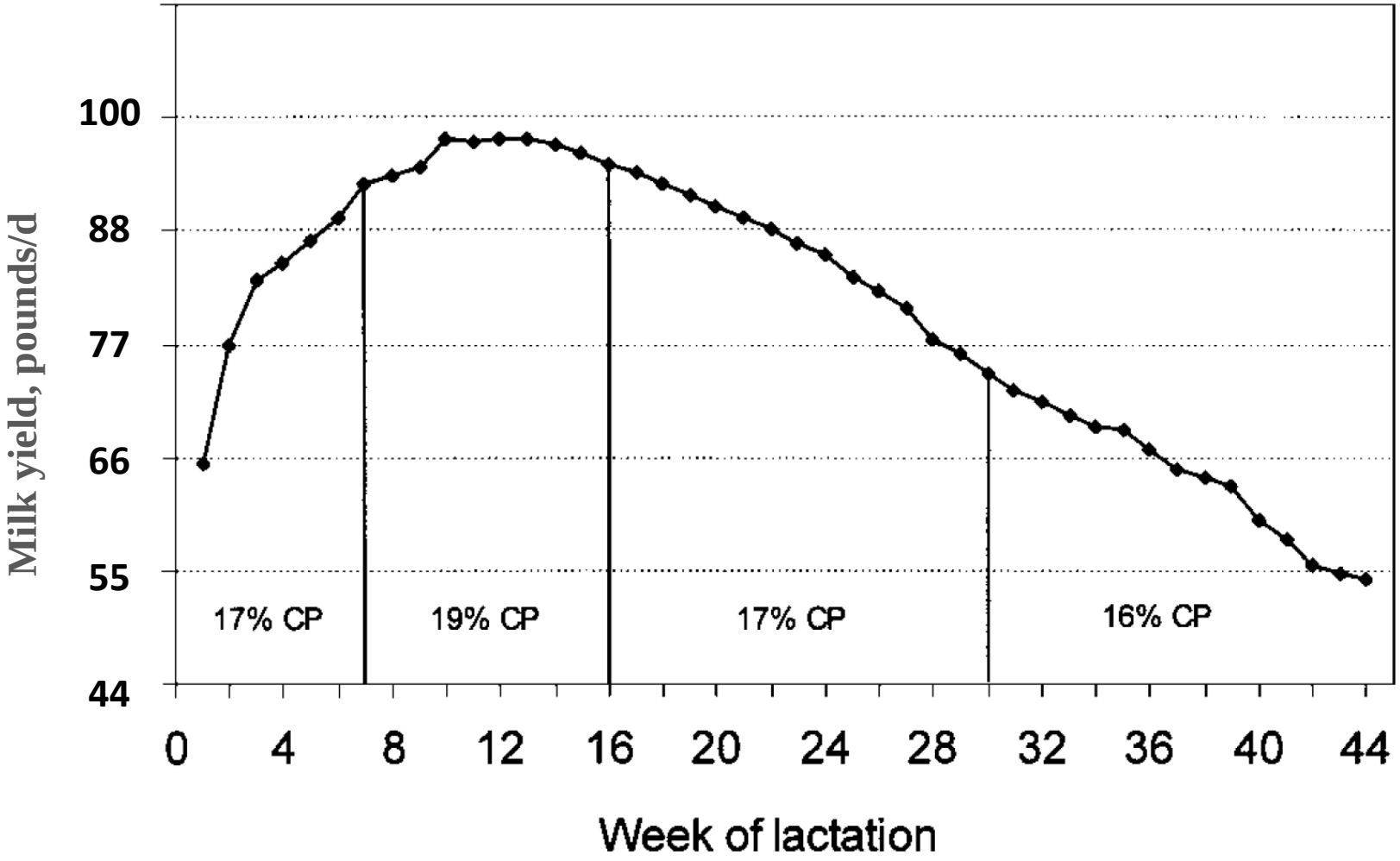
Nitrogen and feed efficiencies are affected by dietary protein and DIM





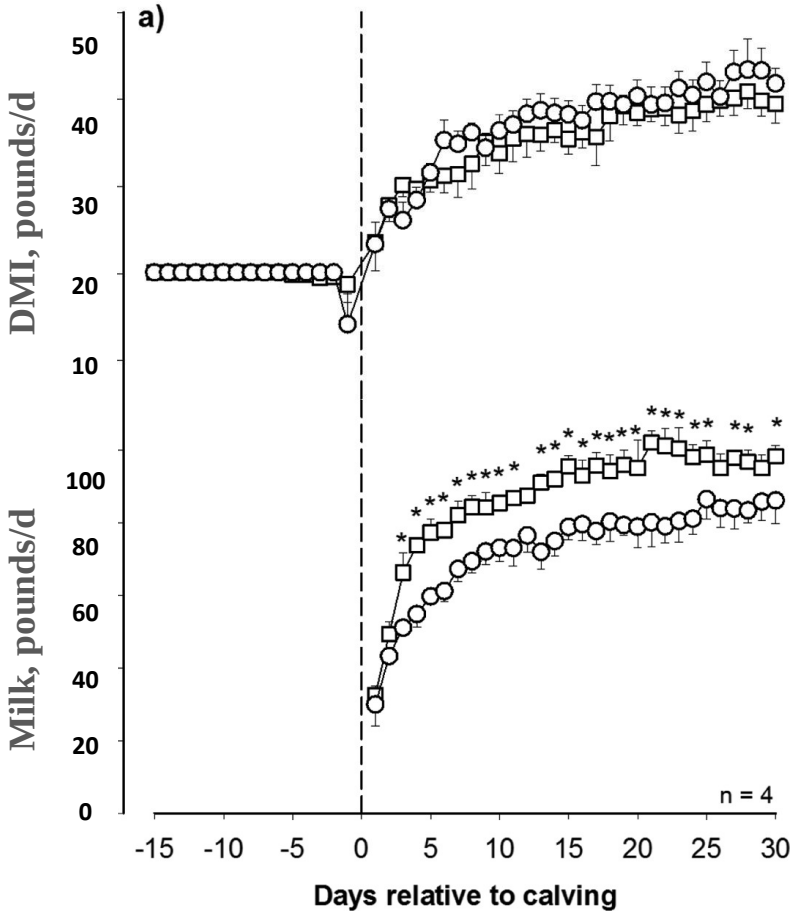
Data from Zanton, 2016

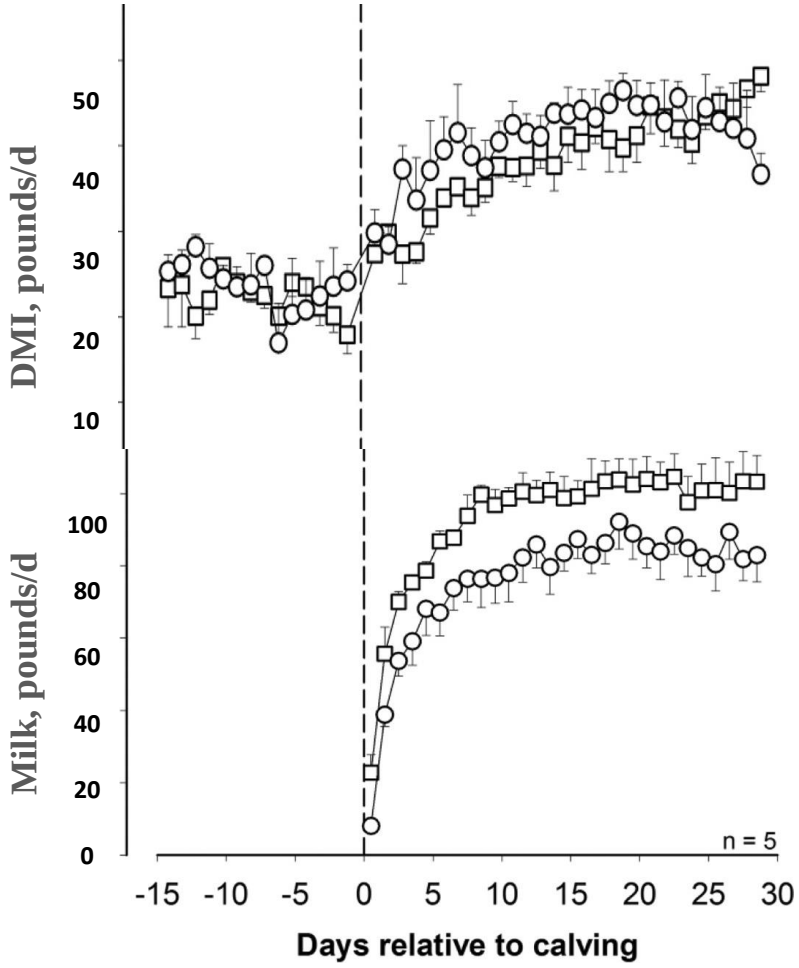
Phase feeding CP was proposed to accommodate the disproportionate changes in protein and energy status



Wu and Satter, 2000

Adding RUP (~200-700 g/d casein infusion) greatly increased early lactation milk yield





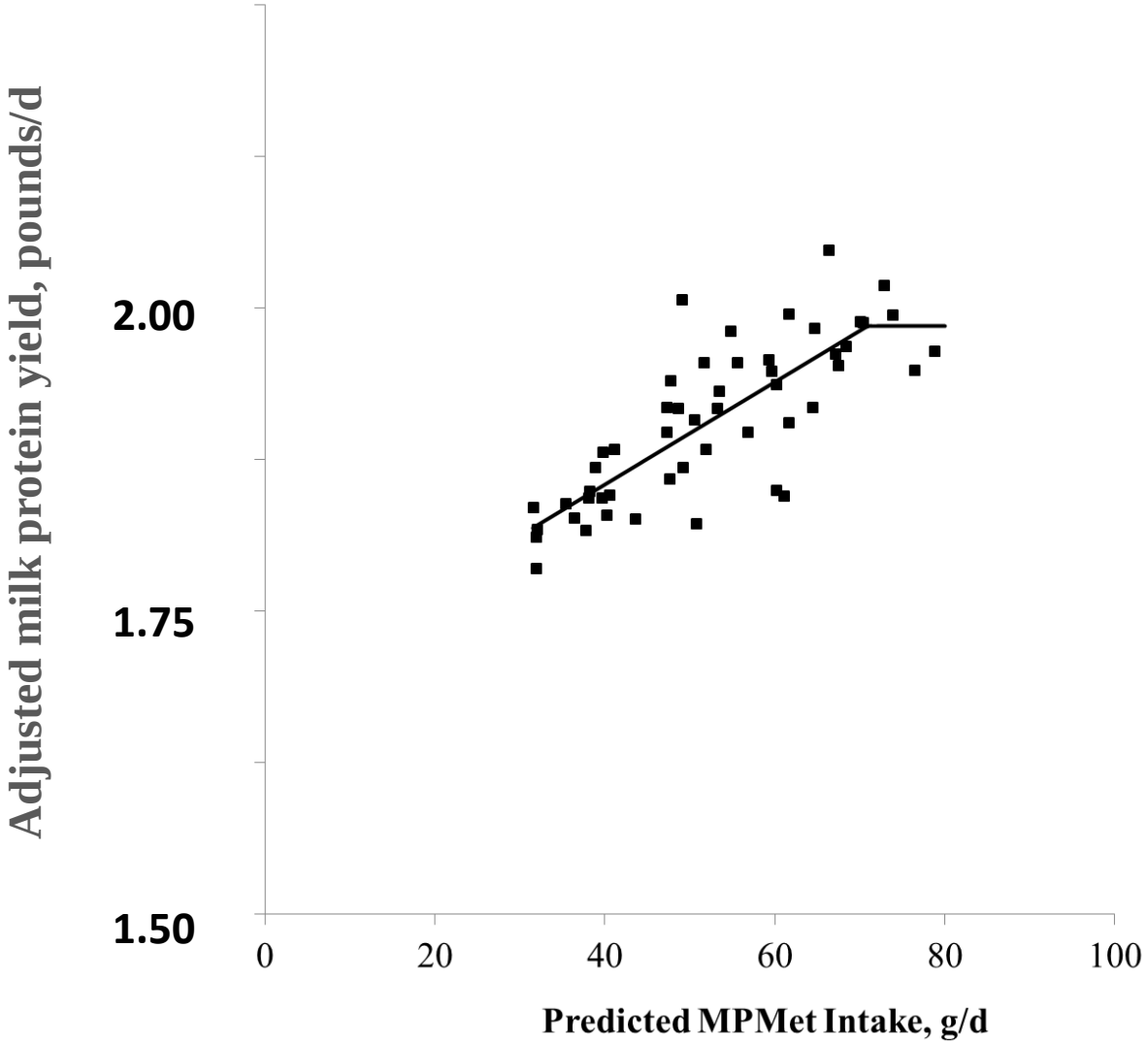
Larsen et al., 2014, 2015

Increased metabolizable protein from 3-23 DIM increased energy corrected milk and reduced protein mobilization

Item, pounds	Control	High MP	High MP + AA balance	SEM	*P*-value MP	*P*-value AA
DMI	39.2	39.6	40.7	1.0	0.46	0.44
Milk	74.1	76.3	73.0	2.4	0.78	0.33
Fat	2.77	3.21	3.30	0.18	0.01	0.73
Protein	2.29	2.40	2.38	0.07	0.34	0.82
Energy corrected milk	77.7	84.9	84.5	3.0	0.05	0.95
3-methylhistidine, μM	5.80	4.50	4.55	0.49	0.03	0.94

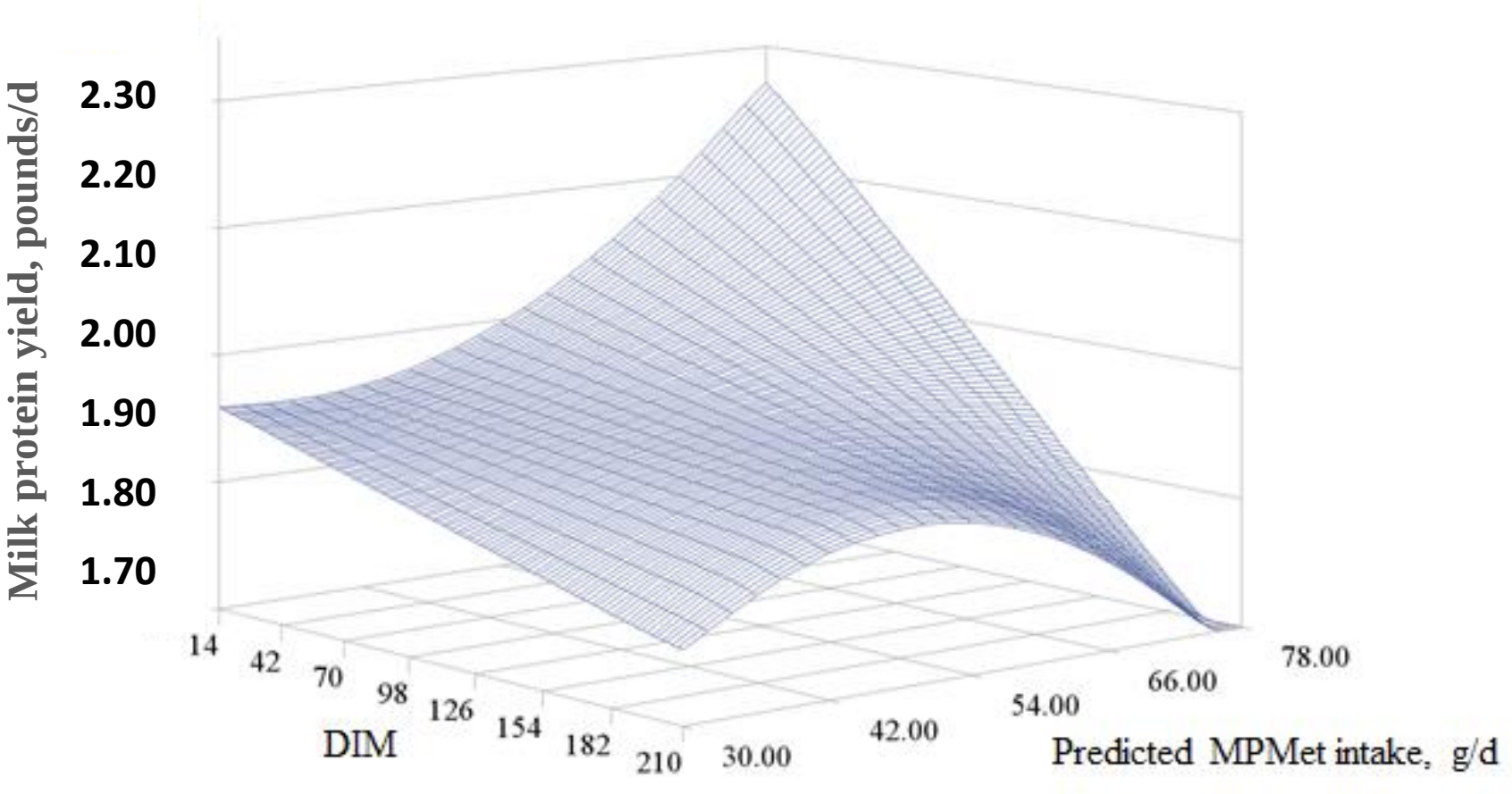
Carder and Weiss, 2017

Response to post-ruminal methionine infusion



Zanton et al., 2014

Milk protein response to infused DL-Met interacted with stage of lactation



Data from Zanton et al., 2014

Strategies for successful application

- **Approaches**
  - Balance for RDP to optimize microbial protein flow
  - Embrace AA modelling
    - Complementary RUP sources
    - Balance for AA using rumen protected AA
  - Group cows by requirement
- **Measurements**
  - Given AA functionality, response to improved AA nutrition may not be an immediate production response
    - Health
    - Reproduction
  - Give a high weight to peer reviewed/controlled research
- **Take home message**
  - Meeting metabolizable protein requirement is critical in early lactation where excessive energy reserves are being mobilized

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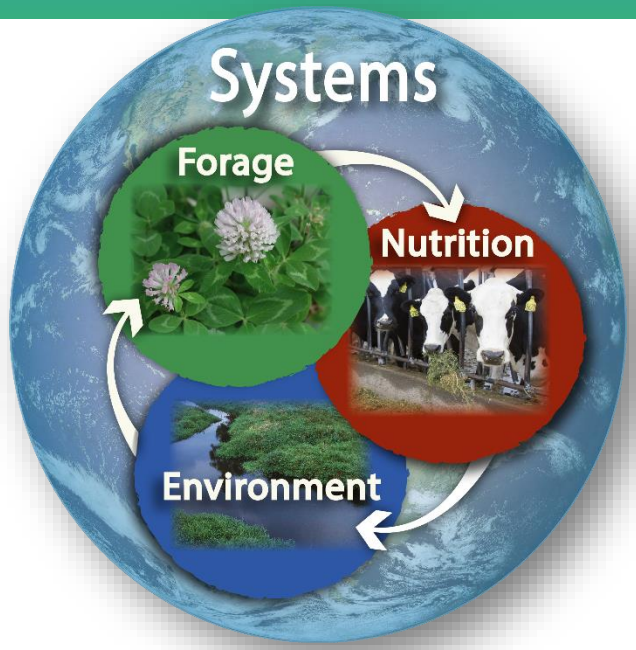
QUESTIONS?

Leading the world in integrated dairy forage systems research.



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