



**Yes, Met and Lys are Important, but
there are Several Others that are also
Important in Lactating Cow Diets**

**Dr. Mark Hanigan
Virginia Tech**



Four-State Dairy Nutrition & Management Conference

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Dr. Mark Hanigan, Virginia Tech

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1

N Efficiencies are Low for Ruminants

↑ efficiency = ↑ food/ac and ↓ environmental loading!

Bequette et al., 2003

2

Ohio Dairy Nutrient Values – 5-year Average

Nutrient values derived using Sesame
Buckeye Dairy News: Vol 22, Issue 2 (March, 2020)

Nutrient	Cost/unit	Daily Supply*	Cost/cow/d
NEL (3x, NRC 2001) MCal	\$0.08	35.4 Mcal	\$2.83
Metabolizable Protein (NRC) Lbs	\$0.43	5.44 lbs	\$2.34
Effective NDF (forage NDF) Lbs	\$0.14	10.4 lbs	\$1.46
Non-effective NDF (Total NDF – Forage NDF) Lbs	-\$0.02	7.3 lbs	-\$0.15
Total Cost for Energy, Protein and Fiber			\$6.48

* 1600 lb cow, 80 lbs milk/d, 3.0% protein, 3.5% fat

<https://dairy.osu.edu/newsletters/buckeye-dairy-news/volume-22-issue-2/milk-protein-costs-margins-and-comparison>
Sesame can be licensed and used for local markets.

3

Milk Protein vs Metabolizable Protein

650 g / 454 x \$0.44/lb = \$0.63/c/d (€0.54)

Lapierre et al., 2007

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4

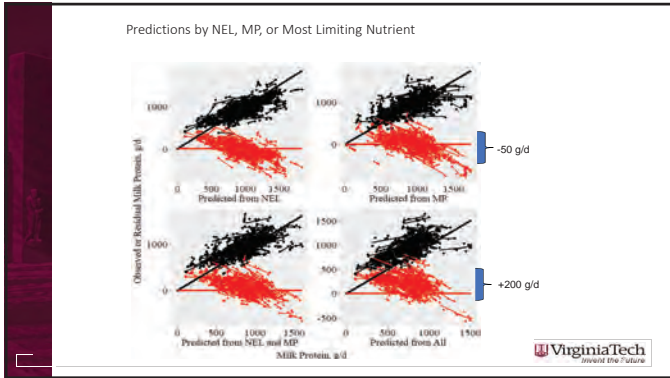
Ration Balancer: Behind the User Interface

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Inaccurate and Imprecise

- High RMSE
- Low CCC
- High mean bias
- High slope bias
- May be useful but difficult calibration
- NRC 2001

6

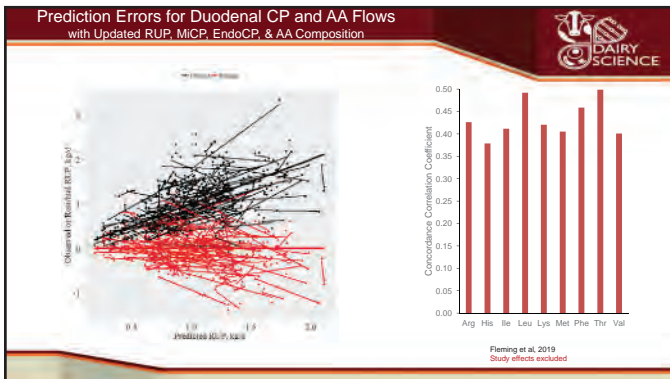


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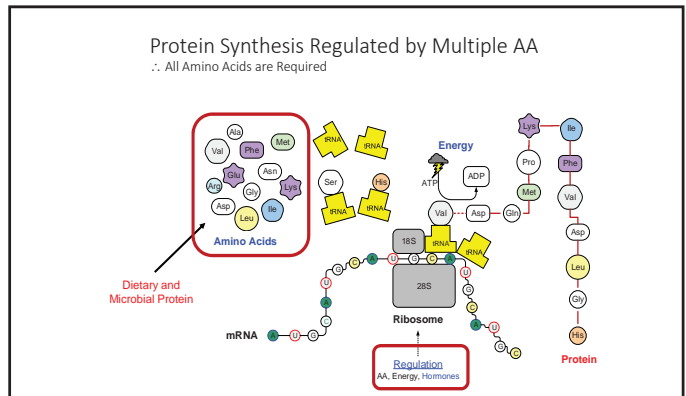
Subsequent NRC Committee Work

- **Updated Feed Library**
 - All nutrients including Kd and AA
- **Updated RUP Predictions**
 - Both Kp and Kd are off
 - Kd is too low, Kp is too high
 - Updated RUP digestibility
- **Updated microbial CP prediction (Morales et al.)**
 - Integrated RDCHO and RDP
- **Updated AA throughout**
 - Corrected AA for hydration and recovery from acid hydrolysis
 - Updated microbial and endogenous AA composition
 - Retained assumption that AA digest = RUP digest
 - Carried EAA through the full model
- **New milk protein equation**
 - 6 EAA, DE, and dNDF
- **New milk fat equation**
 - DMI, DIM, Total FA, C16:0, and C18:3

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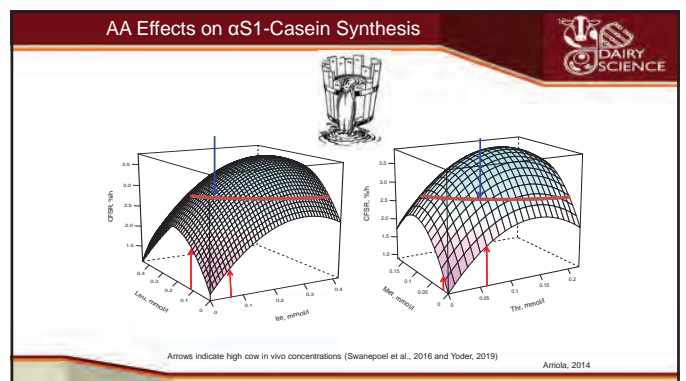


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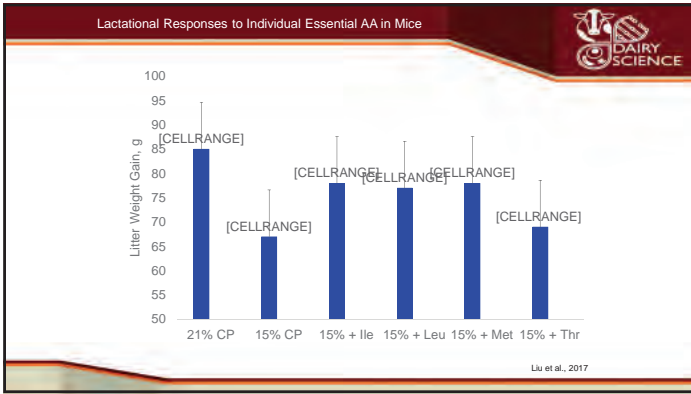
State of the Art for AA Requirements

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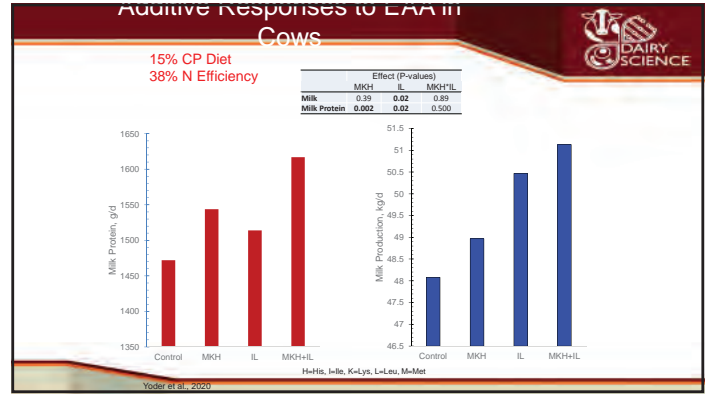
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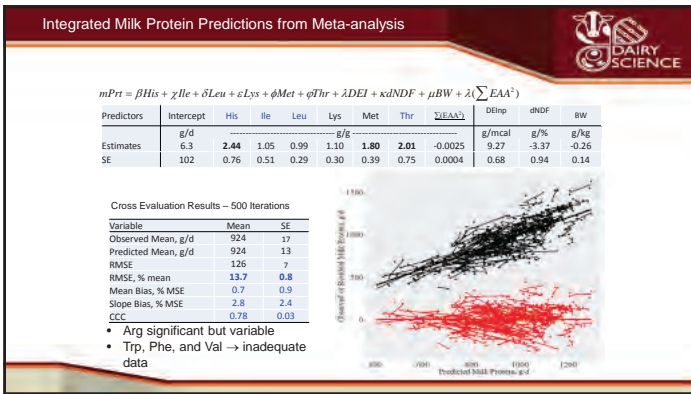
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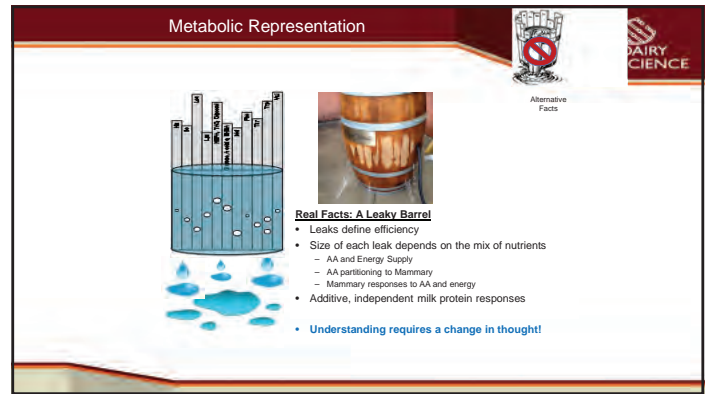
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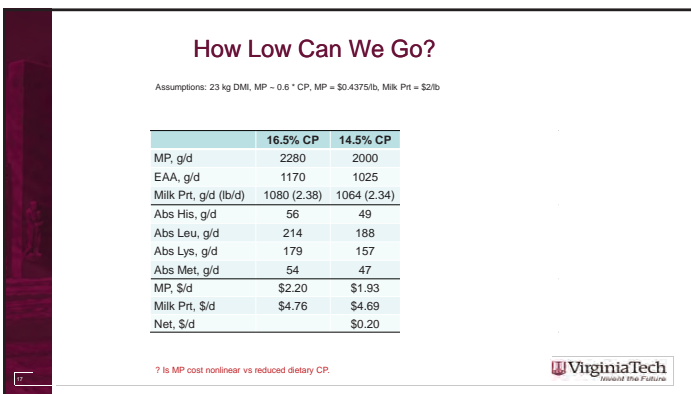
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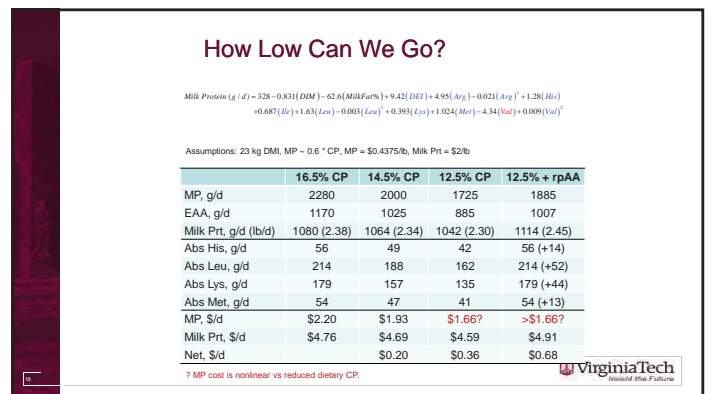
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Diet Optimization Using Different Strategies

RP His, Lys, Ile, Leu, Met, and Thr offered

	Least Cost	Maximum IOFC ^a	IOFC + N Penalty ^b	IOFC ↓ Milk\$ ^c	IOFC ↓↓ Milk\$ ^d
Diet Cost, \$/d/c	\$6.38	\$7.72	\$7.81	\$7.46	\$6.80
Milk Value, \$/d/c	\$14.59	\$16.74	\$16.18	\$12.31	\$7.75
Milk Protein, g/d	1110	1286	1210	1262	1189
ME, mcal/kg	2.92	3.01	3.12	3.00	2.98
MP, g/d	2039	3067	2110	2907	2364
Dietary CP, %	14.9	21.8	14.7	20.6	17.1
N Efficiency, %	29.7	23.6	33.0	24.5	27.8
Neutral Detergent Fiber, %	35.7	32.8	34.5	33.4	35.3
Starch, %	26.2	24.1	25.2	24.8	25.9
Fatty Acids, %	2.55	3.17	2.83	2.96	2.77

^a Milk protein = \$4 / lb and milk fat = \$2 / lb; assumed high potential production
^b Milk protein = \$3 / lb and milk fat = \$1.50 / lb
^c Milk protein = \$2 / lb and milk fat = \$1 / lb

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Conclusions



- ✓ Updated feed library
- ✓ Revised RUP and Microbial CP predictions
- ✓ New concepts for milk protein predictions
 - 6 to 8 EAA, DEI, dNDF
 - Marginal responses to individual AA not high
 - AA responses > MP and RPAA input cost
 - Energy supply very important
 - No such thing as a single-limiting AA
- ✓ Milk Protein equations in trial version of NDS
- ✓ AMTS waiting on me
- ✓ NRC out in 2021
- ✓ Optimize or Plug and Chug?
 - dNDF, dStarch, RDP, dFat, 8 dEAA, 2 dFA, 38 MV, Ingr\$, M
 - How much money are you leaving on the table????



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