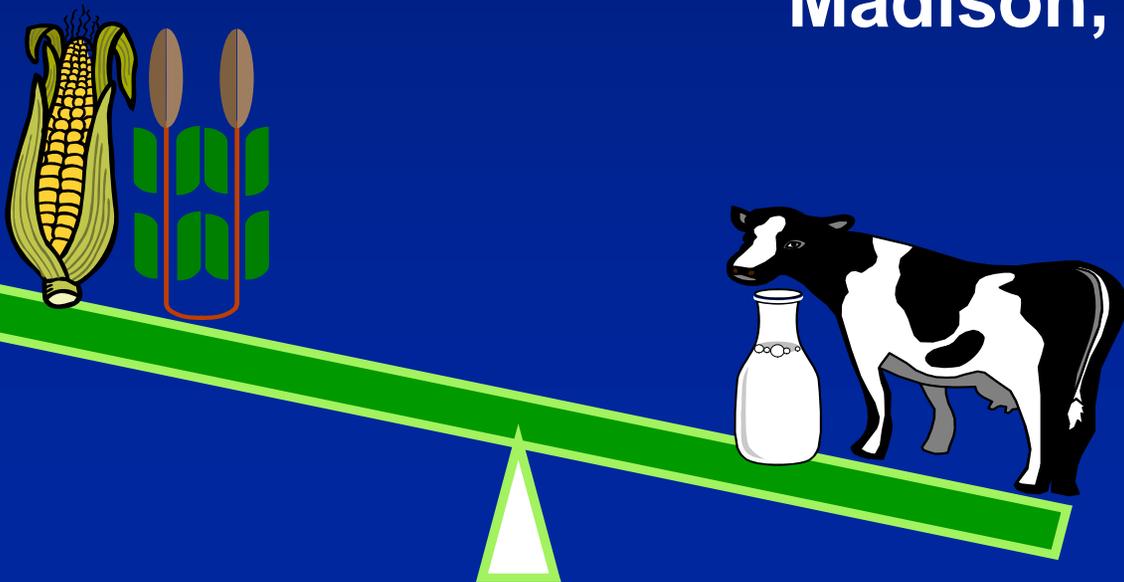


New Understanding of The Stories Cows Tell About Nutrition

Mary Beth Hall
U. S. Dairy Forage Research Center
USDA – Agricultural Research Service
Madison, WI



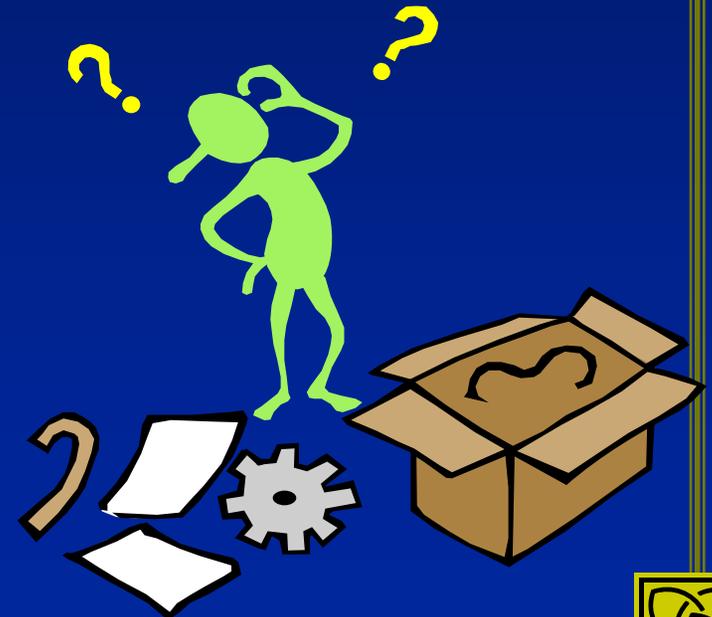
Just when you think you have dairy cattle nutrition figured out, the cows go and do something else.....



We know that it's not the cows who don't know what's going on.

The most exciting phrase to hear in science, the one that heralds new discoveries, is not 'Eureka' (I found it!) but, 'That's funny.....'

Issac Asimov





Questions that might matter:

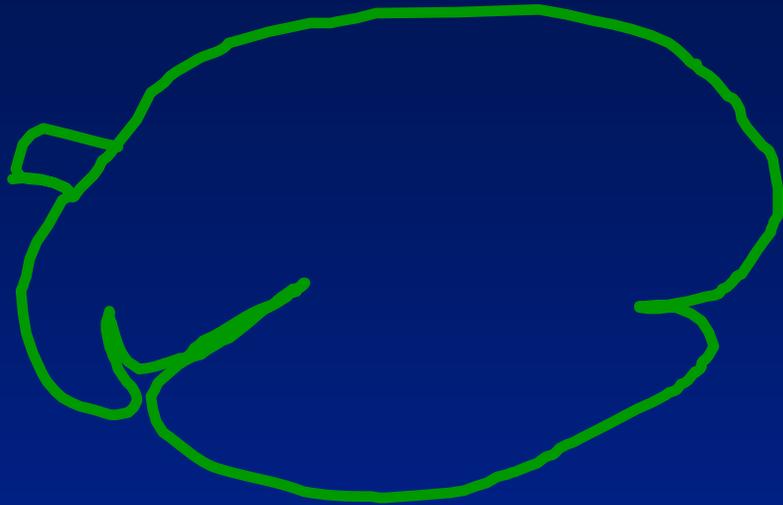
- ☀ Why does manure get “loose” when cows have ruminal acidosis or have heat stress?
 - ☀ Why might RUP make cows stand more?
 - ☀ Why should rumen pH or acid production change by protein feeding?
 - ☀ Why might milk protein drop with feeding sugar as compared to starch?
- 
- 

Loose Manure

- ✦ Common in heat stress and ruminal acidosis
- ✦ Think that fermentable feed, like starch, escaped the rumen and fermented in the large intestine
- ✦ But, we're missing part of the picture.....



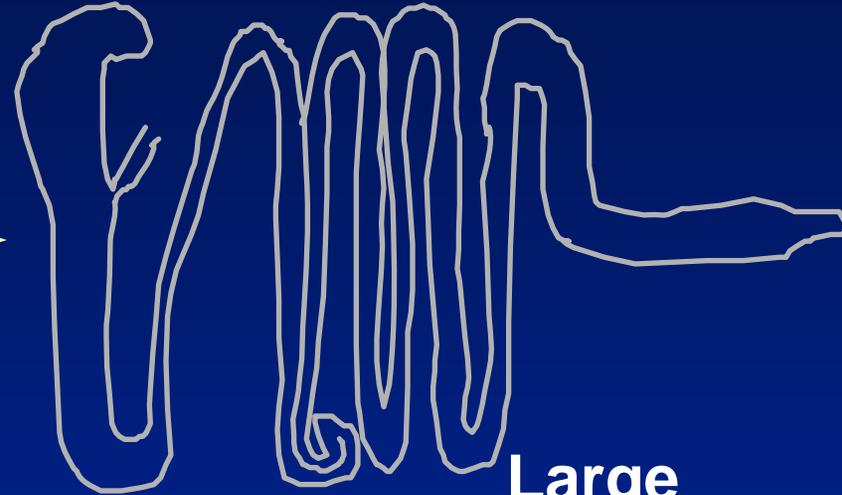
Loose Manure



Rumen



Small Intestine



Large Intestine & Cecum

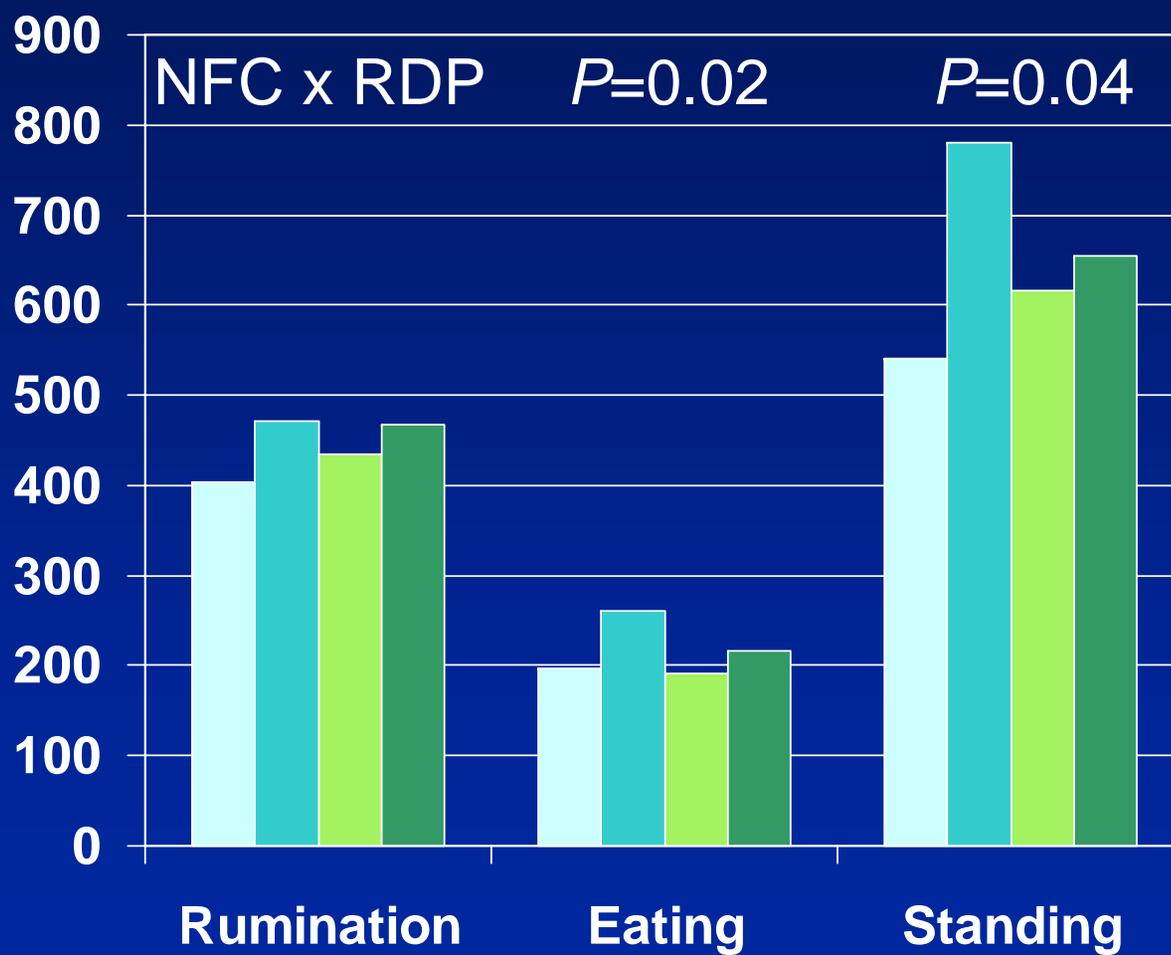
Why didn't the small intestine work to digest the starch before it got to the large intestine?

- ✦ Not working?
- ✦ Passage too quick?
- ✦ Can we fix it and maybe enhance normal cows?

Protein and Standing



min/day



Diets with 10% corn starch or table sugar & Higher or lower rumen degradable protein

	<u>DM intake, lb</u>
Suc+RDP	49.9
Suc-RDP	51.5
Sta+RDP	51.9
Sta-RDP	52.1

M. B. Hall, 2009

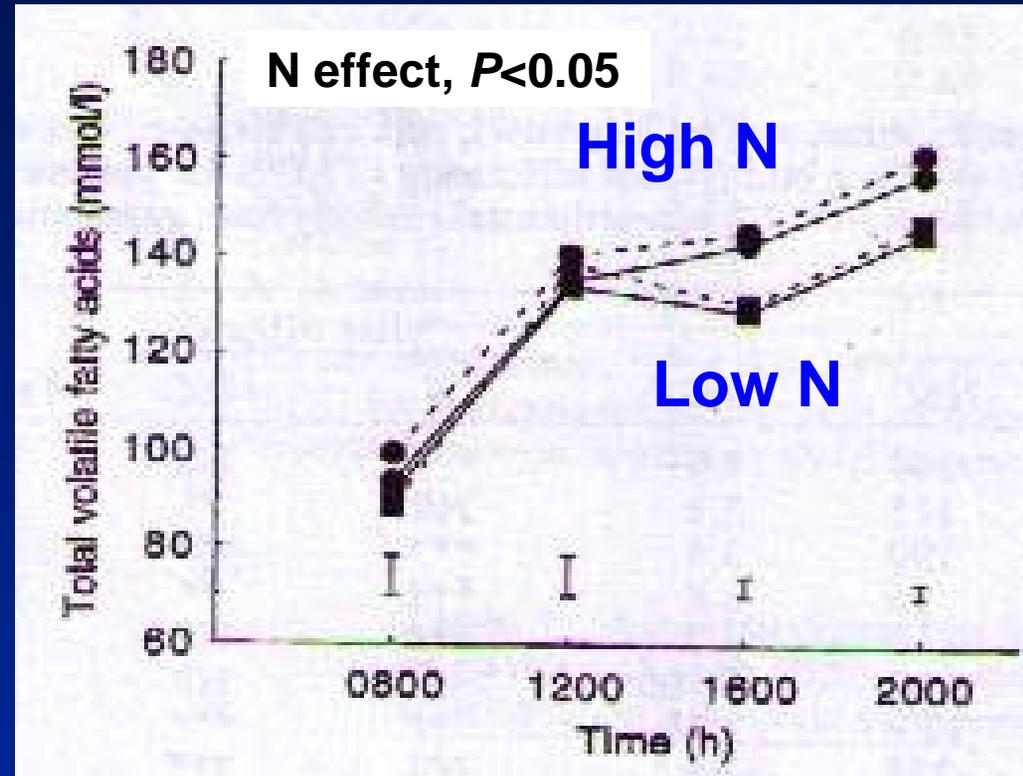
Protein and Standing



- ☀ How is protein having this effect?
- ☀ A good thing: more even eating, nibbling for good rumen function?
- ☀ A bad thing: more time spent on their feet?

Protein and Rumen pH & Acid

- ★ Fermentating carbohydrates give the most acids and greatest pH decrease in the rumen.
- ★ Sometimes, even when protein looks adequate, when we increase rumen degradable protein strange things happen...



Total VFA, mmol/L

High N (17.6%) or Low N (15.7%) pastures +/- a carbohydrate drench (4x daily feeding of each).

Protein and Rumen pH & Acid



RANSC

High

Low

RDP

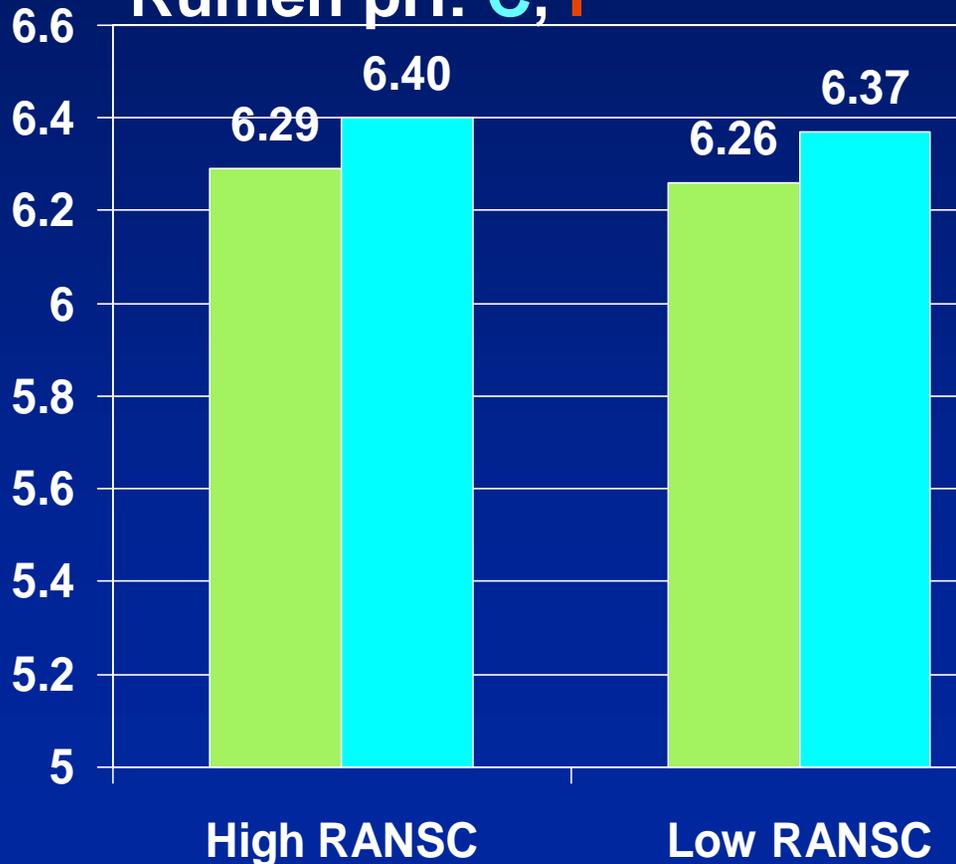
High

Low

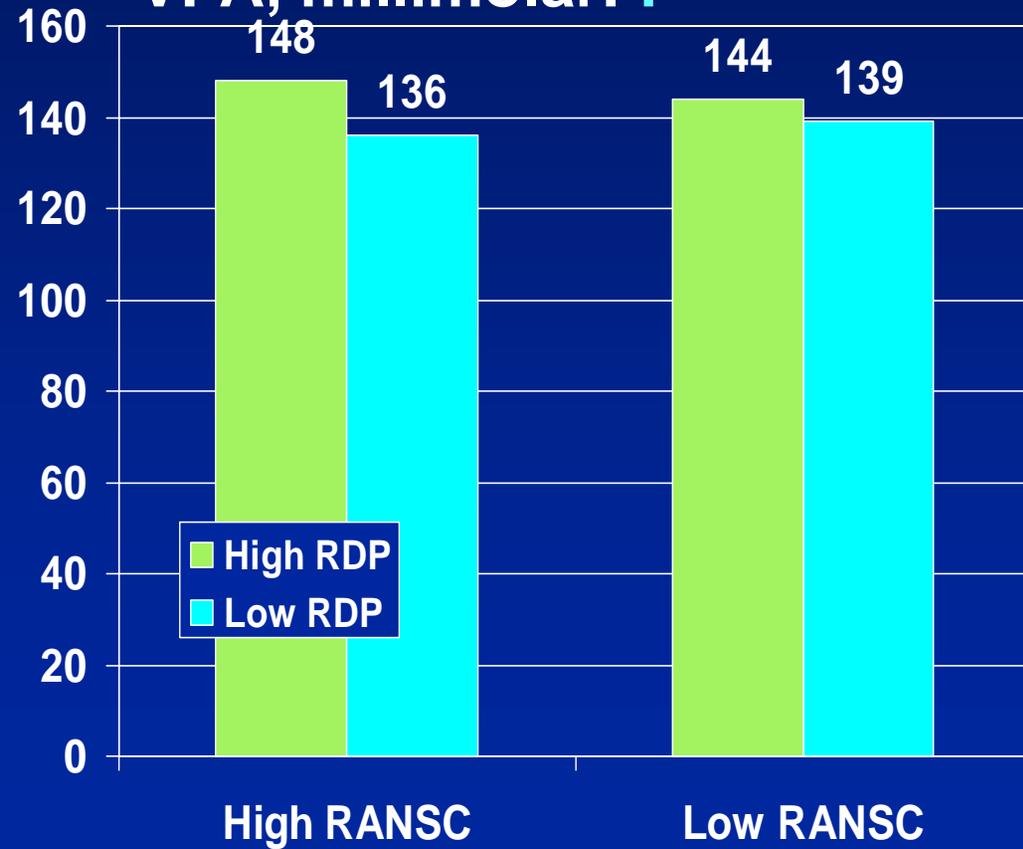
High

Low

Rumen pH: C, P



VFA, millimolar: P



Aldrich et al., 1993

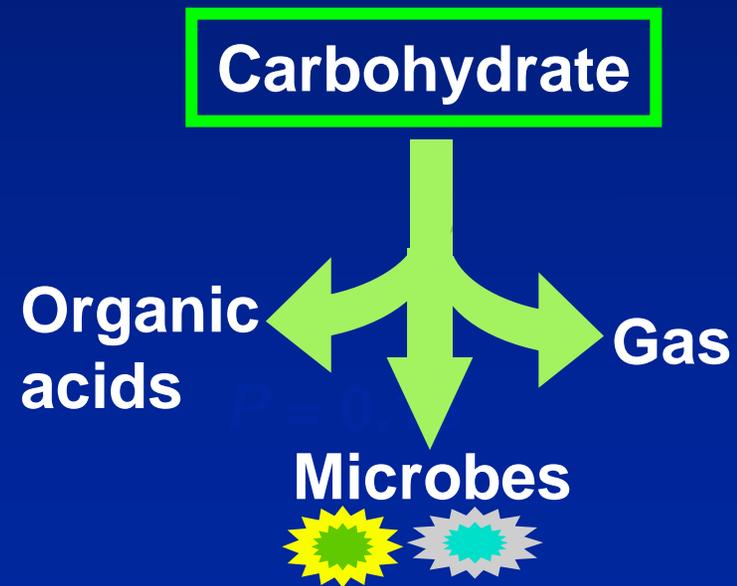
Protein and Rumen pH & Acid



Fermentation Results

<u>Sucrose, mg</u>	<u>65</u>	<u>130</u>	<u>195</u>
Acid C/Sucrose C	82%	60%	49%

- ★ Where did the fermented substrate go?
- ★ What tips the balance for protein to affect acid production?
- ★ How can we avoid or enhance it: improve feed efficiency or avoid ruminal acidosis?



Hall and Weimer, 2007

Sugar, Starch, & Milk Protein



Sugar is a rapidly fermented carbohydrate that should give more microbial protein than starch to support production.....

Broderick et al., 2002



Sugar, Starch, & Milk Protein



Fermentations with glucose or sucrose had lots of white material that sank to the bottom if you let the tubes sit.

Hall, unpub.

Sugar

= Organic acids + Microbes + Gas + Glycogen

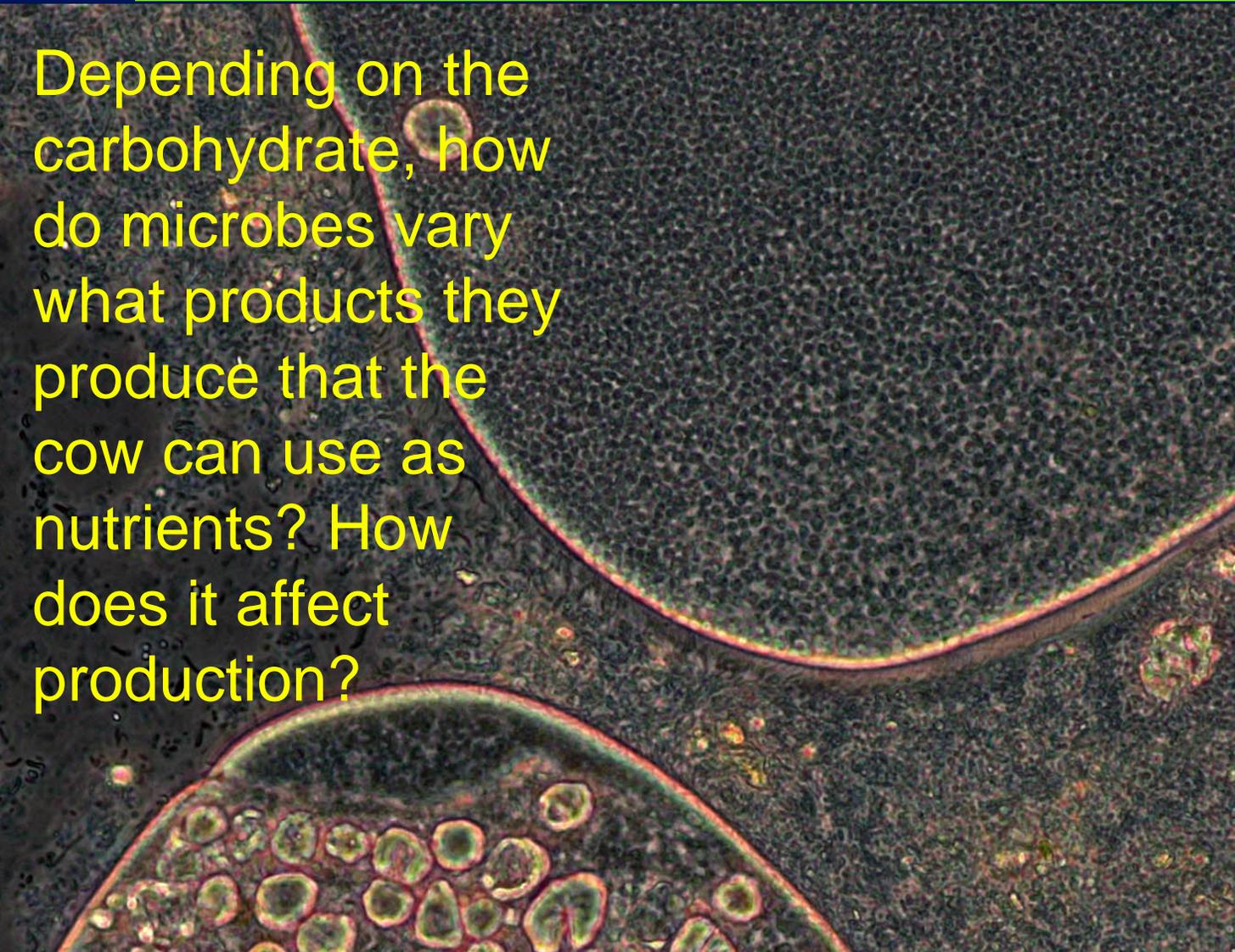


5. Rumen Protozoa & Carbohydrates



Depending on the carbohydrate, how do microbes vary what products they produce that the cow can use as nutrients? How does it affect production?

Are the dots bacteria eaten by the protozoa or glycogen the protozoa made from the sugar?



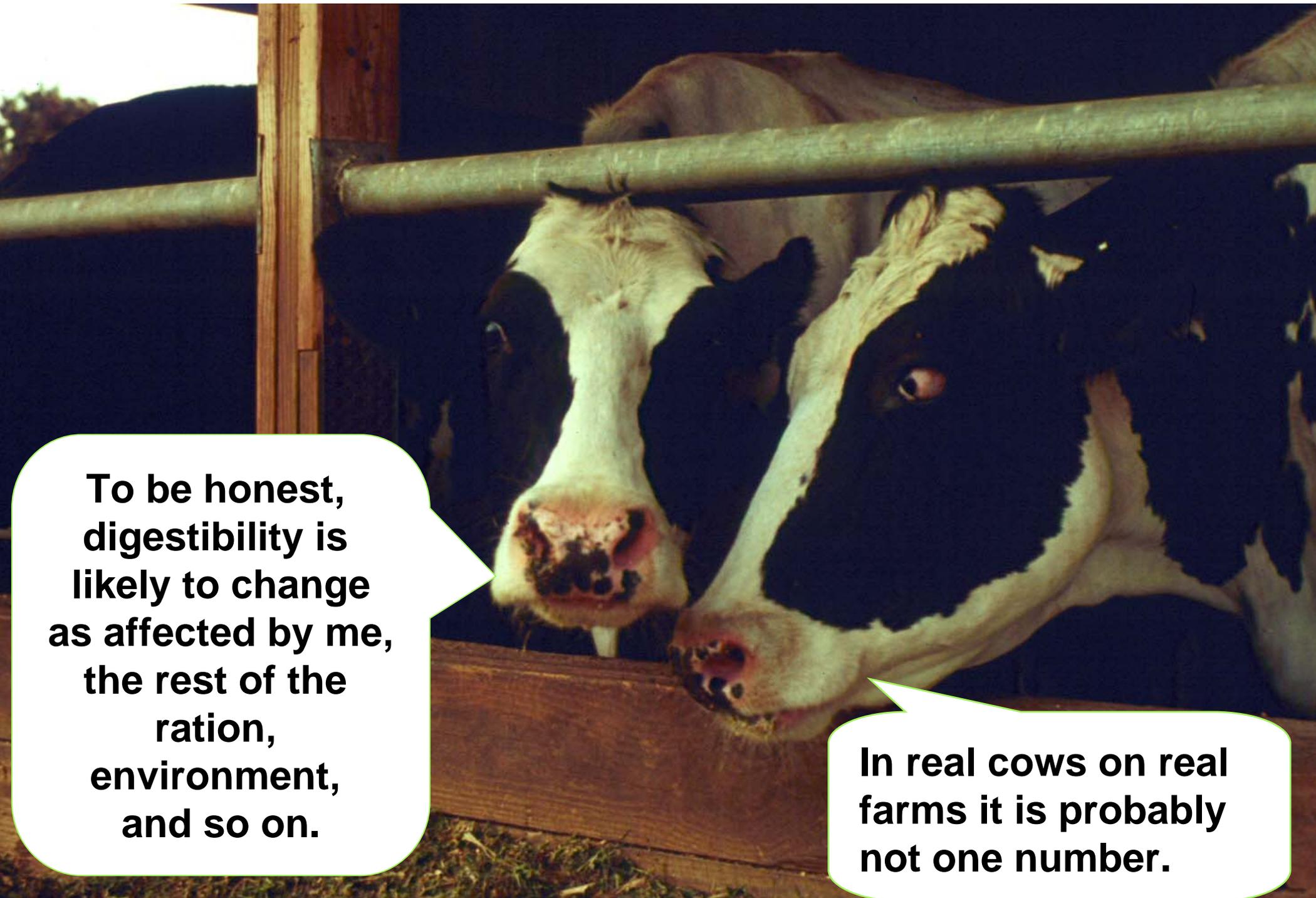
Hall, unpub.



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To do anything well (and repeatably), we need to understand what we are dealing with.

Questions?



**To be honest,
digestibility is
likely to change
as affected by me,
the rest of the
ration,
environment,
and so on.**

**In real cows on real
farms it is probably
not one number.**