




Introduction


- On a **gross** scale, increasing crude protein content of diets:
 - Increases feed intake
 - Increases milk yield

- May increase milk protein content



Concerns

- **Inefficiency of nitrogen use**
 - Costly if excess protein is fed
 - Environmental issues
 - Cheese



CHEESE

- Processing yields affected by true protein content
- Increased value of protein



Protein Fractions of Milk

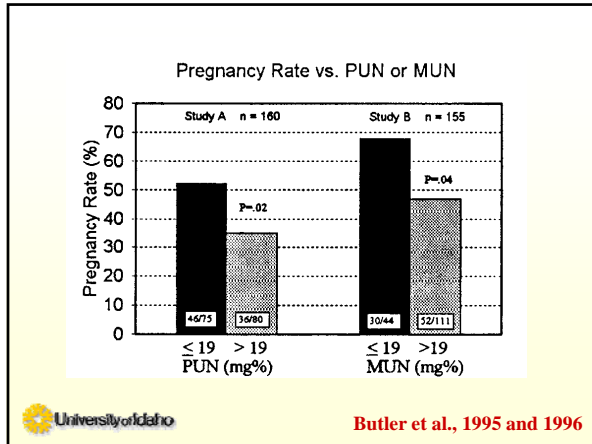
- Casein (~80%)
 - Whey (14-15%)
- } = True Protein
- NPN - nonprotein nitrogen (5-6%)
 - 25-30 mg/dl of milk
 - ~50% of NPN is urea N



Concerns (con't)

- Inefficiency of nitrogen use
 - Costly if excess protein is fed
 - Environmental issues
 - Cheese
 - Poor reproductive performance





BUN and MUN suggested as a measure to evaluate efficiency of protein utilization

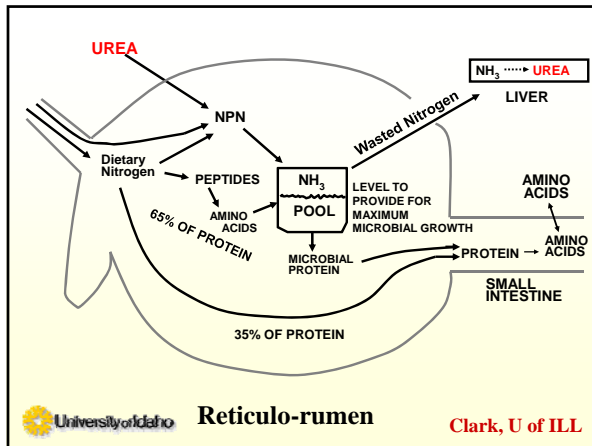
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Urea

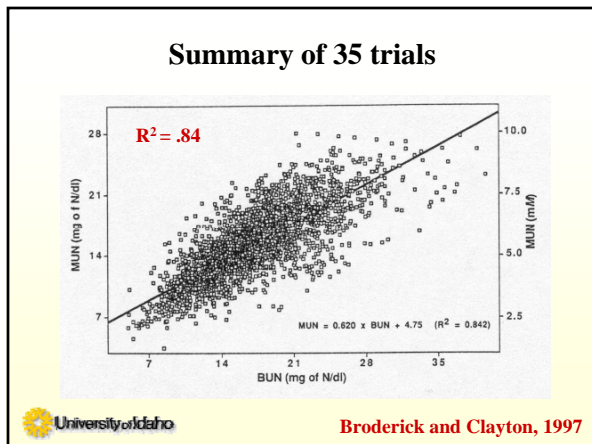
$$\begin{array}{c}
 \text{NH}_2 \\
 \diagdown \\
 \text{O}=\text{C} \\
 \diagup \\
 \text{NH}_2
 \end{array}$$

- Excretory product of ammonia (NH₃)
 - Rumen
 - AA catabolism
- Formed in liver: urea cycle

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- Released into blood for excretion by kidney
 - Blood urea nitrogen - BUN, PUN or SUN
 - Urea equilibrates with body water
 - BUN highly correlated with milk urea N (MUN)
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MUN

- Easier to sample
- Pre- and post-milking strip samples not different than typical milk sample



Gustafsson and Palmquist, 1993

Nutritional effects on MUN



Quick summary

- MUN increased with increasing dietary protein
- Response confounded with carbohydrate availability
- RDP as a % of crude protein increased with increasing dietary CP



Quick summary

- **Excess RDP increases MUN**
- **Imbalance in protein supply contributes to increased MUN**



Quick summary

- **MUN is affected by level of dietary RUP**
- **Non-urea NPN is stable**



Quick summary

Dietary fat...

- **Decreases casein and increases NPN fractions of milk N**




MUN may be a useful tool, BUT...

- Dietary protein source
 - RDP
 - RUP
- Dietary carbohydrate
- Dietary fat source




Milk Urea Nitrogen (MUN)

- What does it tell you?
 - Low MUN (<12 mg/dl) suggests a very efficient use of amino acids
 - possibly limiting



Milk Urea Nitrogen (MUN)

- High MUN (>18 mg/dl) suggests a significant rate of amino acid oxidation
 - overfeeding of protein
 - imbalanced amino acid pattern
 - excess urea fed
 - low energy
 - inadequate carbon for the bacteria to capture the N as microbial protein



How to Use MUN

- **Sampling**
 - with normal herd testing (individual animals)
 - more repeated in a subset of each ration fed or pen of cows (10-15% of cows sampled)
 - Time of day
 - little variation unless significant slug feeding or significant sorting occurring



How to Use MUN

- Results only can suggest that protein nutrition is improper (could be either protein or energy effect)
- Only provides a clue; does not give the full answer
- You must investigate to determine if there is a problem