

# **The continued need for DL-methionine in organic poultry diets**

**National Organic Standards Board Meeting**  
Seattle, Washington  
April 24, 2019

**Kristjan Bregendahl, Ph.D.**  
*Poultry Nutritionist, Devenish Nutrition*

# Amino acids—not protein

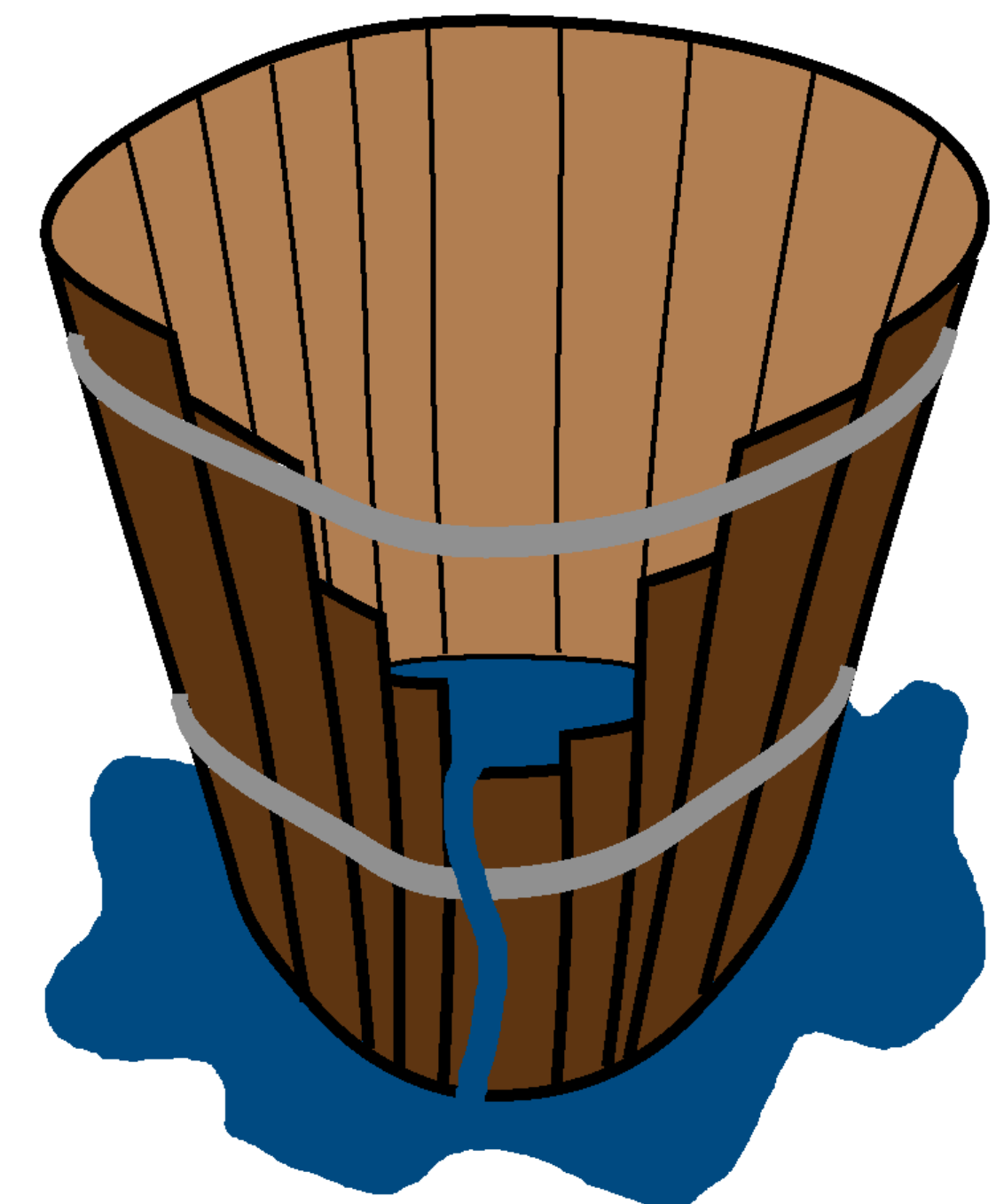
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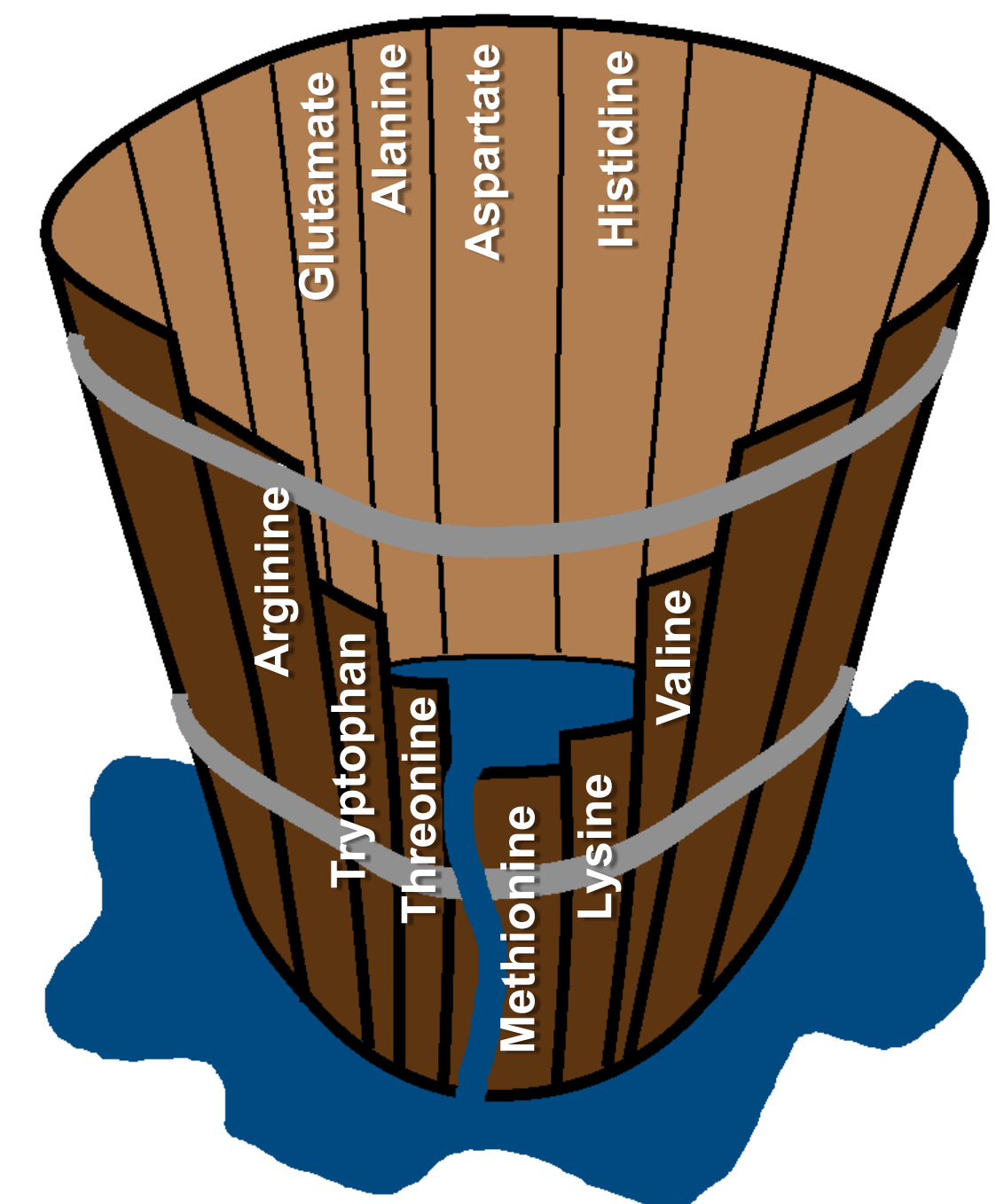
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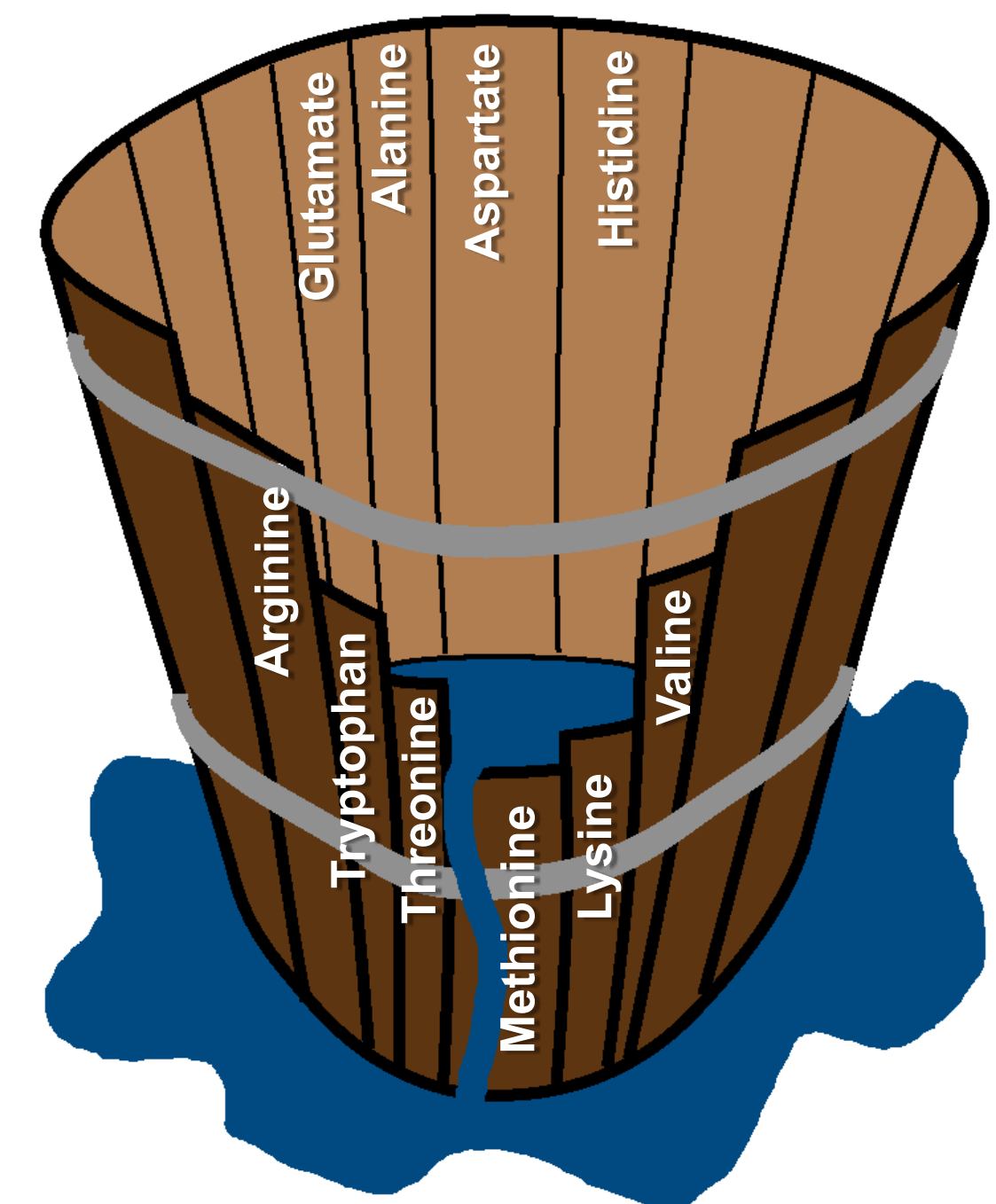
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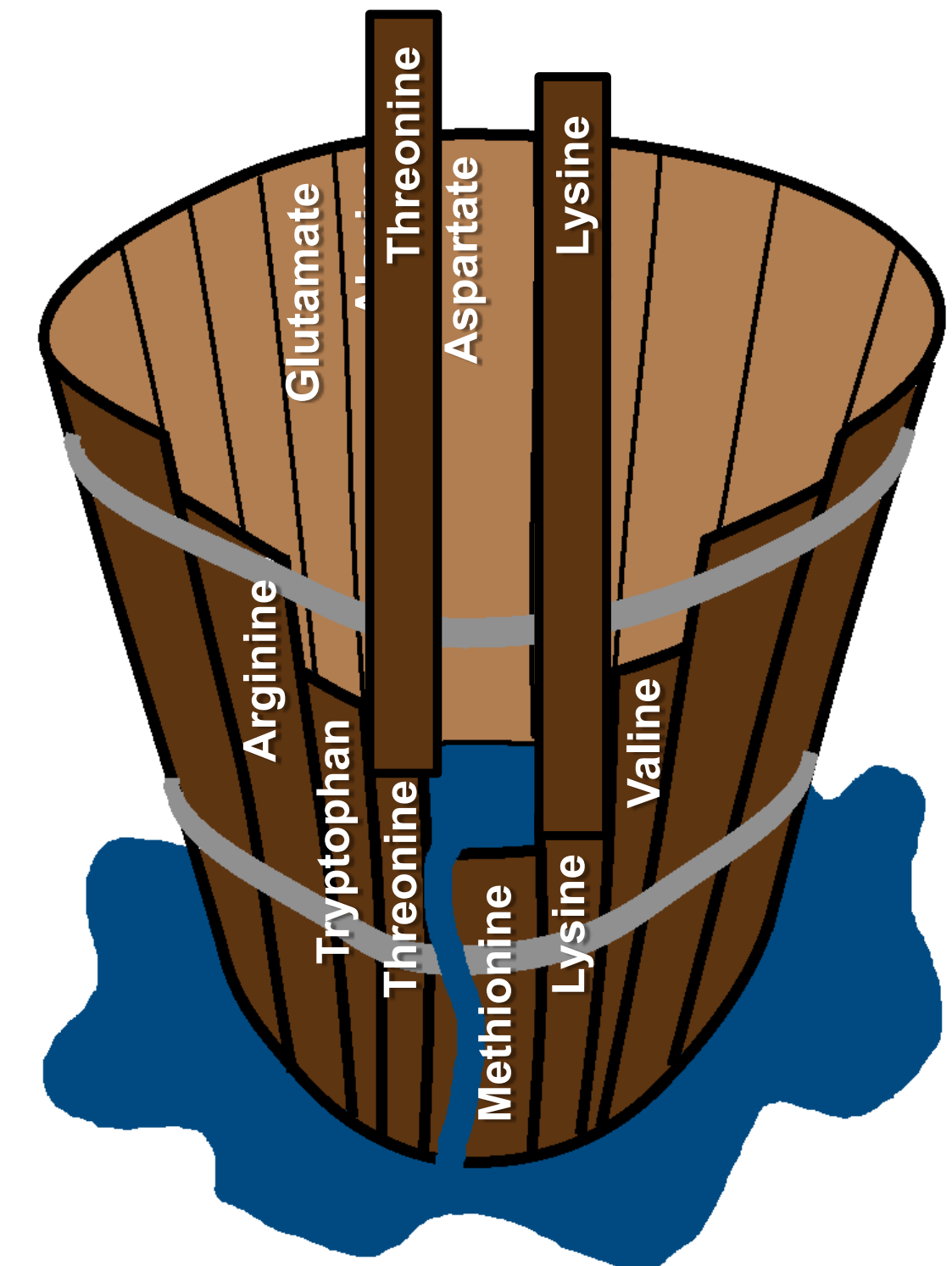
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    - Supplied in least amounts compared to requirements



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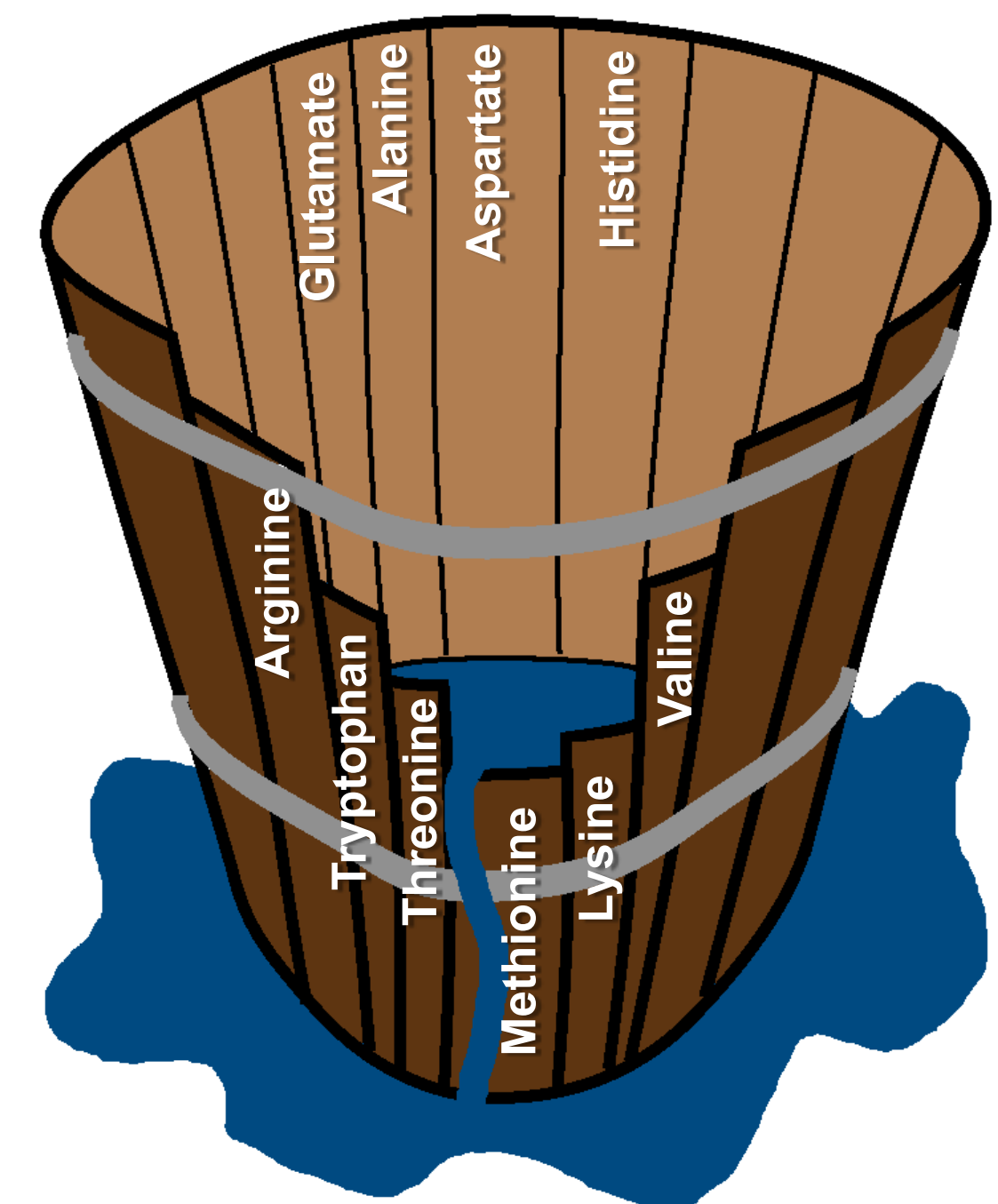
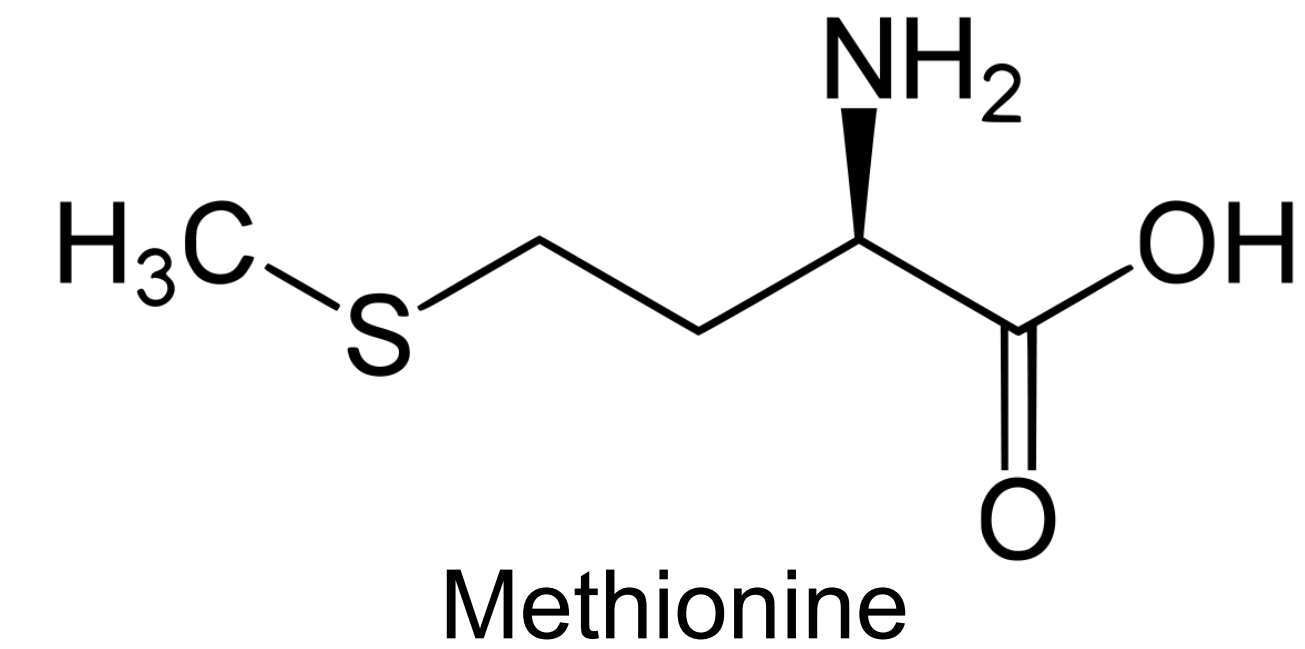
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## ◆ Amino acids are needed in different amounts

- First-limiting amino acid
  - Supplied in least amounts compared to requirements
  - Methionine for poultry



# Organic laying-hen diet

Ingredient (lb/ton of feed)	DL-Methionine allowed
Corn, organic	1,193
<b>Soybean meal, domestic, organic</b>	<b>570</b>
<b>DL-Methionine</b>	<b>2</b>
Soy oil, organic	10
Monocal (21% P)	28
Limestone (fine+coarse blend)	186
Salt	6
Vitamin premix, organic	5
Total	2,000
<b>Crude protein, %</b>	<b>17.8</b>
<b>Methionine+cysteine, digestible, %</b>	<b>0.60</b>

# Organic laying-hen diet

Ingredient (lb/ton of feed)	DL-Methionine allowed	DL-Methionine not allowed
Corn, organic	1,193	923
<b>Soybean meal, domestic, organic</b>	<b>570</b>	<b>820</b>
<b>DL-Methionine</b>	<b>2</b>	<b>—</b>
Soy oil, organic	10	35
Monocal (21% P)	28	26
Limestone (fine+coarse blend)	186	186
Salt	6	6
Vitamin premix, organic	5	5
Total	2,000	2,000
<b>Crude protein, %</b>	<b>17.8</b>	<b>22.5</b>
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Soy oil, organic	10	35	
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Limestone (fine+coarse blend)	186	186	
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<b>Crude protein, %</b>	<b>17.8</b>	<b>22.5</b>	← <b>4.7% difference</b>
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← **250 lb/ton difference**

1 organic flock w/20,000 hens

+ 100 tons organic soybean meal

+ 125 tons organic soybeans

+ 100 acres of organic land

← **4.7% difference**

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Soy oil, organic	10	35	+ 100 tons organic soybean meal
Monocal (21% P)	28	26	+ 125 tons organic soybeans
Limestone (fine+coarse blend)	186	186	+ 100 acres of organic land
Salt	6	6	Excess protein
Vitamin premix, organic	5	5	• Wet litter
Total	2,000	2,000	• Ammonia
			• Foot-pad lesions
			• Blindness
			• Respiratory issues
			• <i>E. coli</i> peritonitis
<b>Crude protein, %</b>	<b>17.8</b>	<b>22.5</b>	← <b>4.7% difference</b>
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# DL-Methionine alternatives...?

Ingredient	Methionine (%)	Lysine (%)	Met:Lys ratio	Data source
Soybean meal	0.64	2.85	22	Bregendahl, internal value
Corn	0.17	0.24	71	Bregendahl, internal value

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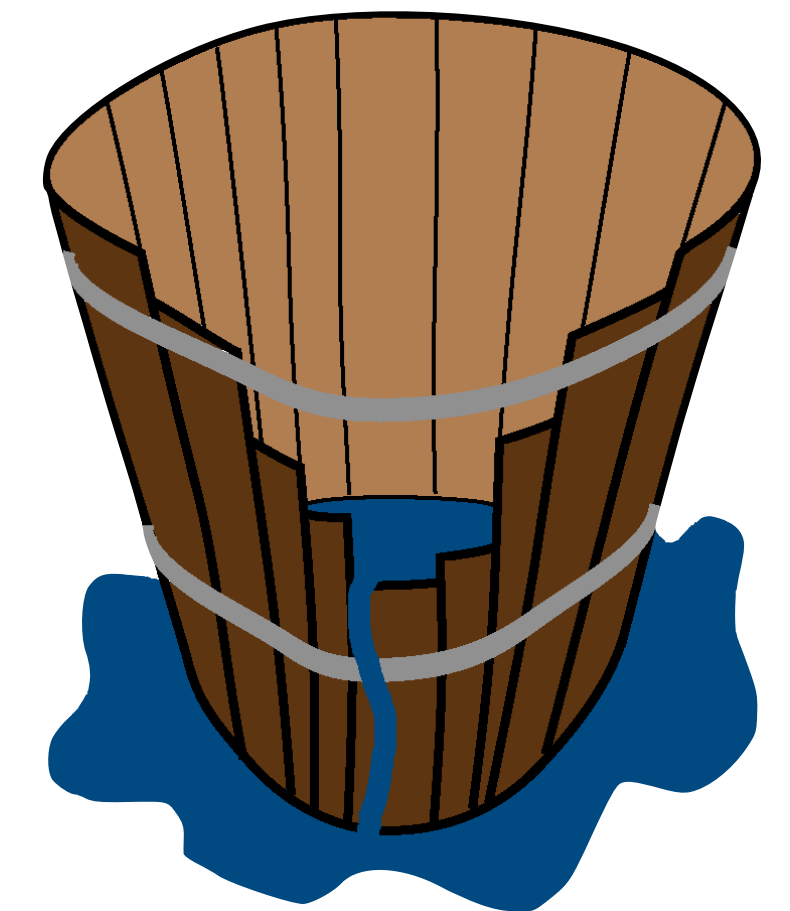
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# Marginal methionine deficiency

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## ◆ Production

- Low egg production
- Low egg weight
- Increased feed consumption



# Marginal methionine deficiency

## ◆ Production

- Low egg production
- Low egg weight
- Increased feed consumption

## ◆ Animal welfare

- Poor feathering
- Aggressiveness
- Feather pulling
- Cannibalism





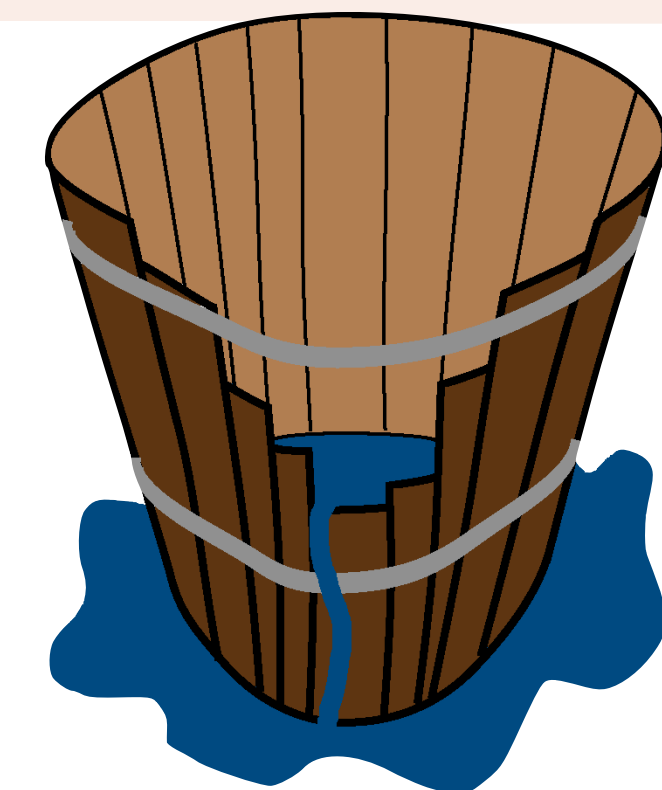
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*Poultry Nutritionist, Devenish Nutrition*

# Organic laying-hen diet

Amino acid,* %	DL-Methionine allowed	DL-Methionine not allowed	Requirement
Methionine+cystine	0.61	0.61	0.61
Methionine	0.36	0.31	0.34
Lysine	0.88	1.18	0.71
Threonine	0.67	0.86	0.51
Tryptophan	0.17	0.24	0.15
Arginine	1.09	1.45	0.73
Valine	0.74	0.84	0.59
Crude protein, %	17.80	22.50	—



\*Digestible amino acids

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DL-Methionine	99.00	0.00	∞	Evonik (AminoDat 5.0)

# **Synthetic Methionine Replacement Strategies Explored**

**Dr. Heather K. Burley, Ph.D.**

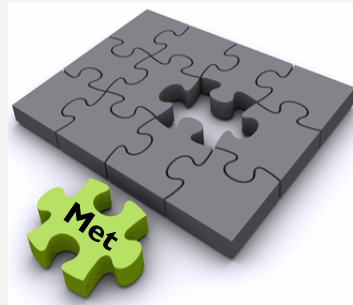
**Poultry Nutrition/Environmental Management**

# Balancing amino acids vital to poultry well-being!

- Methionine (**Met**) is one of 10 essential amino acids (**AA**) for poultry
- AA are building blocks of protein; to make various proteins in the body, AA all need to be a specific levels, like the pieces of a puzzle

**If you are missing one piece, you can't build the puzzle or protein**

- **Met** deficiencies cause ↑ feather pecking & cannibalism and ↓ growth & egg weight



**If you have duplicate pieces, these extra pieces can't be used**

- **Excess AA** are excreted, makes manure wet, causes foot lesions, ↑ ammonia in air



- Poultry, like humans, are naturally omnivorous
- Plants are “incomplete” proteins for poultry since they do not provide all essential AA; animal products are “complete” proteins and high in Met
- Thus, challenging to provide sufficient Met for organic poultry without conventional meat-based ingredients or synthetic AA allowed in feed without provide excesses of other AA

## **Breeds DO NOT Differ in their Requirement for Specific AA Levels/Ratios**

- Poultry categories (broilers, layers, turkeys, etc.) differ in AA needs based on age, size, & purpose (build different proteins for meat vs. eggs)
- Individual breeds within categories DO NOT differ in RATIO of AA needs (i.e. you still need the same puzzle pieces to build a specific puzzle)
- Slower growing (12 vs. typical 5-7 wks to market) breeds CAN have lower DAILY AA needs, but they do not grow/produce as well, with poorer feed efficiency, decreased meat yield, lower producing layers and these breeds are not widely available in the U.S.

## **Alternative Feeding Strategies Cannot Reduce Synthetic Methionine Needs**

- Lower dietary energy increases feed intake, but not enough to make up for Met deficient diets
- Birds given the choice between energy- and protein-rich ingredients in attempt to have them select for balance diets with sufficient Met; however, instead they selected highly palatable energy-rich ingredients (e.g. corn)



# Foraging/Pasture Access is NOT Sufficient to Replace Synthetic Methionine

- **Forage/pasture for poultry:**

- **Pasture Intake low** (only 2-8% of diet)
- Palatability of plant species differ greatly
- Moisture high (dilutes nutrients) - **Met low - only 0.17-0.40%**
- **Digestibility low** (poultry cannot utilize pasture like cattle/goats)
- Pasture not available in cold/winter months
- Pasture rotation needed to prevent “burn out” from manure
- **Insect/worm intake very low** (only 0.42% of crop contents) and present a disease/parasite risk



# Numerous Ingredients Investigated (some promising, but ALL with challenges)

Ingredient	% Met (as is)	Issues
Brazil nut meal	3.35	Very limited availability; ↑ cost
Inedible egg white (dried)	3.06	No organic available; antinutritional factors
Casein	2.70	No organic available; ↓ digestibility; ↓ Cys
Inedible egg blend (70:30 alb:yolk) (dried)	2.44	No organic available; antinutritional factors
Fish meal	2.20	Fishy taint to eggs; gizzard erosion; ↑ cost
Potato protein	1.64	No organic available; antinutritional factors
Algae (Chlorella)	1.33	Production difficult; heavy metals
Earthworm meal	1.23	Limited availability; heavy metals; biohazard
Corn gluten meal	1.20	No organic availability; ↑ pigments in yolk
Sunflower seed meal (w/o hulls)	1.04	Limited availability; low Lys
Black soldier fly larvae meal	0.89	Low availability; consumer acceptance
Soybean meal (expeller/typically fed)	0.55	Low Met
High methionine corn	0.34	Poor yield; high moisture (↑ mold issues)
Corn (typically fed)	0.18	Low Met

# Conclusions

- **Insufficient Met leads to deficiency symptoms in poultry (e.g. increased feather pecking/cannibalism and lower growth/egg size)**
- **Extreme, impractically high protein diets can be formulated to meet requirements without synthetic Met, but so many other AA are fed in excess that bird health and manure and air quality suffer as a result**
- **No single strategy/ingredient (OR combination of methods) can fully replace synthetic Met in poultry diets currently, despite extensive research**
- **Pasture access does not aid in meeting Met needs**
- **Recommendation would be to maintain current average lifetime allowance for organic poultry until an effective alternative can be identified**

# Where it all began

- ▣ Fed 100 percent certified organic feed, except for trace minerals and vitamins used to meet the animal's nutritional requirements.--
- ▣ Managed without antibiotics, added growth hormones, **mammalian or avian byproducts**, or other prohibited feed ingredients (e.g., urea, manure, or arsenic compounds).

# Methionine Task Force

- ▣ Presented to NOSB as an allied industry group looking for options to a common problem.
- ▣ Members consisted of broilers and layers farmers.
- ▣ Members cover all forms of organic egg production Pastured to larger scale.
- ▣ Industry funded to support research, trials and literature search.
- ▣ Provided information to NOSB and gave timeline for projects.

# Work Done by Members

- ▣ Organic Valley has looked at
  - Milk Whey
  - Potato Starch
  - High Methionine corn

# Members Work Continued

- ▣ Chino Valley Ranchers
  - Did sister birds test one not fed any methionine
  - Day of age to 65 weeks
  - Looked at Mulberry Leaves
  - Looked at Brazil Nuts

# Methionine Task Force Work

- ▣ High methionine corn trial (Three Years)
- ▣ UC Davis Black Soldier Fly Study (Two Years)
- ▣ Literature Review (Starting)
- ▣ Looking into planting field trial of corn



# Black Soldier Fly Larvae

- ▣ UC Davis study
- ▣ 80 birds to 65 weeks of age (two groups)
- ▣ Methionine Task Force funded \$67,000.00
- ▣ UC Davis made several media releases while study ongoing. Final paper being released shortly.

# Study Goals

- ▣ We propose to investigate the nutritional inputs and flock outcomes for using *Hermetia illucens* (black soldier fly) larvae as a potential supplemental methionine source. Our objective is to develop an easily accessible and sustainably produced protein source that can be mixed with the commercial feed in order to supplement the methionine in organic broiler and layer rations. Our selection of black soldier flies is due to the potential bio-residue conversion rates, which could offer farms additional environmental benefits. Our study will be conducted in two phases over 2 years (Fall 2016 to Fall 2018). Phase 1 will define optimal feedstocks for cultivation and conduct the nutritional analysis of supplements. Phase 2 will move optimized supplements to field trials.

# Results

- ▣ Feeding trial started at 2.28 pounds per day/35 hens or .065 pounds per hen per day
- ▣ 14,000,000 organic layers = 910,000 pounds per day of dried larvae per day.
- ▣ In late stages of life this was reduced to .57 pounds per day/35 hens .017 pounds per day
- ▣ 14,000,000 organic layers = 238,000 pounds per day of dried larvae per day
- ▣ This does not take into account any broiler needs.

# The History of Methionine

- ▣ Passed for use in poultry rations on 1/1994 as long as it is on the nation list of allowed synthetics
- ▣ Tap review done in 2001
- ▣ First put on allowed list on 10/01 with a sunset of 10/05
- ▣ Addressed in 2/1/2005. At 2010 sunset by Livestock Committee and put back on list for only two years.

# Given a two year extension to 2010

- ▣ No cap.
- ▣ NOSB wanted to see results.
- ▣ NOSB felt we needed more time.
- ▣ The board of 2010 wanted to make final decision on Methionine and wanted the issue closed once and for all.

# 2010 NOSB Review

- ▣ NOSB passed methionine with and cut the 2010 levels in half or more based on species (layer/broiler/turkey).
- ▣ Went from 4.0 for layers and 5.0 for broilers and turkeys to 2.0 for layers and broilers 2.5 for turkeys and others



# Where are we now?

- ▣ Spring 2015- Methionine petition from 2012 that was tabled in San Antonio was finally voted on. Passed 10-4 with the following:
- ▣ Changed the hard cap to an average over the life of the flock at the following levels:

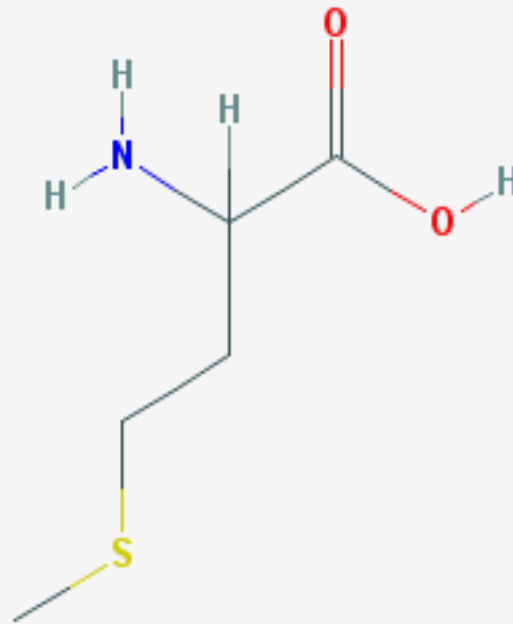
Layers	2.0 pounds
Broilers	2.5 pounds
Turkeys/Ducks	3.0 pounds

# Future work/Meeting take away

- ▣ We need to advance the work on insects as a possible methionine source.
- ▣ We need to continue the work on high protein corn.
- ▣ We need to explore any and all natural sources of methionine.
- ▣ We need to look once again at breeds of layers to satisfy current members.
- ▣ Pasture as a source of methionine.

# Questions?

▣ Thank you!



# Methionine Update 2019

- Midwest Poultry Show
  - 03/12/2019
- David Will Methionine Chair

# Methionine Update 2019

- Methionine rule before 1/28/2019

Hard cap for all poultry

2 pounds for layers and broilers

3 pounds ducks and turkeys

Post 1/28/2019

Average over flocks life

2 pound average layers

2.5 pound average for broilers

3 pound average for ducks and turkeys

# Methionine Update 2019

- NOSB meeting in April 2019 in Seattle
  - Methionine will be up for renewal
    - » 2 step vote for extension. Seattle and Pittsburg.
    - » We were asked to make 10 – 15 minute presentation.
    - » Using outside of Industry voices.
    - » Putting together history of Methionine.
  - » Second meeting and vote for renewal to happen in October 2019.



# Methionine Update 2019

- What can you do to help
  - Join Methionine Task Force.
  - Write letters.
  - Come to NOSB meetings.
  - Join video NOSB public comment period.