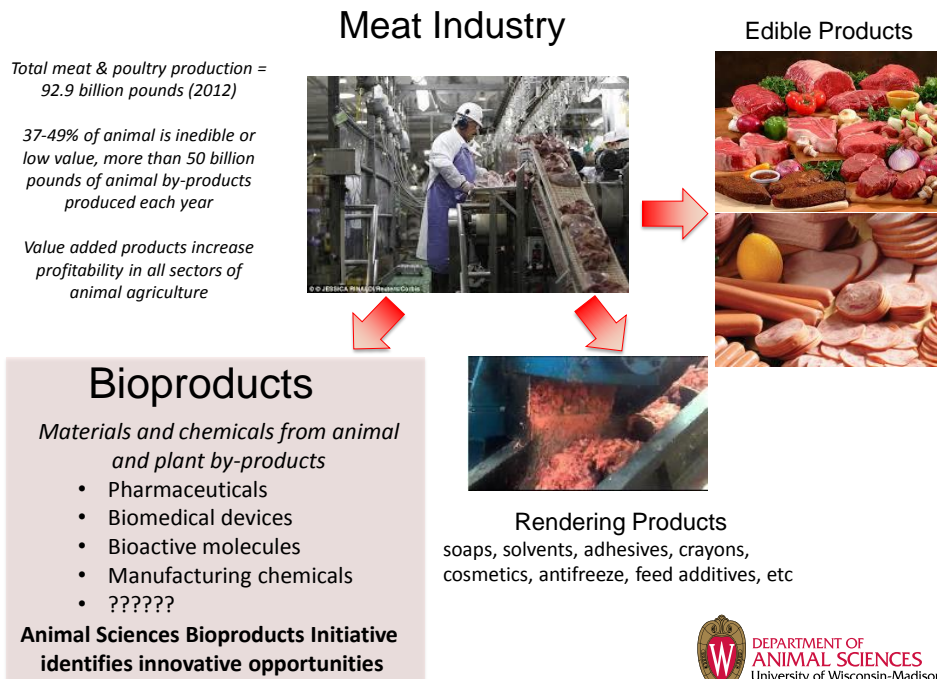


UW-Madison's Bioproducts Initiative: Discovering value in animal slaughter by-products

Mark E. Cook, Professor
Animal Sciences Department
University of Wisconsin-Madison

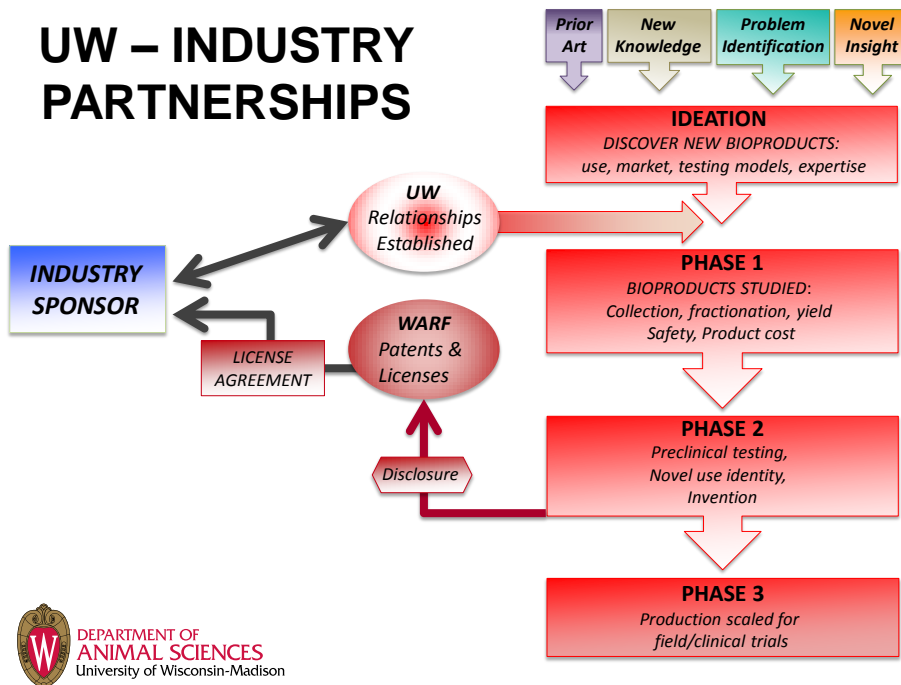


Planned Meat Science Laboratory. UM-Madison



Bioproducts innovations

- Hand full of high value bioproducts produced from animal slaughter
 - Heparin. \$4B
 - Glucosamine. \$2B
- New patents in the area of animal by-products few and far between
- No national initiative focused on creating valuable bioproducts from animal byproducts.

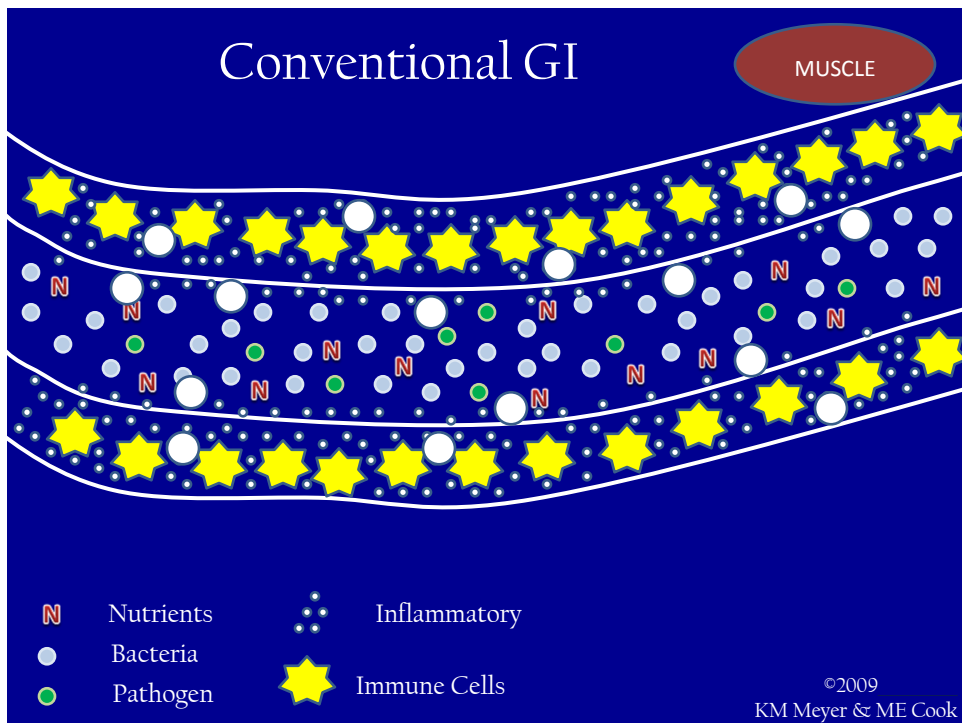


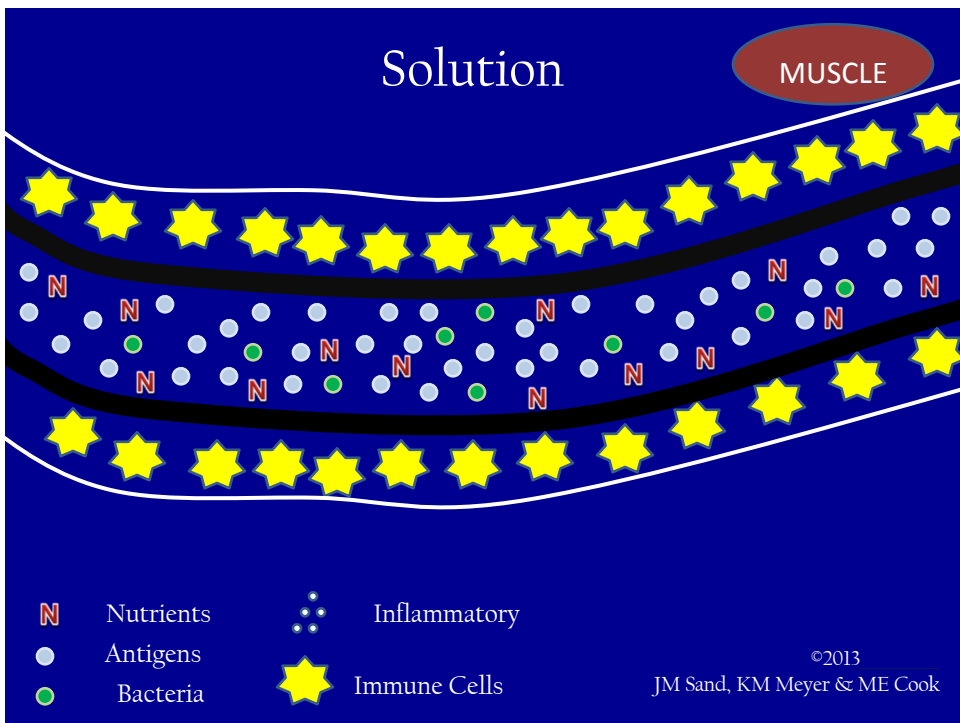
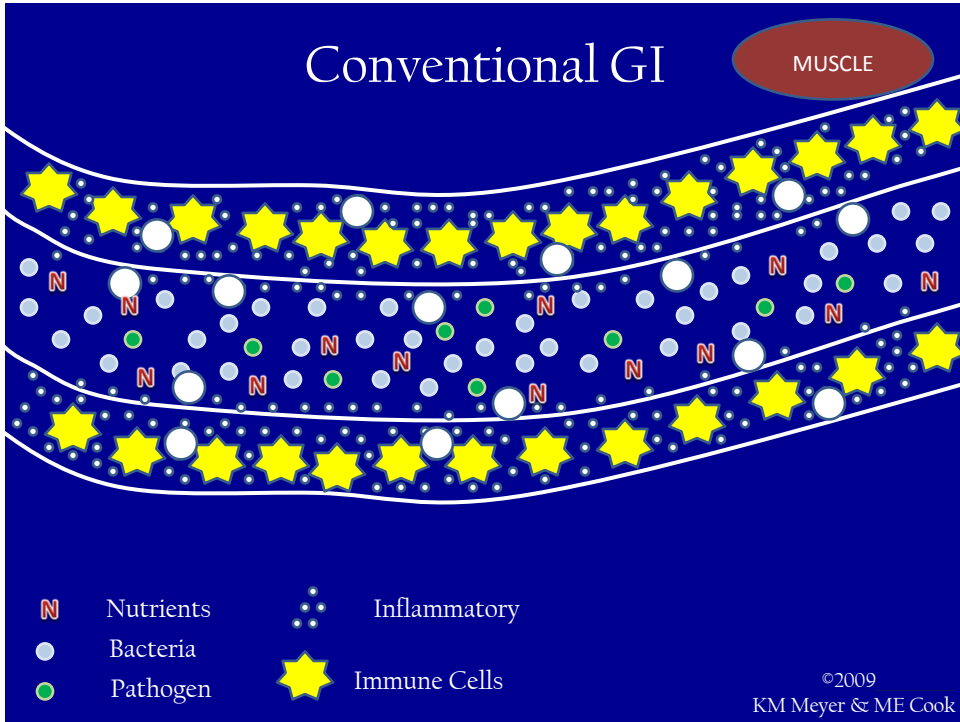
Cook lab project objectives

- Identify a by-product in the slaughter industry that has value.
- Cost of collecting the product should be considerably less than value.
- Production of the product by any other means should either be impossible or cost prohibitive
- Research into the isolation of the product and demonstration of its use should be compatible with Cook's group capability and Cook's group should be the best suited in the world to advance the technology
- The product must have at least one high value use.
- Product has a reasonable level of safe use.

Need

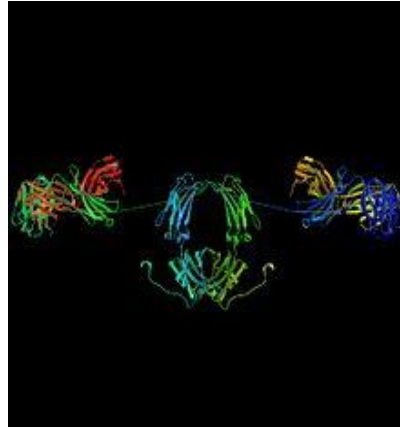
Protection of gut barrier function





slgA

- Antigen binding protein secreted at gram quantities into the GIT
- Binding occurs without inducing inflammation
- slgA binds bacterial and food antigens preventing translocation and systemic inflammation
- Collection could be easily segregated during the slaughter process



Final product

Cosatein™

Discovered uses

- Broiler withdraw feeds
 - Final feeds where antibiotics and drugs are removed from poultry diets
 - Can represent over 30% of feed used in broiler production
- Animal dermatitis
 - Common problem in B6 mice
 - Affect 2-10M dogs in US
 - 1:1000 human have low production levels

Independent verification of
usefulness of Cosatein™ in broiler
grown to 60 days

Virginia Diversified Research

Study Design

- **Experiment Objective:** To determine if Cosatein will improve the feed conversion to market weight
- **Location:** Harrisonburg VA
- **Start Date:** September 18, 2014
- **Experimental setup:** 2 Treatments; Control, Cosatein at 0.25lbs/ton
- **Experimental Design:**
 - 12 pens of 30 chickens per pen will be divided into two groups. One group was fed an integrator recommended diet (control). A second group was fed the control diet with cosatein 0.25lbs/ton. Cosatein was added pre-pelleting
 - Floor space will start at 1.1 sqft/chicken.
 - A natural litter challenge was induced at day 4 to ensure challenge at the same day for every pen.
 - Chickens will be monitored for weight gain, feed efficiency and mortality.

Results

	d62 net Wt/bird (lb)	d42-60 Feed/Gain (Inc. mort wt)	D62 Net Feed Cons/pen
CONTROL	8.428	2.412	114.719
Cosatein	8.581	2.322	116.125
T-Test p-value	0.0928	0.0407	0.2654

Value at 8.5 pound broiler

- Feed saving per bird= .76 pounds
- Value of feed saving per bird= \$0.09
- Value for 9B broiler=\$810M/yr

SCD-1 -/- diet-induced dermatitis



Gut/Skin/sIgA

- Dermatitis begins with diet change in SCD1^{-/-}
- Intestines indicate increased inflammatory process
- Increased secretion of sIgA suggested compensation for decreased gut barrier function

Literature

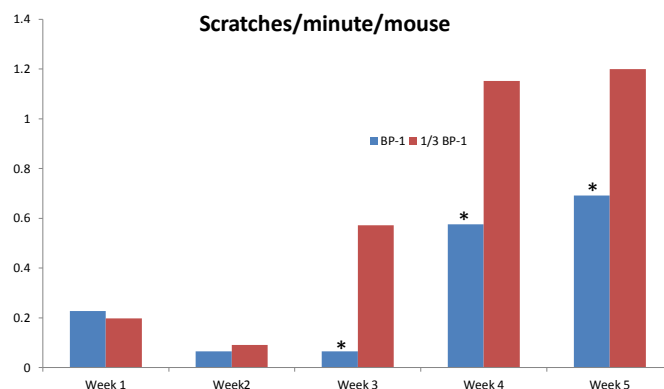
- Clinical manifestation IgA deficiency= respiratory infections, GI disorders, allergies including atopic dermatitis (Yei, 2010)
- Low salivary Immunoglobulin A (IgA) is associated with an increased risk of atopic dermatitis in children and increased response to allergens (Luoviksson et al., 2005)
- Atopic dermatitis in dogs correlates (neg) to serum IgA (Tengvall et al., 2013)

Effect of IgA on UD

Treatment	Mice with UD	% incidence
Control*	8/8	100
0.33g/Kg**	7/14	50
1g/Kg	2/14	14

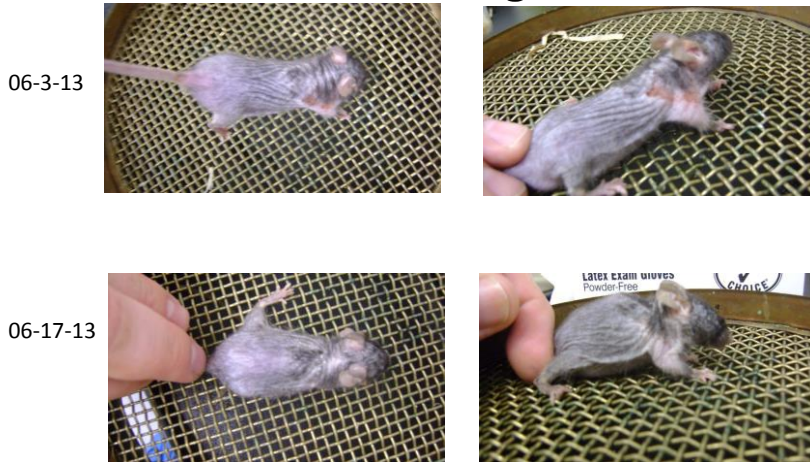
- *See Krugner-Higby *et al*
- ** Bioactivity was reduced to 1/3 activity after heating to 80C for 30 minutes using E. coli O55:B5 LPS and Isolated Soy Protein in an ELISA in 1g/Kg “heat killed” BP-1

Scratches/minute/mouse BP-1

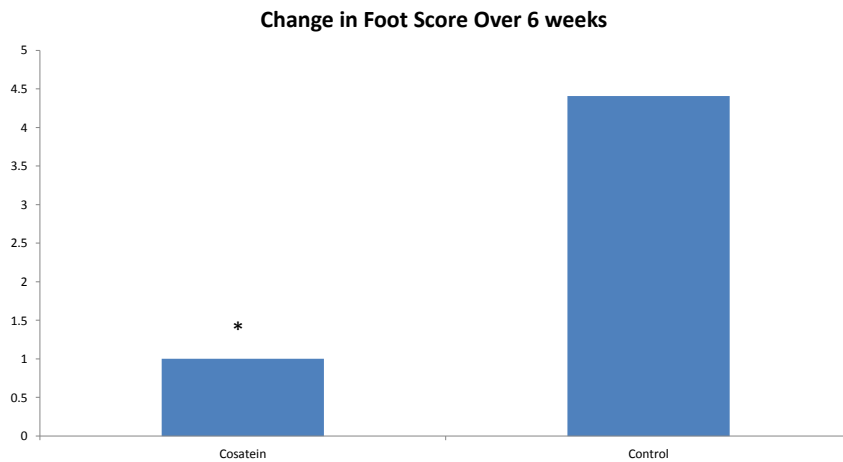


SCD1 $-/-$ mice consuming either 1/3 activity BP-1 or BP-1 were monitored daily for scratching. Each mouse was watched for one minute to determine if they were scratching. Numbers are an average of the weekly total number of scratches/the number of days and the number of animals. There is a significant decrease in scratching with the mice consuming BP-1. * = $P < 0.03$

Mouse before and after treatment with sIgA



Interdigital dermatitis in beagles



*=P<0.01

Mouse market

- 6.5M B6 mice/year
- UD affects 4.1% or 264K
- Mouse value \$20/mouse
- Gross value \$5M/yr
- Does not include cost associated with failed experiments



Animal Sciences Bioproducts Initiative

Mark E. Cook's laboratory, Animal Sciences UW-Madison

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Jordan Sand jsand@wisc.edu 608-354-3067

Field of interest: Novel solutions for inflammation in animal agriculture and human medicine

Patents: Over 40 US Patents and applications

Commercialization: 4 startups, 8 current licenses and options

Active university/external partnerships: 4

Reed Research Group, Animal Sciences UW-Madison

Contact: Jess D. Reed jreed@wisc.edu 608-263-4310
Christian G. Krueger ckrueger@wisc.edu 608-890-1396

Fields of interest: Cardiovascular, mucosal immunology and phytochemistry

Patents (Disclosures): 6 US patents, applications and licensable bio-materials

Commercialization: 2 startups

Active university/ external partnerships: 3



Reed Research Group
Cardiovascular • Mucosal Immunology • Phytochemistry

The Richards Lab, Animal Sciences UW-Madison

Contact: Mark P. Richards mprichards@ansci.wisc.edu 608-262-1792

Expertise: Antioxidant Technologies

Patents (Disclosures): 1 patent in use of a natural antioxidant to stabilize fats and oils

Active university/ external partnerships: 1



DEPARTMENT OF
ANIMAL SCIENCES
University of Wisconsin-Madison

Conclusions

- Animal byproducts represent a gold mine of molecules to solve current problems in agriculture and human medicine
- The isolated bioproduct may have more value than the animals meat and definitely a higher return on investment
- For the bioproducts initiative to be successful, expanded science participation is needed