An Integrated Program for Reducing Bovine Respiratory Disease Complex in Beef and Dairy Cattle

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The “Integrated Program for Reducing Bovine Respiratory Disease Complex (BRDC) in Beef and Dairy Cattle” Coordinated Agricultural Project is supported by Agriculture and Food Research Initiative Competitive Grant no. 2011-68004-30367 from the USDA National Institute of Food and Agriculture.
Background and Rationale

“Year in and year out, diseases of the respiratory system are a major cause of illness and death in cattle from 6 weeks to two years of age. Sadly, this is as true today as it was 30 years ago despite development of new and improved vaccines, new broad spectrum antibiotics, and increased fundamental knowledge as to the cause of disease”

- Bovine Respiratory Disease (BRD) has been extensively studied since the 1800s, and yet it remains prevalent
- More effective vaccines have not decreased the morbidity or mortality of BRD
- Mortality has increased as vaccine efficiency has increased
- 1.4% of all US feedlot cattle perish before reaching harvest weight
- Need to develop new approaches to tackle BRD

COLUMBIA, Mo., April 15, 2011 – Roger Beachy, director of the U.S. Department of Agriculture’s National Institute of Food and Agriculture (NIFA), today announced two grant awards to the University of Missouri and Texas A&M University to support research, education and outreach on cattle production to increase global food security.

“The United States is the world’s largest producer of beef and milk and has the largest fed-cattle industry in the world,” Beachy said. “As the demand for food rises due to a growing global population, it will be critically important to develop methods to produce more food with greater efficiency, while lowering the prevalence of bovine respiratory disease that inflicts significant losses each year.”

NIFA also awarded a $9.75 million grant to Texas A&M University to support research led by Dr. James Womack to reduce the prevalence of bovine respiratory disease (BRD) in beef and dairy cattle. BRD is the leading natural cause of death in beef and dairy cattle, causing annual losses of more than 1 million animals valued at nearly $700 million.

Womack and colleagues will use a DNA-based approach to identify cattle that are resistant to disease-causing pathogens. In addition to studying known pathogens, they will identify novel pathogens responsible for BRD. The data will be used to develop BRD diagnostic tests and genetic selection tools to identify BRD-resistant animals, while also assessing the welfare of cattle with BRD. The researchers intend to share their results with producers and develop undergraduate courses and related educational materials and instruction for 4-H youth.

Womack’s team includes scientists from the University of California-Davis, Colorado State University, the University of Missouri, New Mexico State University, Washington State University and USDA’s Agricultural Research Service.
Long-term goal is to reduce the incidence of BRD in beef and dairy cattle by capitalizing on recent advances in genomics to enable novel genetic approaches to select for cattle that are less susceptible to disease.
Funding for this project is provided by the National Institute of Food and Agriculture.

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Location of US collaborators

http://BRDComplex.org
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Our goal is to integrate research, education, and extension activities to develop cost-effective genomic and management approaches to reduce the incidence of BRD in beef and dairy cattle.

Dr. Jim Womack, Texas A&M University, College Station, TX

The objective of this multi-institutional project is to reduce the incidence of bovine respiratory disease by:

- Capitalizing on recent advances in genomics to enable novel genetic approaches to select for disease-resistant cattle
- Developing improved DNA-based tests for disease diagnosis
- Providing educational opportunities for undergraduate, graduate and veterinary students to generate a future human resource for the continued reduction in bovine respiratory disease incidence
- Producing and delivering a variety of educational materials for beef and dairy cattle producers, and feedlot personnel on best management practices to reduce disease incidence
The ready availability of dense single nucleotide polymorphism arrays (i.e. SNP chips) has given rise to hitherto unforeseen opportunities to dissect between-host variation and identify possible genes contributing to this variation using genome wide association studies (GWAS).


770,000 SNPs evenly distributed throughout the genome
What is needed to develop DNA-tests for selection against BRD?

Large training/discovery populations with BRD case:control (BRD:healthy) and SNP genotypes used to estimate the value of every chromosome fragment contributing variation to BRD susceptibility. This allows for prediction of which chromosome segments or regions are important to confer resistance/susceptibility.

**Prediction equation** = the results of training can then be used to predict the genetic merit of new animals not contained in the training data set based on their genotype alone.
Year 1: CA Dairy Calf Ranch
70,000 head capacity

Dr. Terry Lehenbauer, DVM, University of California, Davis, CA

Sharif Aly, DVM
Pat Blanchard, DVM
Jessica Davis, DVM

Veterinary Medicine Teaching and Research Center, Tulare

Photo credit: Jessica Davis
Standardization of BRD Diagnosis

- 1000 case and 1000 control 30-60 day old calves
- Use Dr. Sheila McGuirk’s calf respiratory scoring chart
  - Temperature, eyes, ears, nose, +/- cough
  - Additional clinical signs: tachypnea, dyspnea, position of head, appetite
  - Give score and either enroll or not (5 or greater to enroll as case)
- Sample collection
  - Blood for DNA
  - Nasal swab and deep pharyngeal swab to identify viruses (PCR: IBR, BVD, BRSV, and Corona) and bacteria (*Manheimia haemolytica*, *Pasteurella multocida*, and *Histophilus somni*, and *Mycoplasma spp.*.) present in the nasopharyngeal and pharyngeal recesses
# Calf Health Scoring Criteria

<table>
<thead>
<tr>
<th>Rectal Temperature</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
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<tbody>
<tr>
<td>100-100.9</td>
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<td>101-101.9</td>
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<td>102-102.9</td>
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<tr>
<td>≥103</td>
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<tr>
<th>Cough</th>
<th>None</th>
<th>Induce single cough</th>
<th>Induced repeated coughs or occasional spontaneous cough</th>
<th>Repeated spontaneous coughs</th>
</tr>
</thead>
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<tr>
<th>Nasal Discharge</th>
<th>Normal serous discharge</th>
<th>Small amount of unilateral cloudy discharge</th>
<th>Bilateral, cloudy or excessive mucus discharge</th>
<th>Copious bilateral mucopurulent discharge</th>
</tr>
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<tr>
<th>Eye Scores</th>
<th>Normal</th>
<th>Small amount of ocular discharge</th>
<th>Moderate amount of bilateral discharge</th>
<th>Heavy ocular discharge</th>
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<tr>
<th>Ear Scores</th>
<th>Normal</th>
<th>Ear flick or head shake</th>
<th>Slight unilateral droop</th>
<th>Head tilt or bilateral droop</th>
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To culture organisms associated with BRD, pharyngeal swabs offer a less invasive, less stressful and more rapid alternative to bronchoalveolar lavage.
Control Calves

- Score control in same way as cases (score of 4 or less)
- Try to select animals in the adjacent hutch, same dairy of origin, and same sex
- Collect samples for control animals in same was as case

Try to identify cases and controls in a relatively constant environment, subjected to the same exposure and stresses, to decrease the environmental “noise” of these field BRD datasets
Year 2: CO Feedlot
*Bos taurus beef cattle*

Sample collection (1000 case and 1000 controls) scheduled to be completed by 3/2013 and analysis of genotype data completed by 12/31/2014
Utilize existing extension networks to integrate producers, industry, veterinarians, researchers, graduate and veterinary students into the conducting and interpreting of the research trials.
WSU Extension
BRD CAP Project

Bovine Respiratory Disease Prevention from Bloodlines to Fence lines

4/15/2012-4/14/2013
Goals for WSU Extension

- Develop a modular curriculum, sets of educational materials, and a BRD Risk Assessment tool.

- The curriculum will be delivered to and evaluated by Washington cattle producers.

- The final curriculum will be available nationwide through the BRD CAP program.
**Progress**

- WSU extension has met and developed 11 outlines for BRD Factsheets.

- September 1 deadline for rough drafts of all factsheets.

- Arranged a presentation to the Washington Cattlemans Association Convention to present the project and factsheets in November.
List of factsheet titles

- Managing the pregnant cow for optimum calf health
- Documenting BRD incidence and animal health costs associated with BRD in your herd
- Calving Management and its influence on calf health
- Cattle handling to minimize the incidence of BRD
- Testing for BRD agents and Vaccinations in the life of a cow and her calf
- Optimizing calf care to reduce the incidence of BRD
- Weaning procedures to reduce stress and minimize the risk of BRD
- The value of preconditioning on reducing the incidence of BRD
- Management approaches to reduce transportation stress risk for BRD
- Biosecurity on the ranch to reduce risks for BRD
- Feedback from feeders – what health conditions do they see in our calves?
Develop and deliver educational programs on best management practices for integrated and economically sustainable animal health management, genomic, and animal breeding approaches to reduce BRD.
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Press Articles

- **Working Ranch Magazine: Why Do the Strong Survive? It may have something to do with genes.**
  June/July 2012

- **Agriculture.com: Super Bull 2014!**
  April 5th, 2012

- **Capital Press: Scientists Seek Traits for Bovine respiratory Disease**
  February 28, 2012

- **Agriculture.com: Selecting cattle for disease resistance**
  February 2nd, 2012

- **Angus Productions Inc.: Genetics of Disease**
  February 1st, 2012

- **Beef Magazine: The Genetics of Bovine Respiratory Disease**
  June 10th, 2011

- **Drovers Cattle Network: The Value of BRD Resistance.**
  June 7th, 2011

- **Beef Improvement Federation: What Weighting Should be Given to BRD Resistance in Selection Decisions?**
  June 3rd, 2011
Cattlemen to Cattlemen – Episode 1.  
Shot on location at MARC in NE June 2012. Will be aired week Tuesday October 16, 2012.

“Six ten minute video vignettes be developed for viewing and distribution via various outlets including YouTube, eXtension, and the National Cattlemen’s Beef Association (NCBA) TV show “Cattlemen to Cattlemen” (http://tinyurl.com/C2CBRDCAP)

Brad Bulla and Pete Kaiser of Baxter Communications
How can genomic tools be integrated to capture the economic value of project findings within the beef industry?

Lots of hard to measure economically-important trait cattle grants

- National Program for Genetic Improvement of Feed Efficiency in Beef Cattle
- Identification And Management Of Alleles Impairing Heifer Fertility While Optimizing Genetic Gain In Angus Cattle – Patterson et al. MO
- Reproduction in dairy cattle – Spencer et al., WA

> $20 million in active grants – can these work together?
Industry structure may need to evolve to enable the exchange of information and value between the different sectors.

For widespread technology adoption, breeders need to be adequately rewarded for making DNA investments and selection decisions for traits that benefit the different sectors of the beef industry.

Is there an opportunity to try something a little different with the extension component of these integrated bovine genomics grants?

Can we partner with an integrated supply chain to demonstrate a value proposition based on gathering phenotypes on reproduction, feed efficiency and feedlot health, carcass etc. and genotyping these animals.... Use this as the demonstration of value of DNA information to beef industry as a whole?
Discussion

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