



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

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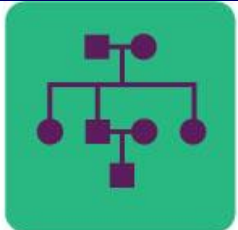
US Bovine Respiratory Disease

Coordinated Agricultural Project

<http://www.brdcomplex.org>



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.



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# 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**

Montgomery, D. 2009. Bovine Respiratory Disease & Diagnostic Veterinary Medicine. Proceedings, The Range Beef Cow Symposium XXI. December 1, 2 and 3 2009, Casper, WY. Pages 1-6.



United States  
Department of  
Agriculture

National Institute  
of Food and  
Agriculture



## USDA Awards Grants to Improve Cattle Production and Health

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.



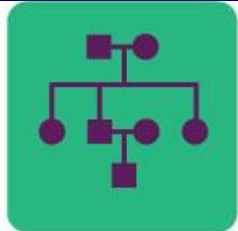
# BRD Coordinated Agricultural Project (BRD CAP)

*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*



Agriculture and Food Research Initiative Competitive Grant no. 2011-68004-30367





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# BRD Coordinated Agricultural Project



**TEXAS A&M**  
UNIVERSITY

- **Jim Womack, PD**
- Alan Dabney
- Scott Dindot
- Noah Cohen
- Chris Seabury
- Lawrence Falconer
- Lauren Skow
- Gary Snowder

**UC DAVIS**  
UNIVERSITY OF CALIFORNIA

- Laurel Gershwin
- Terry Lehenbauer
- Cassandra Tucker
- **Alison Van Eenennaam**



- Jerry Taylor

**Colorado**  
State  
University



United States Department Of Agriculture  
Agricultural Research Service

- **Milt Thomas**
- Mark Enns
- Mike MacNeil
- Curt Van Tassell

WASHINGTON STATE  
UNIVERSITY



- **Holly Neibergs**
- Shannon Neibergs



- Robert Hagevoort
- Tim Ross

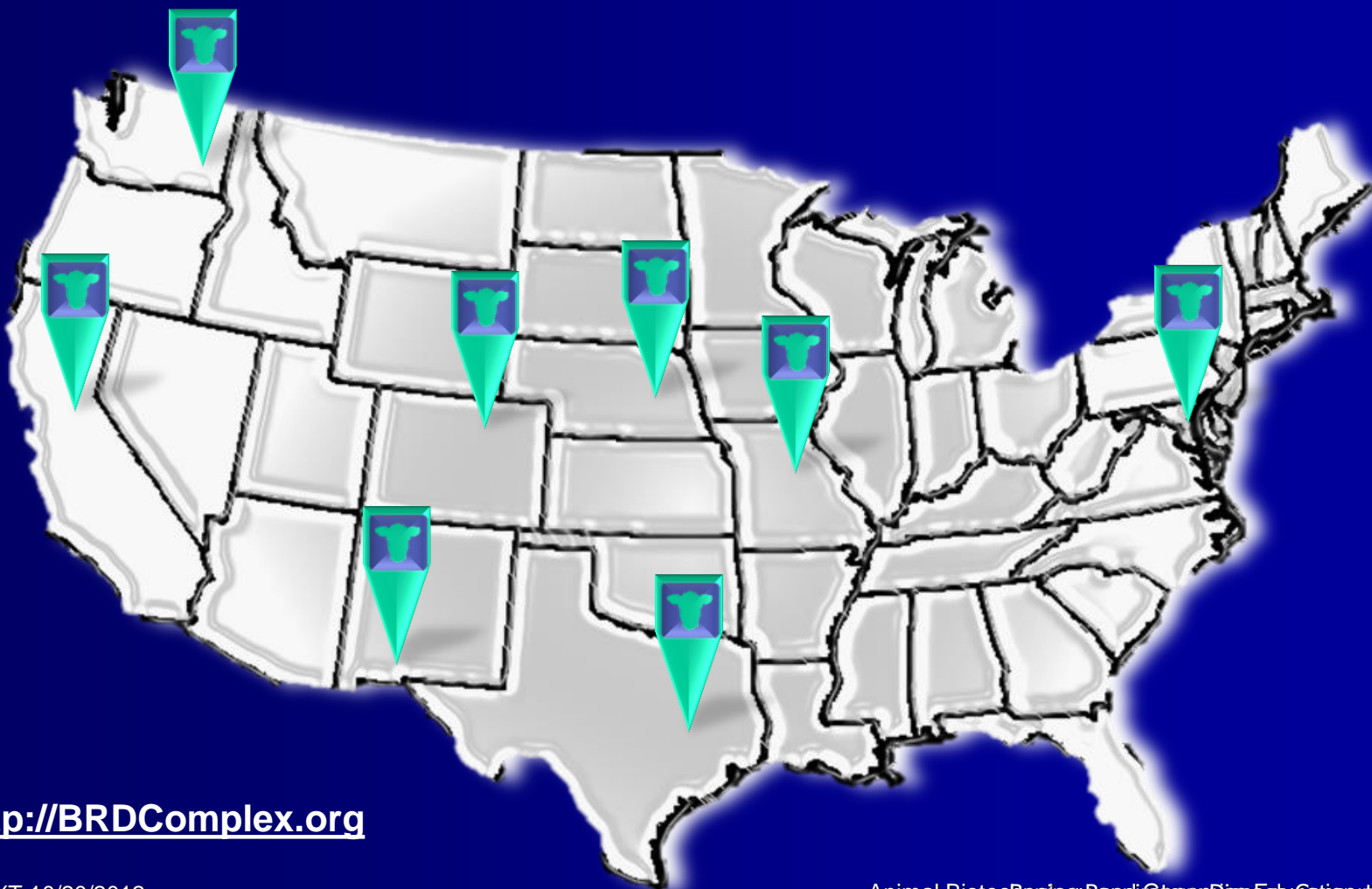
## OTHER COLLABORATORS

- Daniel Pomp (NC)
- Shiela McGuirk (WI)
- Adroaldo Zanella (Norway)



# Location of US collaborators

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<http://BRDComplex.org>





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### Research Team

**Project Leader: James Womack, Ph.D**

Texas A&M University [E-mail](#) [Website](#)

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National Institute of Food and Agriculture



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[E-mail](#) [Website](#)



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## Advisory Board

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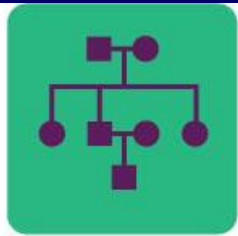
# **Our goal is to integrate research, education, and extension activities to develop cost-effective genomic and management approaches to reduce the incidence of BRD in beef and dairy cattle**

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





# Genomic development: High Density SNP Chip

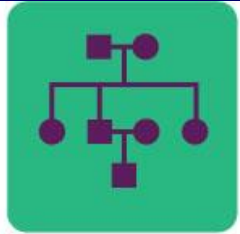
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- The ready availability of dense single nucleotide polymorphism arrays (i.e. SNP chips) has given rise to hitherto unforeseen opportunities to dissect between-host variation and identify possible genes contributing to this variation using genome wide association studies (GWAS)

Bishop, S. C., and J. A. Woolliams. 2010. On the genetic interpretation of disease data. Plos One 5: e8940.

770,000 SNPs evenly  
distributed throughout  
the genome





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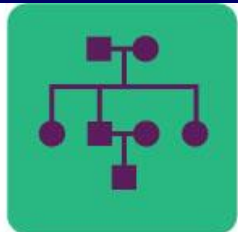
# What is needed to develop DNA-tests for selection against BRD?

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.







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# Year 1: CA Dairy Calf Ranch 70,000 head capacity

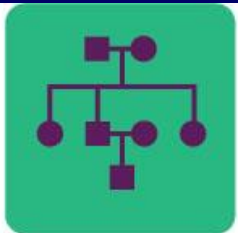


Dr. Terry Lehenbauer, DVM, University of California, Davis, CA

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

Veterinary Medicine Teaching  
and Research Center, Tulare

















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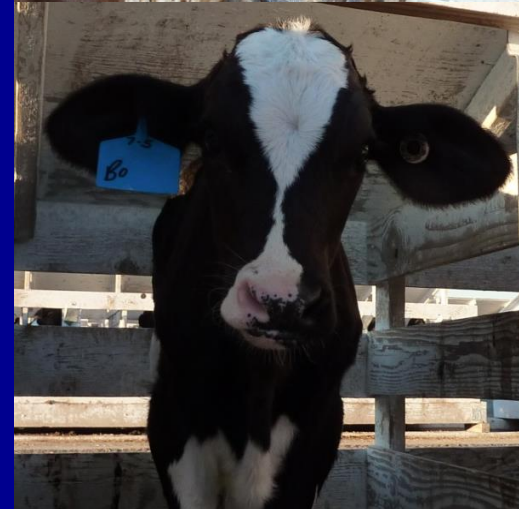
# Standardization of BRD Diagnosis

- 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  |   |  |   |
|---|---|--|---|
| 0   | 1   | 2  | 3   |
| <b>Rectal temperature</b>   |   |  |   |
| 100-100.9   | 101-101.9   | 102-102.9  | ≥103  |
| <b>Cough</b>  |   |  |   |
| None  | Induce single cough   | Induced repeated coughs or occasional spontaneous cough                              | Repeated spontaneous coughs   |
| <b>Nasal discharge</b>  |   |  |   |
| Normal serous discharge   | Small amount of unilateral cloudy discharge   | Bilateral, cloudy or excessive mucus discharge                                       | Copious bilateral mucopurulent discharge  |
|    |    |    |    |
| <b>Eye scores</b>   |   |  |   |
| Normal  | Small amount of ocular discharge  | Moderate amount of bilateral discharge   | Heavy ocular discharge  |
|   |   |   |   |
| <b>Ear scores</b>   |   |  |   |
| Normal  | Ear flick or head shake   | Slight unilateral droop  | Head tilt or bilateral droop  |
|  |  |  |  |





Blood collection



Deep  
pharyngeal  
swab  
collection



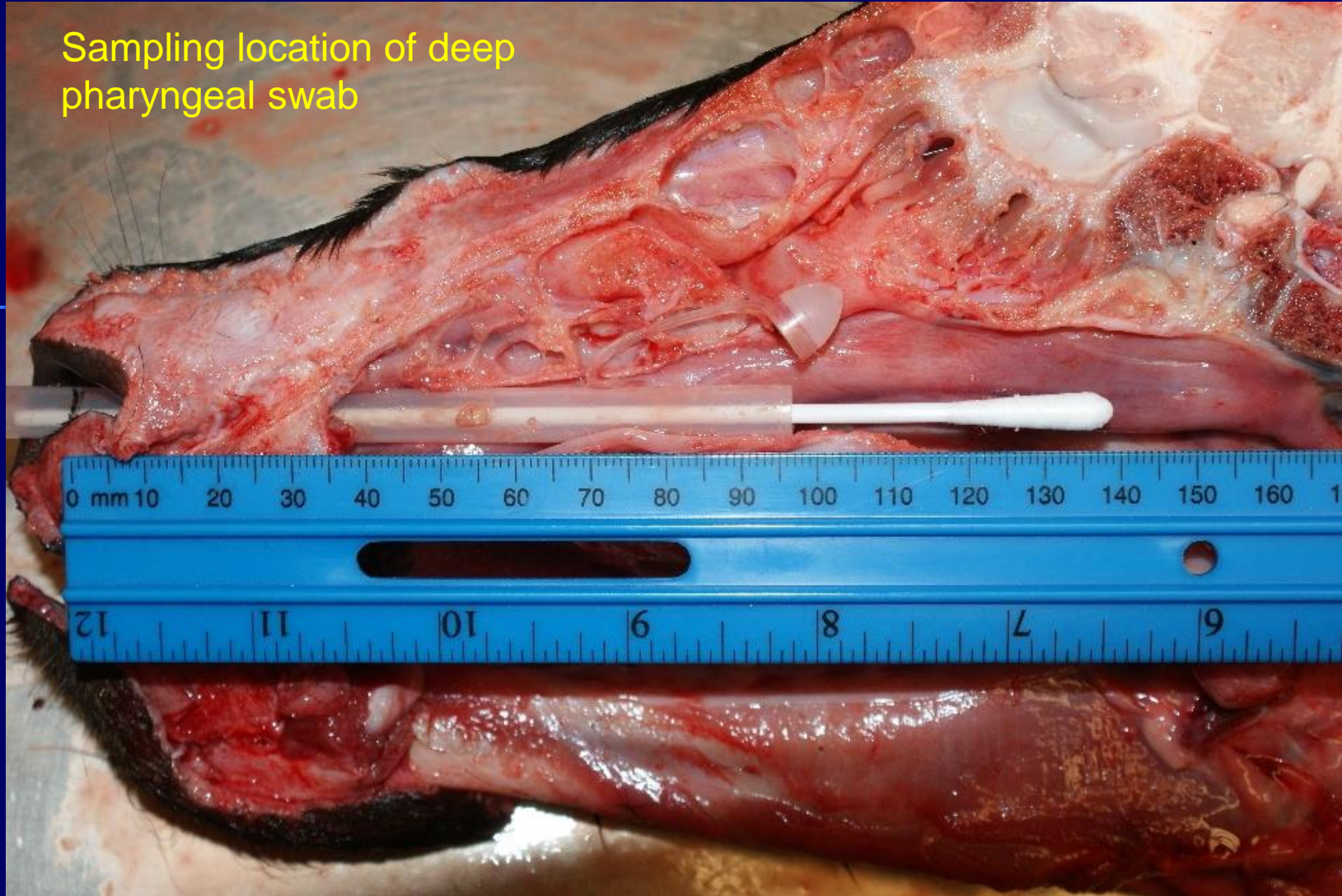
Nasal swab







Sampling location of deep pharyngeal swab



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 way 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



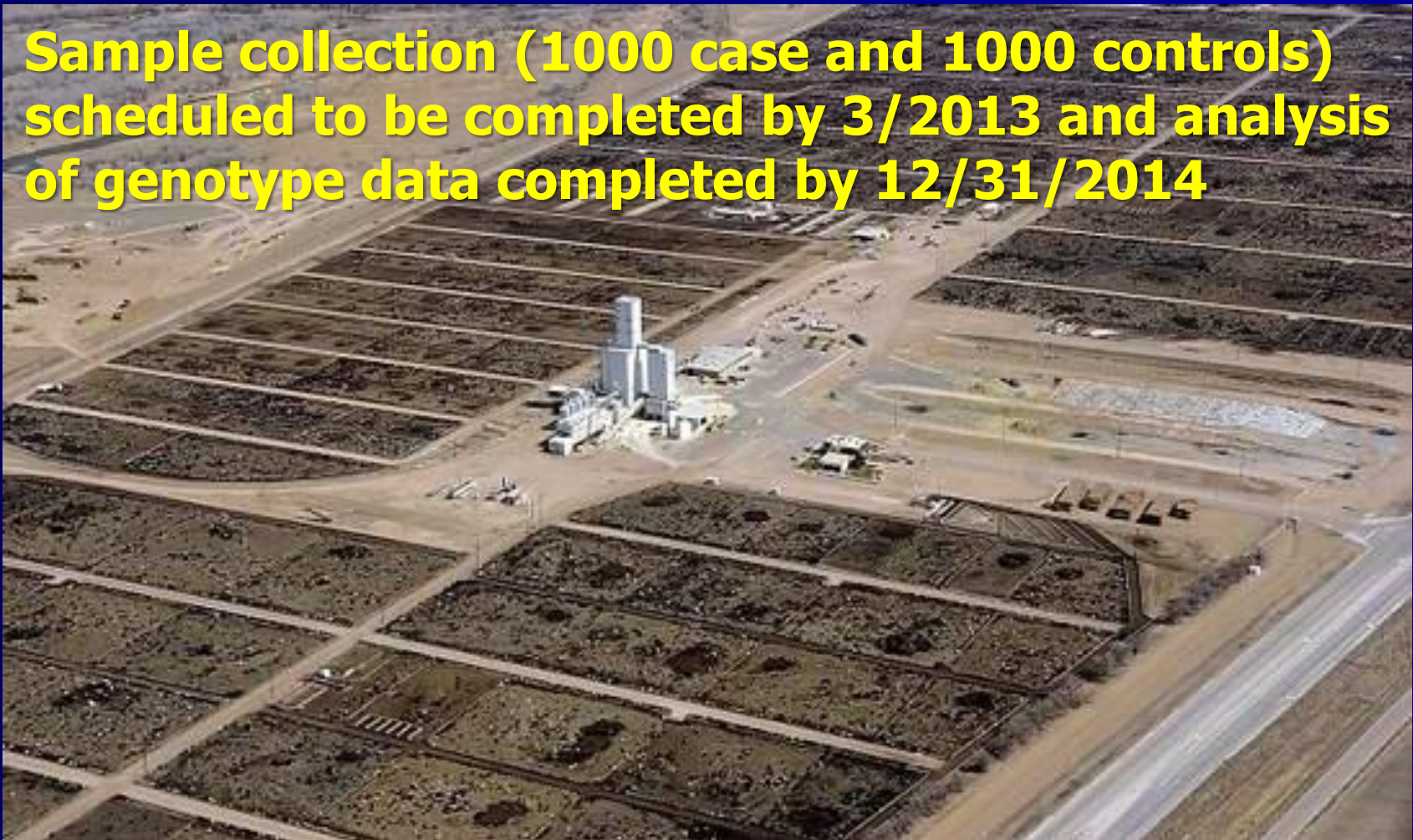




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# Year 2: CO Feedlot *Bos taurus* beef cattle

Sample collection (1000 case and 1000 controls)  
scheduled to be completed by 3/2013 and analysis  
of genotype data completed by 12/31/2014







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***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.

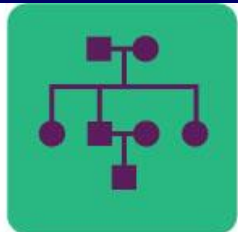
# Progress

- 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?





## Bovine Respiratory Disease Complex Coordinated Agriculture Project

*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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### Papers



**Integrated Program for Reducing Bovine Respiratory Disease Complex in Beef and Dairy Cattle Coordinated Agricultural Project (BRD CAP) (Sept. 2012)**  
By: Alison Van Eenennaam, Ph.D  
American Society of Bovine Practitioners meeting, Montreal, Canada



**The Potential Value of DNA-based Tests for Host Bovine Respiratory Disease (BRD) Resistance to the Beef Cattle Industry (Sept. 2012)**  
By: Alison van Eenennaam, Ph.D  
American Association of Bovine Practitioners (AABP) meeting, Montreal, Canada



**Feeding The World Through Improved Animal Health and Genetic Selection (September 2011)**  
Written by: Holly L. Neibergs, Ph.D  
Published in: Proceedings of the American Association of

Project Summary

Research Plan

Annual Progress Report

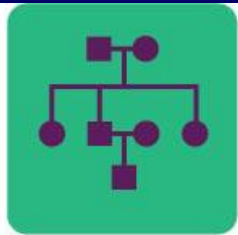
Papers

Abstracts

Posters



United States Department of Agriculture  
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## Bovine Respiratory Disease Complex Coordinated Agriculture Project

*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.*



### 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

<http://www.brdcomplex.org/producers.html#presentations>

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Videos

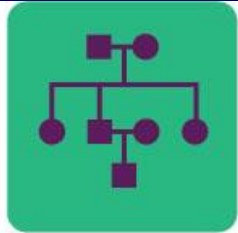
Press Articles

Presentations



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National Institute of Food and Agriculture



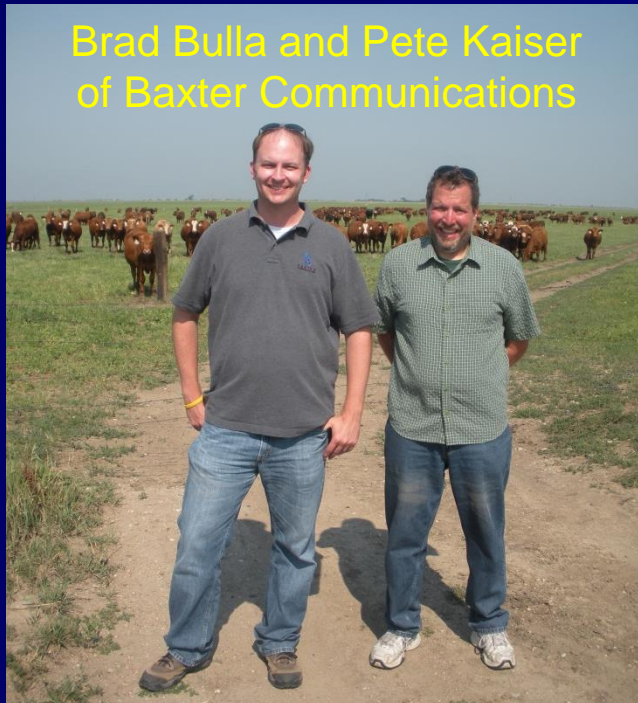


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***Cattlemen to Cattlemen – Episode 1.***  
*Shot on location at MARC in NE June 2012.*  
*Will be aired week **Tuesday October 16, 2012.***

“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/C2CBRDCA>)

Brad Bulla and Pete Kaiser  
of Baxter Communications







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# 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



United States Department of Agriculture  
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Identification And Management Of Alleles Impairing Heifer  
Fertility While Optimizing Genetic Gain In Angus Cattle –  
Patterson et al. MO

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Reproduction in dairy cattle – Spencer et al., WA

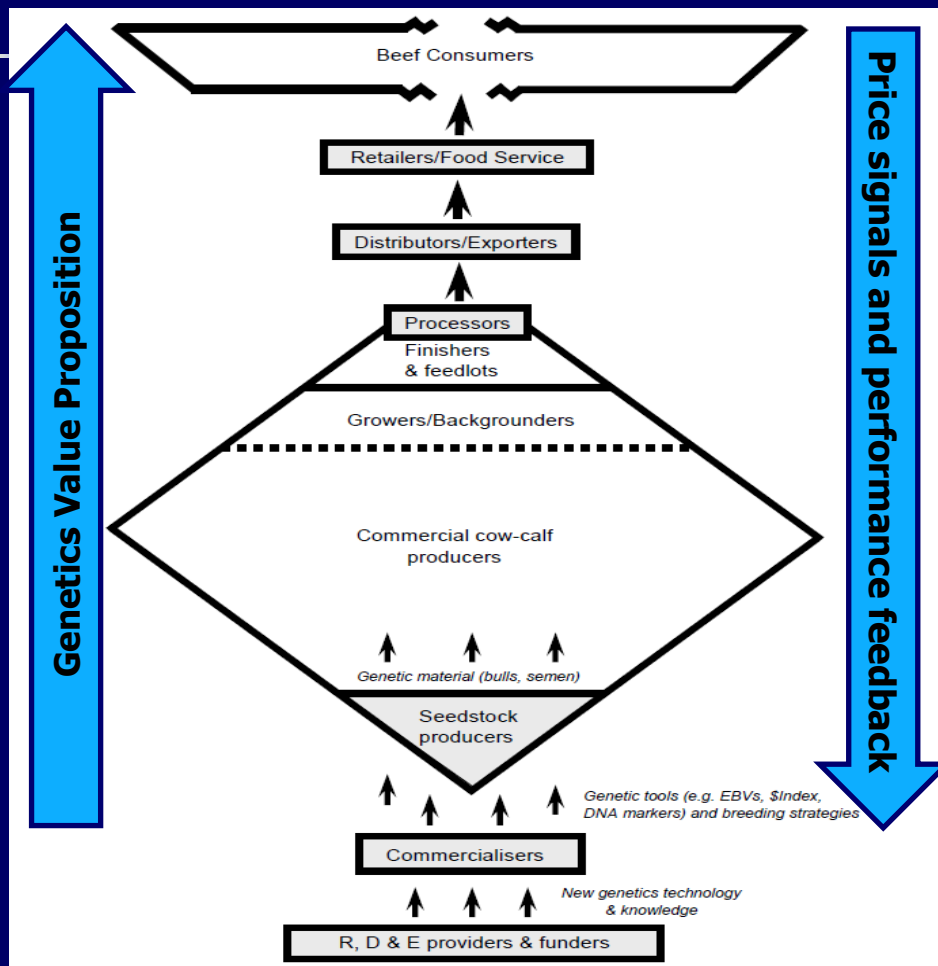
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> \$20 million in active grants – can these work together?





# 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.

Parnell, P.F. 2007. Effective value chain partnerships are essential for rapid adoption of beef genetics technology. Association for the Advancement of Animal Breeding and Genetics. 18. 167-174 .



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



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**Quality Beef by the Numbers aims to boost profits**  
Drovers/CattleNetwork news source | Updated: August 14, 2012

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Quality Beef by the Numbers is the official name of a University of Missouri and industry joint project to boost the quantity of Prime and Choice grade beef produced in Missouri and neighboring states.

Details of the project will be presented Aug. 30 at a public announcement in Columbia, Mo.

The effort is in response to changing consumer preferences toward higher quality products, said Scott Brown, research assistant professor at Mizzou's College of Agriculture, Food and Natural Resources (CAFNR). USDA statistics show that production of Choice and Prime beef over the past several decades hasn't kept up with market demand, he said.

According to recent studies, consumers are willing to pay more for USDA Prime than Select grade steaks. That willingness to pay has not gone unnoticed by packers or feedlots, which are taking advantage of grid pricing to source more quality cattle while passing on premiums prices to producers for those cattle.

The Aug. 30 meeting will announce specifics of the program for producers to adapt to and profit from these new consumer preferences and feedlot opportunities. Quality Beef by the Numbers will describe a system how cow-calf producers, stockers, feed yards and processors can work in coordination to produce high-demand products.

Brown said that segmentation within the U.S. cattle industry has hindered such coordination as well as adoption of newer production and marketing strategies. David Patterson, professor of Animal Science at CAFNR and co-director of the project with Brown, said that the Quality Beef project will show how using best practices in genetic selection, artificial insemination, record keeping, statistical analysis, feeding and health strategies will result in more carcasses graded high quality at harvest.

"Today there is often a disconnect between Missouri cow-calf producers and profits when their product is graded," Patterson continued. "Most producers today sell calves for an average price. Their calves may be of very high quality, but they reap none of the financial rewards that result from their health, reproduction, genetic and management decisions."

Working with MU on the project are Irsik and Doll Feed Services Inc., Garden City, Kan.; Pratt Feeders LLC, Pratt, Kan.; Accelerated Genetics, Baraboo, Wisc.; Genex Cooperative Inc., Shawano, Wisc.; and Select Sires MidAmerica with offices in Louisville, Ky. and Logan, Utah. Tyson Foods and Sysco Foods, a company involved in marketing and distributing food products to restaurants, healthcare and educational facilities, hotels and inns, and other food service and hospitality businesses, will participate in a panel discussion during the Aug. 30 program.

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- Webinar to highlight needs of veterans in agriculture
- Commentary: Farm kids healthier than city kids
- Allendale Cattle on Feed and Cold Storage estimates
- Winter pastures could reduce supplementation and feeding costs
- As drought continues, forecast yield lowered 23 bushels per acre
- Grains trading volatile at midday
- Monday Market Sentiment: Higher beef prices support cattle market
- How will test weight impact the value of your 2012 corn?
- Quality Beef by the Numbers aims to boost profits

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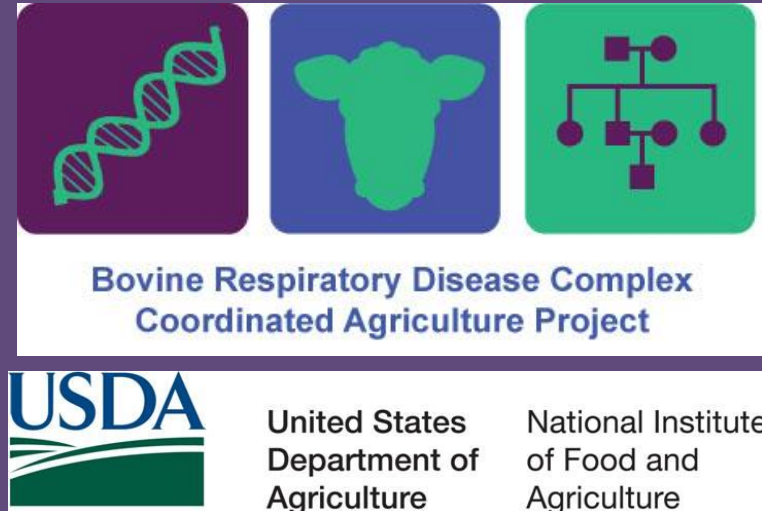
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Can we partner with an integrated supply chain to demonstrate a value proposition based on gathering phenotypes on reproduction, feed efficiency and feedlot health, carcass etc. and genotyping these animals.... Use this as the demonstration of value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



# Discussion



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