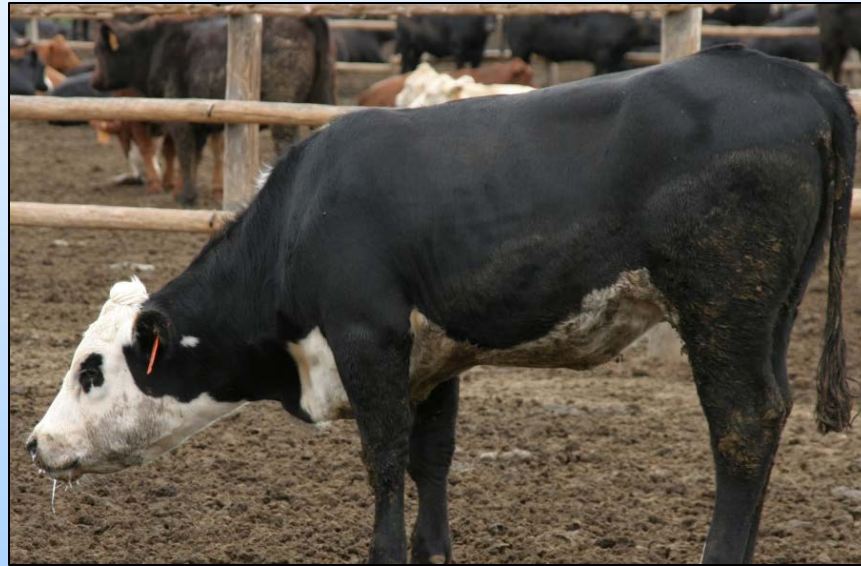


## OVERVIEW

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

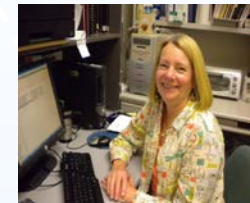


Holly Neibergs

Supported by USDA-AFRI 2011-68004-30367



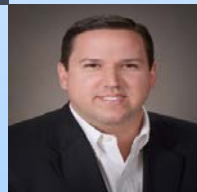
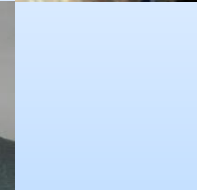
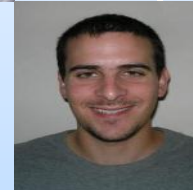
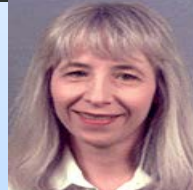
# Project Director James Womack



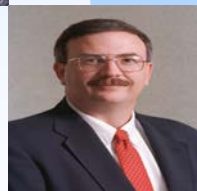
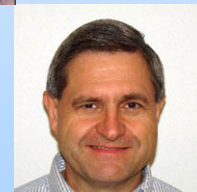
Project Coordinator  
Jan Elliott



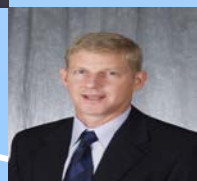
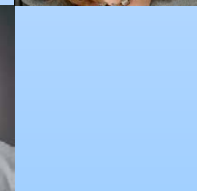
Extension  
Coordinator



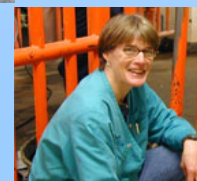
Co-Education  
Coordinator



Co-Education  
Coordinator



Research  
Coordinator



# BRDC Industry and Scientific Advisory Board



Heather Burrow, PhD, CEO  
Cooperative Research Centre  
Beef Genomics in Australia



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Tom Field, PhD  
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Unit of Animal Genomics  
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Manager,  
Columbia River Dairy, LLC



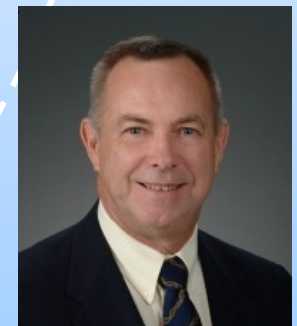
Pamela Hullinger, DVM  
Clinical Professor  
Department of Medicine  
and Epidemiology  
UC Davis, CA



Harris Lewin, PhD  
Vice Chancellor for Research  
UC Davis, CA



Daniel Grooms, DVM, PhD  
Associate Professor  
Department of Large Animal  
Clinical Sciences



James Womack, PhD  
Luse Endowed Chair, PD  
Texas A&M University

# BRDC Industry and Scientific Advisory Board

- Integration and relevance with industry
- Active participation
- Quarterly reports
- Annual face-to-face meeting
- Decisions on modification or continuation of projects based on performance and progress

# THE PROBLEM



***“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”***

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.

# Background and Rationale

- 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
- Need to develop new approaches to tackle BRD



*“Because of the high economic cost associated with BRD incidence, BRD resistance should be considered for incorporation into beef cattle breeding programs”<sup>\*</sup>”*

\* Schneider, M.J., et al., 2010. Evaluation of fixed sources of variation and estimation of genetic parameters for incidence of bovine respiratory disease in preweaned calves and feedlot cattle. J. Anim Sci. 88: p. 1220-1228.

# Long Term Goal

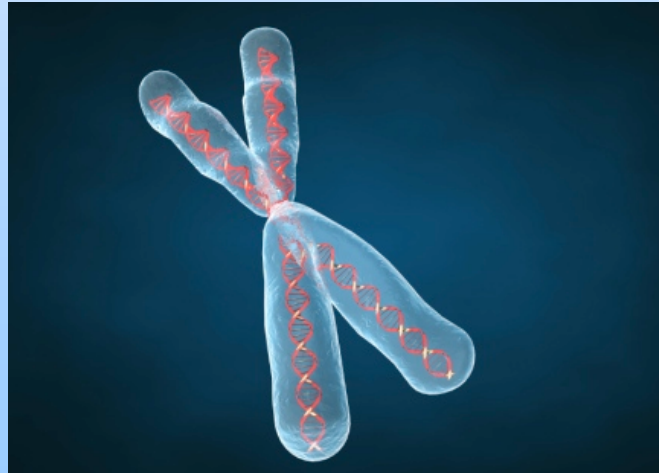
Reduce the incidence of BRD in beef and dairy cattle with resultant improvements in animal welfare and industry profitability by:

- 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
- 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
- Providing educational opportunities for undergraduate, graduate and veterinary students to generate a future human resource for the continued reduction in bovine respiratory disease incidence



# RESEARCH HYPOTHESIS:

- Genetic selection for resistance to BRD coupled with improved animal health management can provide a significant, sustainable, and profitable reduction in the prevalence of BRD.



# Research Objectives

- “The *research* component of this proposal will identify genetic loci and genomic rearrangements associated with BRD, and use these data to develop BRD diagnostic tests and SNP-based selection tools to identify BRD-resistant animals. Incorporating BRD into genetic evaluations and selection decisions offers a sustainable approach to reduce disease incidence. Selection for resistant animals will ultimately result in improved welfare, reduced antibiotic use and handling costs, superior production efficiency, and improved profitability”

Research  
Coordinator



Holly Neibergs  
Washington  
State University

# Research Aims

1. Identify genomic regions associated with BRD resistance/susceptibility in beef and dairy cattle.
2. Identify the interaction of the cattle genome with the pathogens responsible for BRD.
3. Identify novel pathogens present in animals with BRD, and develop pathogen diagnostic panel.
4. Develop BRD Genetic Selection Panel.
5. Develop genomic estimates of breeding values for resistance to BRD.
6. Assess how animal welfare is affected by BRD in cattle.

# Educational Hypothesis

- Didactic and experiential learning approaches describing the complex issues associated with BRD in the cattle industry will be most effective in preparing students to make the management decisions needed to reduce BRD impact.

Education Coordinators:



Milton Thomas  
New Mexico  
State University



Robert Hagevoort  
New Mexico  
State University

# Education Objectives

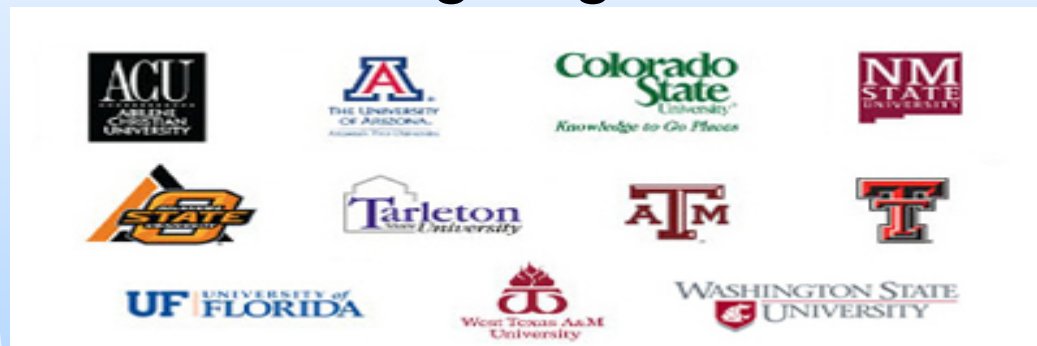
- The *education* component will develop undergraduate courses, and offer educational and research internships to cultivate a future human resource for continued reduction in BRD prevalence. 4-H youth will be exposed to approaches to minimize BRD through participation in educational games and instruction.

# Education Aims

1. Develop a nationally accessible distance-learning course on the integration of animal health management with genomic and animal breeding approaches to reduce livestock disease.
2. Develop an undergraduate summer research internship program, with an emphasis on students from minority-serving institutions, to expose and train them in multidisciplinary integrated research to reduce BRD prevalence.
3. Develop a veterinary feedlot and dairy internship program.

# Education Aims, cont.

3. Sponsor graduate and undergraduate students to attend the Southern Great Plains Dairy Consortium where extension and research activities will be ongoing.



4. Develop a 4-H curriculum to expose and train youth on animal disease using BRD as example applications.



Extension  
Coordinator



Alison Van Eenennaam  
University of California  
at Davis

# Extension Hypothesis

- An integrated multidisciplinary approach to reducing BRD will be more successful than approaches which address only one aspect of the disease or a single sector of the cattle industry.



# Extension Objectives

- The *extension* component will employ Advisory panel guidance to develop a sustained effort to disseminate, demonstrate, evaluate and document the impact of a range of educational outreach materials and best management practices for beef and dairy cattle producers, and feedlot personnel. All educational and outreach materials will be integrated into eXtension to ensure their continued accessibility.

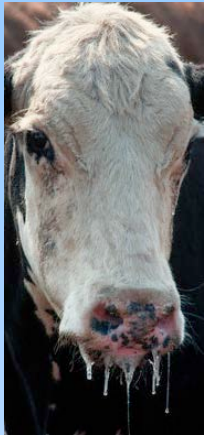


# Web Site



**Bovine Respiratory Disease Complex**  
Coordinated Agricultural Project

<http://www.brdcomplex.org>



# Conclusion

- This proposal aims to advance translational research stemming from the new genomic technologies that have become available to the cattle research community; and seeks to deliver science-based knowledge and management tools to enable the dairy and beef cattle industries to effect a sustainable decrease in the incidence of BRD.

# Ongoing Studies in 2011

# Research Aims

1. Identify genomic regions associated with BRD resistance/susceptibility in beef and dairy cattle.
  - Reference populations encompassing 6000 animals
    - Pre-weaned dairy calves and replacement heifers
    - Crossbred feedlot cattle
    - Purebred beef bulls
    - Pathogens characterized for each diagnosis

# Veterinary Medical Teaching and Research Center at Tulare, CA




- Terry Lehenbauer
- Sharif Aly
- Jessica Davis
- Paul Rossitto
- Kandi Gist



# 2000 Pre-weaned Holstein Calves Tulare, CA

- Evaluate calves between days 10 and 74 of age
  - Received at 1 d of age
  - Weaned at 74 d
  - Walking along hutches to diagnose BRD calves
- Diagnosis with Dr. Sheila McGuirk's calf respiratory scoring chart



| 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  |
|  |  |  |  |



# 2000 Pre-weaned Holstein Calves Tulare, CA

- Diagnostics
  - Bacteriology swab
    - Deep pharyngeal
  - Virology swabs
    - Mid-nasal
    - Deep pharyngeal

Mid nasal swab



Measure distance for deep pharyngeal swab



Correct ventral placement



Incorrect dorsal placement



# 2000 Pre-weaned Holstein Calves Tulare, CA

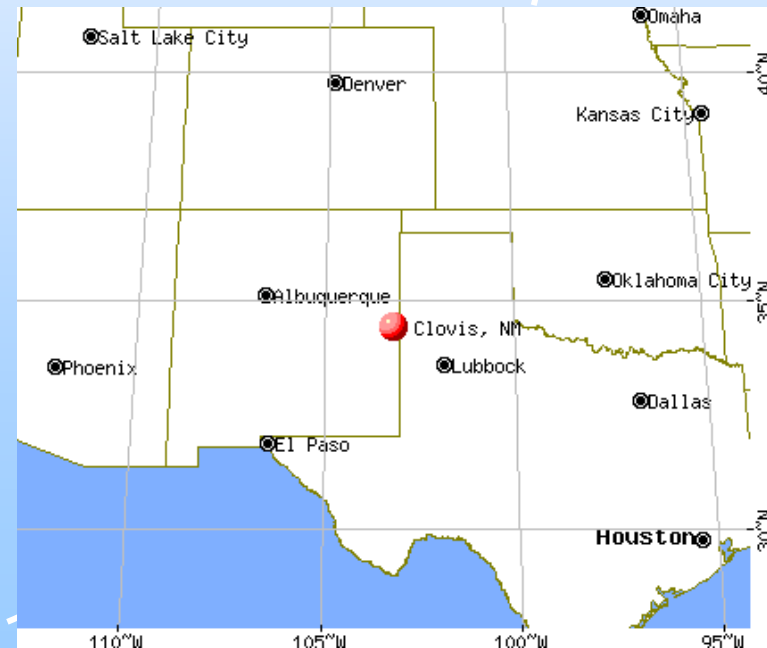
- Blood collected for DNA, serum
- Data entered at farm and uploaded to database



# 1000 Replacement Heifers New Mexico State University



- Milt Thomas
- Robert Hagevoort
- Tim Ross
- Erik Chavez



# 1000 Replacement Heifers Clovis, NM



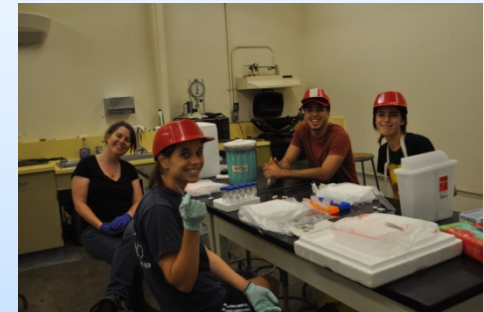
# Establishment of DNA/Serum Repository

- Repository at Washington State University
  - Zeping Wang
  - Erik Scraggs
  - Kevin Sieverkroppf
- Mirror repository at University of Missouri

## 2. Identify the interaction of the cattle genome with the pathogens responsible for BRD.

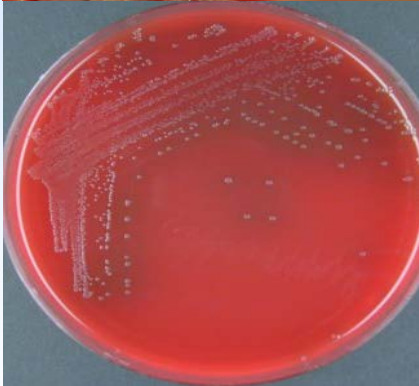
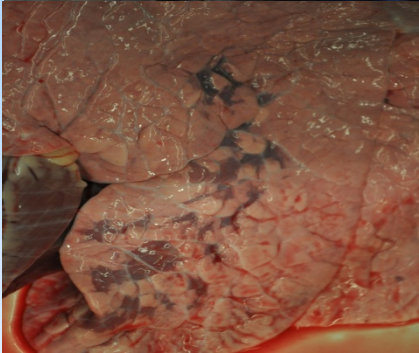


- Challenge study at University of California at Davis
  - Laurel Gershwin
  - Alison Van Eenennaam
  - Shawn Yarnes
- RNA-seq at University of Missouri
  - Jerry Taylor
  - Bob Schnabel
  - JaeWoo Kim



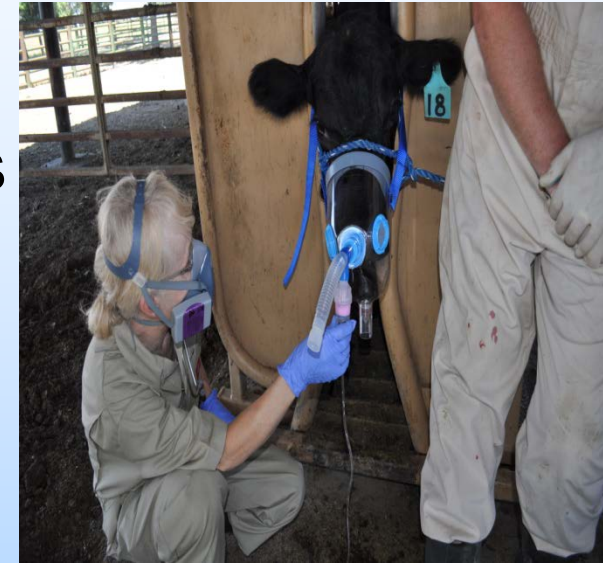
# Pathogen Challenge

- Calves challenged
- Pilot studies to determine timeline of clinical signs
- Calves harvested and tissues collected
- RNA-sequencing done to identify genes involved in pathogenesis



# Organisms used in Challenge Studies

- Bovine respiratory syncytial virus (BRSV)
- Infectious bovine rhinotracheitis virus (IBR)
- Bovine virus diarrhea virus (BVDV)
- *Mannheimia hemolytica*
- *Pasteurella multocida*
- *Histophilus somni*
- *Mycoplasma bovis*





# Research Aims

6. Assess how animal welfare is affected by BRD in cattle.



• University of California at Davis

- Cassandra Tucker
- Rachel Toaff-Rosenstein
- Laurel Gershwin



• University of Edinburgh


- Adroaldo Zanella



## 4 treatments (13 steers/each):

- BRD
- BRD+meloxicam
- Healthy
- Healthy+meloxicam

# Timeline



infect with  
BRSV  
day 0

treatment  
day 8



day -7

move into  
individual  
pens



day 5

infect with  
*H. somni*



day 13

return to herd; monitored  
for 1 additional week

# Monitoring

