

# USDA,ARS Livestock Issues Research Unit Research Update



**Special points of interest:**

- Different mitigation techniques for Bovine Respiratory Disease
- How stress influences food safety and meat quality
- Professional, Stakeholder, and Student outreach by LIRU scientists
- New swine building completed

## Mitigation of negative impact of Bovine Respiratory Disease

Bovine Respiratory Disease, or BRD, continues to be the costliest disease complex affecting cattle production systems, costing an estimated \$1 billion per year. LIRU has developed a method to infect cattle with BRD, allowing researchers to study the disease complex and work with industry partners to test potential prevention and treatment strategies.

Scientists recently collaborated to determine whether administration of Banamine® Transdermal was able to reduce fever associated with BRD. Data from this study

demonstrated that administration of the transdermal product was able to reduce the fever response associated with BRD when it was administered immediately prior to the BRD infection, without affecting immune parameters.

Working with a mineral supplement company, unit scientists tested whether different sources and doses of Zn supplementation would affect the immune response to a BRD infection. The results indicate that zinc source can influence the immune response, and too much zinc in the diet may inhibit recovery from BRD.

Supplementation of steers with a prebiotic/probiotic blend was also evaluated using our BRD model. We found that supplementing with the blend may have helped steers recover faster from the BRD challenge.



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## LIRU 5-Year Impact

There were over 65 visits and inquiries from industry and university representatives expressing interest in research conducted by the LIRU.

Developed indwelling rectal and vaginal temperature monitoring devices that have been placed in over 700 bull/steer calves and over 300 heifer beef and bison calves in the U.S. and Canada.

Based on LIRU Research, immune and heat stress studies using yeast and yeast-based products conducted in cattle have resulted in several feedlots, representing approximately 400,000 head of cattle annually, and

dairy calf ranches, incorporating these products into their feeding strategy.

LIRU has established a repeatable *Salmonella typhimurium* infection model in dairy calves which allows for the monitoring of immune activation and tracking of the bacteria throughout the body.

Two commercial dairies, and four dairy calf ranches, representing over 500,000 head of calves annually, have incorporated bacterial probiotic products based on research conducted by the LIRU on mitigation of negative effects of Salmonellosis.



## Influence of stress on food safety and meat quality

Stress experienced during production, such as weaning, castration, transportation events, and heat stress events, increases stress hormones which can affect many systems in the body. Feed intake and digestion can be negatively impacted, as well as the immune system's ability to fight infection. Tissue damage caused by oxidative stress is a secondary effect of other stressors. This year the LIRU studied the effects of stress on both pathogen migration and food safety, as well as oxidative stress and meat quality.

A study was conducted with collaborators at Auburn University to determine the potential for *Salmonella* to move outside the digestive system into lymph nodes and joint fluid, and subsequently contaminate ground meat products. Dairy calves were challenged with *Salmonella*, and after 5 days various tissues and lymph nodes were collected from one half of the carcass, while the other half was refrigerated for 2 days and then ground. Researchers found that *Salmonella* indeed moved out of the digestive system into various musculoskeletal lymph nodes. Further, *Salmonella* was found in some of the ground beef samples. Because *Salmonella* is found inside these pe-

ripheral, yet internalized tissues, it is not eradicated by traditional methods such as topical washes and sprays used to reduce bacterial contamination such as *E. coli* on beef carcasses, and thus may pose a risk of contaminating various cuts of meat and ground meat products.

A study was conducted with researchers from LIRU, Utah State University and Texas Tech University to determine the influence of a stress hormone challenge, used to mimic an increase in stress associated with transportation, on oxidative stress markers in the strip loin. Muscle samples were collected prior to the stress challenge, at harvest, and after aging for 14 days after harvest to measure various oxidative stress markers. Preliminary data from this study suggests that increasing the time between a stress event and harvest may reduce proteins associated with decreased meat tenderness. This may help producers and packers better coordinate the times in which cattle are shipped and/or harvested.

## Recent Publications

- Burdick Sanchez, N. C., J. A. Carroll, P. R. Broadway, H. D. Hughes, S. L. Roberts, J. T. Richeson, T. B. Schmidt, and R. C. Vann. 2017. Cattle temperament alters the metabolic response to a feed restriction challenge in beef steers. *J. J. Physiol.* 3:016.
- Burdick Sanchez, N. C., J. A. Carroll, P. R. Broadway, B. E. Bass, and J. W. Frank. 2018. Short Communication: Modulation of the acute phase response following a lipopolysaccharide challenge in pigs supplemented with an all-natural *Saccharomyces cerevisiae* fermentation product. *Livest. Sci.* 208:1-4.
- Burdick Sanchez, N. C., J. A. Carroll, P. R. Broadway, B. E. Bass, and J. W. Frank. 2019. Supplementation of a *Lactobacillus acidophilus* fermentation product can attenuate the acute phase response following a lipopolysaccharide challenge in weaned pigs. *Animal* 13:144-152.
- Littlejohn, B. P., D. M. Price, D. A. Neuendorff, J. A. Carroll, R. C. Vann, P. K. Riggs, D. G. Riley, C. R. Long, T. H. Welsh, Jr., and R. D. Randel. 2019. Prenatal transportation stress alters genome-wide DNA methylation in suckling Brahman bull calves. *J. Anim. Sci.* 95:5176-5183.
- Littlejohn, B. P., N. C. Burdick Sanchez, J. A. Carroll, D. M. Price, R. C. Vann, T. H. Welsh, Jr., and R. D. Randel. 2019. Influence of prenatal transportation stress on innate immune response to an endotoxin challenge in weaned Brahman bull calves. *Stress.* 22:236-247.
- Word, A. B., P. R. Broadway, N. C. Burdick Sanchez, S. L. Roberts, J. T. Richeson, Y. L. Liang, B. P. Holland, M. D. Cravey, J. R. Corley, M. A. Ballou, and J. A. Carroll. 2019. Immune and metabolic responses of beef heifers supplemented with *Saccharomyces cerevisiae* to a combined viral-bacterial respiratory disease challenge. *Transl. Anim. Sci.* 3:135-148.

## LIRU Professional, Stakeholder and Student Outreach Activities

LIRU Scientists attended the following professional and stakeholder meetings:

- National Cattleman's Beef Association Cattle Industry Convention
- PMI External Insight Meeting
- Texas Veterinary Medical Association Annual Conference
- Central Plains Dairy Expo
- Plains Nutrition Council Spring Conference
- Spring and Winter Academy of Veterinary Consultants Meetings
- Phibro Animal Health Dairy Research/Tech meeting
- Kemin Industries Customer Meeting
- Panhandle Livestock Professionals Meeting
- World Pork Expo
- 6th Annual Beef Cattle Welfare Symposium and University of Calgary Veterinary Medicine Beef Cattle Conference
- American Dairy Science Association Annual Meeting
- American Society of Animal Science—Canadian Association of Animal Science Annual Meeting and Trade Show
- USDA, ARS Cropping Systems Research Laboratory Field Day
- Feeding Quality Forum
- Deseret Cattle Feeders Meeting

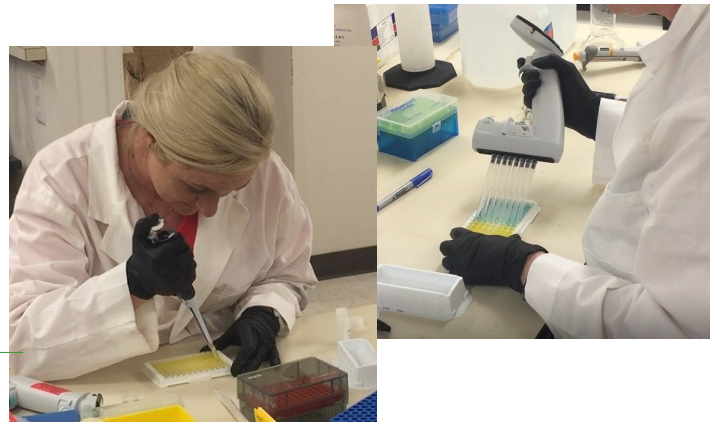
LIRU Student Outreach:

Jeff Carroll and Rand Broadway gave invited lectures at Auburn University. Additionally, Rand Broadway served on the graduate committee for one Master's and one Doctoral student at Auburn University while Jeff Carroll served on the graduate committee for one Doctoral student at Auburn University. Jeff Carroll and Nicole Burdick Sanchez also served on the graduate committee for one Doctoral student at Texas Tech University.

Nicole Burdick Sanchez taught a distance/online course on endocrinology, specifically for livestock, to graduate students at Auburn University.

Invited Presentation Titles:

- Adding complexity and confusion to understanding Bovine Respiratory Disease
- Alternative pre-harvest interventions to mitigate animal disease and foodborne pathogens
- Animal science career options beyond vet school
- Beef cattle health: Unraveling the unknown
- Bovine Respiratory Disease battle: Challenge model vs. nutritional supplements
- Cattle health: It's complicated!
- Challenges with managing beef cattle health: Naturally occurring variations
- Food safety: Pasture to plate
- Heritability of disease resistance
- Influence of fetal programming on post-natal life
- LIRU's animal health research: Swine, Dairy and Beef
- Potential options for mitigating the effects of heat stress and respiratory challenges in beef cattle
- Stress and meat quality
- The impact of Clostridia and Salmonella on ruminant health
- Understanding stress responses in livestock
- Use of a dual viral-bacterial challenge model to evaluate Bovine Respiratory Disease intervention strategies
- Variations in stress responses and metabolic profiles: Potential link to immune function in beef cattle



## New Swine Research Building Completed

The LIRU has completed a new research building designed to focus on swine, with the first study scheduled for 2019. Similar to the beef and dairy calf research buildings, the new swine building is a 5,000 ft<sup>2</sup> building that



includes space for animal housing, wet laboratory for processing samples, and a break room. Additionally, the building has three showers, allowing for biocontainment procedures. The building also hosts features that are unique to the swine building. Environmental conditions are controlled solely by HVAC with single-pass air circulation. The facility can hold

up to 80 pigs individually housed or 200 pigs in group pens. The building contains a dedicated surgery area for placement of intraperitoneal temperature measuring devices and other surgical procedures. There is also a necropsy room for collection of tissues and samples from animals housed across the research buildings.





## Nutritional Intervention and Management Strategies to Reduce Stress and Improve Health and Well-being in Cattle and Swine

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Striving to improve health, immunity, and well-being in cattle and swine through high-quality and intensive scientific research that generates positive, practical applications.



Get more information:  
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### Livestock Issues Research Unit Personnel

Front Row (left to right):

Dr. Jeff Carroll, Research Leader,

Mrs. Jessica Carroll, Biological Science Technician

Dr. Nicole Burdick Sanchez, Research Immunologist

Back Row (left to right):

Dr. Rand Broadway, Research Microbiologist,

Mr. Jeff Dailey, Support Scientist

