

A publication from the Department of Animal Science, Oklahoma State University

COWPOKE

Research 2016



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Faculty & Student Research



ANIMAL SCIENCE COWPOKE

The Research Edition of Cowpoke News is published annually by the Department of Animal Science within the Division of Agricultural Sciences and Natural Resources (DASNR) at Oklahoma State University. We strive to keep students, alumni, and friends of the department informed about our activities and successes.

The Department of Animal Science offers two majors to students; animal science and food science. It is one of the largest departments on campus with nearly 1,000 undergraduate students, but with a small town feel, a caring attitude and a commitment to every student.

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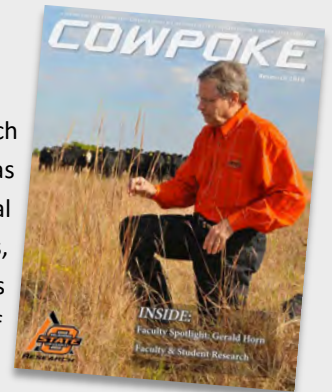
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Welcome to the 2016 Research Edition of Cowpoke News, which strives to share information about the research efforts, recognition and accomplishments of the Department of Animal Science at Oklahoma State University. We hope you enjoy reading about our department, including information on the successes of our undergraduate and graduate students and faculty.

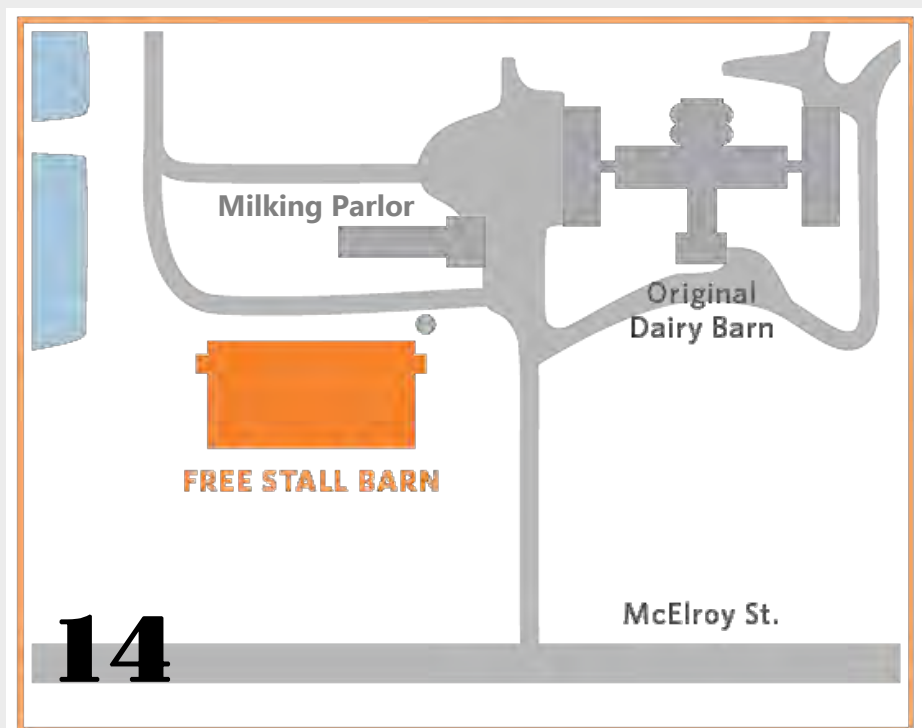
On The Cover: Gerald Horn

A picture of Dr. Gerald Horn at an animal science research range is on the cover of this edition. Dr. Gerald Horn has been a faculty member for the OSU Department of Animal Science for 41 years. He is widely respected by students, colleagues and clientele. Dr. Horn has devoted much of his career towards increasing the biological efficiency of production of cattle by seeking to decrease production risk and increase the logistical stability and profitability of the industry. Read more about Dr. Horn on page 5!



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Faculty Research

Dr. Ravi Jadeja, assistant professor and food safety specialist, is pictured left on an episode of SUNUP. He has developed an antimicrobial ice based novel clean-in-place type process for meat grinders, which greatly reduces contamination and the chance of recall. Dr. Jadeja currently has a patent pending for the new sanitation process.

Learn more about our faculty research, including publications, grants and invited presentations, on pages 15 - 21!

Graduate Research

Corbit Bayliff (pictured right) is a graduate student working on a research project, titled "Energy requirements and production efficiency of lactating beef cows in a drylot system."

Corbit won 1st place at the Southern Section American Society of Animal Science Graduate Student Competition (M.S.) for his oral paper presentation, and received 1st place at the 2016 Whiteman Award for Excellence in Oral Presentation.

Read more about graduate student research in our department on pages 22 - 23!



Undergraduate Research

Mary Temple Lee (pictured left) is an Animal Science Undergraduate Research Scholar and recipient of a Spring 2016 Wentz Scholarship.

She worked with Dr. Ali Beker on her project, titled "Factors associated with unhatched chicken eggs after incubation: fertility, temperature and humidity."

Learn more about undergraduate research in our department on pages 24 - 26!



From the Assistant Department Head



Dear Alumni and Friends:

We are pleased to present you with our annual Research Edition of the Cowpoke News. The faculty in the Department of Animal Science at Oklahoma State University continue to conduct fundamental and translational research that is having an impact on our state, region, nation and world. As the world population increases, food safety and security on a global scale will continue to become an even greater research priority. Population growth, economic growth and the rise of the middle class in developing countries are expected to further increase the demand for meat, milk and eggs. Our faculty are working to meet this challenge through innovative research and technology development to increase efficiency and output of livestock production systems in a socially, environmentally and economically sustainable manner.

In this Research Edition, you will read about experiments being conducted to replace antibiotics in feed with probiotics without decreasing health and performance in poultry, to enhance pre-harvest food safety by predicting risk factors associated with common management practices, and to measure greenhouse gasses for developing mitigation strategies to ensure sustainability of dairy (and beef) production. In addition, we are very thankful for and excited about the Ferguson Family Gift that will allow us to build a new freestall barn equipped with an Insentec feeding system, which will greatly enhance our research capabilities at the Ferguson Family Dairy Center.

This edition also reports manuscripts published in top-tier journals and invited presentations given throughout the U.S. and world by our faculty and graduate students. As extramural grants increase in importance, our faculty continue to seek and obtain funding to support their research. In addition, our faculty are mentoring students to be the academia/industry leaders of tomorrow. These students will be at the peak of their professional careers in 2050, and will be responsible for helping to fulfill the increased food demand. The Animal Science Undergraduate Research Scholars Program is designed to foster interest in science-based careers and graduate school. We are proud to introduce you to our undergraduate scholars involved in research in this edition. We also celebrate the awards and recognition of our undergraduate and graduate students and faculty.

Finally, and most significantly, we highlight the career of Dr. Gerald Horn in our Faculty Spotlight. Dr. Horn has served this department for 41 years and has continuously exemplified excellence in research, teaching and service. The impact that Gerald has had on the sustainability of beef cattle production in Oklahoma, the U.S. and throughout the world has been profound. The overwhelming majority of what we understand about managing cattle on wheat pasture and the impact of grazing wheat pasture on subsequent feedlot performance and carcass merit has resulted from research conducted by Dr. Horn and his students. Dr. Horn was working to keep beef cattle production sustainable in Oklahoma and the southern Great Plains region long before “sustainability” was a popular scientific word. We are grateful to Gerald for his service to this department and for the example he continues to set for all of us to follow as we strive to achieve excellence in our respective disciplines.

In closing, Dr. Rusk and I are proud to say that our research faculty and their students have had a very successful year, and we are proud to present this Research Edition of Cowpoke News. Please pay close attention to our list of publications, and if a copy of a manuscript is of interest to you please let us know. Finally, we say THANK YOU to the donors, major sponsors and other supporters who have partnered with us to help us sustain our research mission.

Sincerely,

Clint Krehbiel, Assistant Department Head
OSU Department of Animal Science

Faculty Spotlight

Written by Ryan Reuter & Rebekah Alford

Dr. Gerald Horn has been a faculty member for the OSU Department of Animal Science for 41 years. He is widely respected by students, colleagues and clientele. Dr. Horn has devoted much of his career towards increasing the biological efficiency of production of beef cattle by seeking to decrease production risk and increase the logistical stability and profitability of the beef cattle industry.

Dr. Horn earned his B.S. degree from Texas Tech University (1966) and his M.S. (1968) and Ph.D. (1971) degrees from Purdue University. After graduation, Dr. Horn became a faculty member of the University of Georgia. While there, his research focused on the etiologic involvement of gastrointestinal hormones in the pathophysiology of ruminal lactic acidosis, endotoxemia and the “sudden death syndrome” of feedlot cattle.

In 1975, Dr. Horn joined the OSU Department of Animal Science. He soon recognized the unique and economically important role of wheat pasture for the stocker cattle that graze Oklahoma’s pastures and southern Great Plains each year, as well as the important price-stabilizing role wheat pasture plays for most of the fall-weaned calves in the U.S. Dr. Horn initiated activities in 1979 to obtain federal funding for development of resources and expansion of research in the wheat pasture area. These efforts proved fruitful in 1989 when federal funding was obtained for development of a first-of-its-kind, multidisciplinary research and education program around dual-purpose winter wheat grazing.

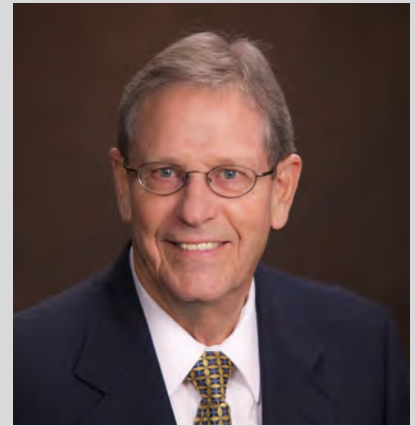
“Dr. Horn is a nationally recognized authority on stocker cattle,” said Dr. Clint Rusk, animal science department head. “His wheat pasture research has generated numerous grants and refereed journal

articles over the years. His work at the Crosstimbers-Bluestem Stocker Range involving the grazing of native range and Old World Bluestem by stocker cattle is also well documented.”

Dr. Horn has worked diligently as project director for this program to ensure continued funding, which has exceeded \$5.7 million from extramural federal and private industry support. In addition, he obtained funding, served as program chairman and edited the proceedings of the National Wheat Pasture Symposium at Oklahoma State University, which was attended by scientists from 11 states, Great Britain and Canada. The proceedings of this symposium served as a landmark publication of the knowledge base and future research priorities for the production and utilization of winter wheat pasture for many years.

“Dr. Horn is very dedicated to animal science, students, Oklahoma State University and cattle producers,” said Dr. Bob Wetteman, animal science emeritus professor. “His world recognized grazing research has provided ranchers and farmers with the opportunity for additional income by grazing wheat pasture. His major contribution has been the students he has worked with in the classroom and in the field. These graduates are successful beef producers, researchers and educators throughout the U.S. and the world.”

The central theme of Dr. Horn's research has been to enhance fundamental understanding of the system to increase profitability and growth of the industry to improve the economies of rural communities in the southern Great Plains. Collectively, results of this research undergird most modern nutrition and management practices for growing



Dr. Gerald Horn

Dr. Horn's research in the wheat pasture area has included:

- ◆ Classical studies with surgically implanted pressure transducers to evaluate the potential role of altered ruminal motility in the bloating and death of wheat pasture cattle
- ◆ Quantification of wheat forage nitrogen pools and their rates of ruminal degradation
- ◆ Effects of management practices such as feeding low-quality roughages on wheat forage intake, rate of passage and utilization
- ◆ Efficacy and economic value of technologies such as ionophores, bloat-preventive compounds, and anabolic implants
- ◆ Development of targeted supplementation programs
- ◆ Quantification of minimum amounts of forage mass and allowance that limit forage intake and growth of stocker cattle
- ◆ Studies of wheat variety by stocking density interaction
- ◆ Development of economic models and microcomputer decision aids for use by extension personnel and producers.

cattle grazing wheat and other small grains pasture in the U.S., and has attracted the interest of scientists in Canada, Mexico, Argentina, Uruguay, Great Britain, Australia and New Zealand. Dr. Horn has presented this research at numerous scientific meetings, cattle conferences, field days, industry meetings and at international symposia in Mexico and Argentina.

Gerald also served as project director of a multidisciplinary research program in cooperation with the USDA/ARS Grazinglands Research Laboratory (El Reno, OK), focusing on methods for increasing the feeding value of low-quality roughages for beef cows and growing cattle through ammoniation or biodelignification using *Pleurotus ostreatus*, the white rot fungus. In other research, Dr. Horn

demonstrated that implants are both biologically and economically efficacious for growing cattle in dry-winter grazing programs, contrary to existing dogma at the time. Gerald recognized the need for systems research and documented the potential improvement in carcass quality for calves managed in these programs.

More recently, Dr. Horn and colleagues have sought to characterize the physiological bases for differences in finishing performance of feeder cattle from different growing programs. An apparent dichotomy is that, while feeder cattle coming off wheat pasture are some of the heaviest and fleshiest cattle placed on feed, their growth performance in the feedlot is typically excellent. The excellent finishing performance of “high-gain” wheat pasture steers has

been shown to be partially attributable to lower maintenance energy requirements per unit of empty body weight. In contrast, “low-gain” wheat pasture steers and steers restricted in energy intake during other growing programs partitioned greater amounts of energy to protein synthesis in visceral tissues resulting in greater heat production.

“It is an honor to work in the same department with Dr. Horn,” said Dr. Rusk. “His national reputation for stocker cattle grazing research is certainly well deserved. He is a man of utmost wisdom and integrity. Dr. Gerald Horn is an outstanding researcher, teacher and mentor in the Department of Animal Science at OSU. He is constantly sought out by students for knowledge and advice.”

Did You Know?

- ◆ Dr. Horn has served the OSU Department of Animal Science as a faculty member for 41 years, including 16 as the graduate program coordinator and 1.5 years as interim department head.
- ◆ He received the Tyler Award in 1987 in recognition of outstanding professional accomplishments by the OSU Department of Animal Science, the Elmo Baumann Distinguished Professorship Award (1992), the Graduates of Distinction Professorship (2008), the ASAS Southern Section Distinguished Service Award (2016) and the ASAS Animal Management (1998) and Fellow (2008) Awards.
- ◆ He is a graduate of the 1995/96 ESCOP Leadership Development Program.
- ◆ He is a Charter Diplomate of the American College of Nutrition (ARPAS), a past member of the Editorial Board of the Professional Animal Scientist and current member of the National Cattlemen’s Beef Association, Oklahoma Cattlemen’s Association and Plains Nutrition Council.
- ◆ Dr. Horn has authored or co-authored 109 refereed journal articles, 194 abstracts or papers presented at scientific meetings, 196 research reports of the Oklahoma Agriculture Experiment Station and 85 papers in conference proceedings.
- ◆ Dr. Horn has personally instructed in excess of 1,200 undergraduates and 250 graduate students in beef cattle nutrition and management.
- ◆ Dr. Horn has mentored in excess of 40 graduate students and post-docs in his career. His students are advancing the science and practice of animal nutrition and management in Argentina, Uruguay, Mexico and all across the United States.
- ◆ He has been a member of the ASAS since 1971 and has served two terms on the Editorial Board and many years as an ad hoc reviewer.
- ◆ He has served as a member and subsequently chairman of the Pastures and Forages, Ruminant Nutrition, Graduate Student Awards Competition and the Distinguished Service Award committees of the Southern Section of ASAS.

Dr. Gerald Horn has been a faculty member for the OSU Department of Animal Science for 41 years. He is widely respected by students, colleagues and clientele alike. Dr. Horn has devoted much of his career towards increasing the biological efficiency of production of beef cattle by seeking to decrease production risk and increase the logistical stability and profitability of the beef cattle industry.





Feeding Broilers Probiotics, a Possible Future Outlet for Growers

Written by Ali Beker & Sarah Schobert



Broilers are young chickens mainly raised for meat. Depending on the type of setting, broilers are raised in a backyard, small scale intensive or under a commercial scale.

Farmers implement different types of feeding techniques since feed costs make up the largest cost in poultry production. In the backyard system, chickens are allowed to scavenge and are supplemented with grains such as a lower nutrient dense feed. In the small scale intensive system, nutrient dense feed could be purchased from local stores or hand mixed at home. Finally, in commercial settings, feed is delivered from a commercial feed mill which could contain a growth promoter or antibiotic.

Whatever production system is practiced, it is important that farmers reduce production time required to bring broilers to market age in order to cope with the increasing demand for poultry meat worldwide. This means a higher

percentage of meat raised in a shorter period of time. Possible avenues that help in reduction of production time include the provision of palatable good quality feed, controlling stress factors like heat stress or disease causing organisms in the house, temperature in the house, and nutrient content of the feed offered. Broilers are able to be reared healthier, grow faster, and mortality is reduced when these factors are optimized.

The rate of weight gain for broilers has increased substantially during the last few decades. In 1960, a commercial broiler chicken attained a four-pound market weight by 12 weeks of age. Today's broilers will attain the same market weight in just less than six weeks. This remarkable improvement is attributed to improvements in genetics, housing systems, nutrition and the development of both nutritional and non-nutritional supplements. An example of this would include antibiotics used as a growth promoter to take advantage of the genetic changes.

Growth promoters are the main additives used in poultry feed; they are responsible for improvement in broiler productivity, especially in the early stages of rearing. The majority of antibiotic products are used at lower doses for almost the whole life of a broiler, except the withdrawal period before slaughter where no antibiotics are fed. However, some countries have banned antibiotics to be fed completely and others have restricted the use of antibiotics in broiler feed due to antimicrobial residues and the concern related to the development of cross-bacterial resistance among humans. In addition, many producers and nutritionists have to find alternatives to commonly fed growth-promoting agents because of the consumer's demand for antibiotic free products. One of the alternatives used is called probiotics, otherwise referred to as a direct-fed microbial. Studies conducted in chickens indicate probiotics help to alleviate production losses when antibiotics are not used by poultry farmers. Direct-fed microbials encourage healthy gut development,

decrease disease causing microbes in the digestive system and improve broiler performance.

At the Oklahoma State University Poultry Research Unit, we compared performance data of broiler chickens raised on an antibiotic free low nutrient density diet (simulating chicken scratch), formulated commercial mash diet without antibiotic supplement, and pelleted commercial diet supplemented with a mixture of strains from the Bacillus probiotic. These strains were specifically selected based upon their compatibility, enzymatic properties and resistance to extreme temperatures.

As shown in Figures 1 and 2, on day 33 broilers supplemented with probiotics showed an improved total body weight gain, and average daily body weight gain compared to those on commercial mash and a low nutrient density diet.

Broilers fed a probiotic supplemented diet exhibited increased performance and growth, which indicates good digestive tract development. This translates into: increased feed digestion, absorption and assimilation of nutrients to body

tissues, better disease resistance, the possibility of reduction in cross contamination of antibiotic resistant microbes and provision of antibiotic free product. Since no antibiotics were used, this diet satisfies today's consumer's demands. Based on the average daily weight gain data, it is estimated that broilers fed antibiotic-free commercial feed will require an additional 22 more days of feeding to attain similar body weight gains as that of probiotic supplemented feed. Ms. Sarah Schobert, a graduate student in the department, is analyzing body composition of broilers with and without probiotic supplementation to discover if probiotic supplementation may improve the meat quality from these birds. Probiotics may prove to be an alternative tool to poultry farmers in the coming decades.

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Image 1. Broiler chickens (30 days old) raised on antibiotic free low nutrient density diet (simulating chicken scratch)



Image 2. Broiler chickens (30 days old) raised on formulated commercial mash diet without antibiotic supplement



Image 3. Broiler chickens (30 days old) raised on and pelleted commercial diet supplemented with a mixture of strains from the Bacillus probiotic.

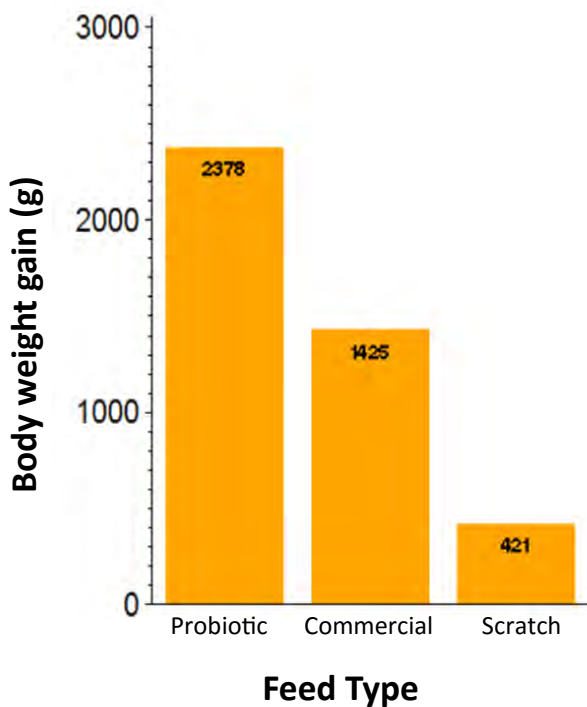


Figure 1. Body weight gain of broilers raised to 33 days of age

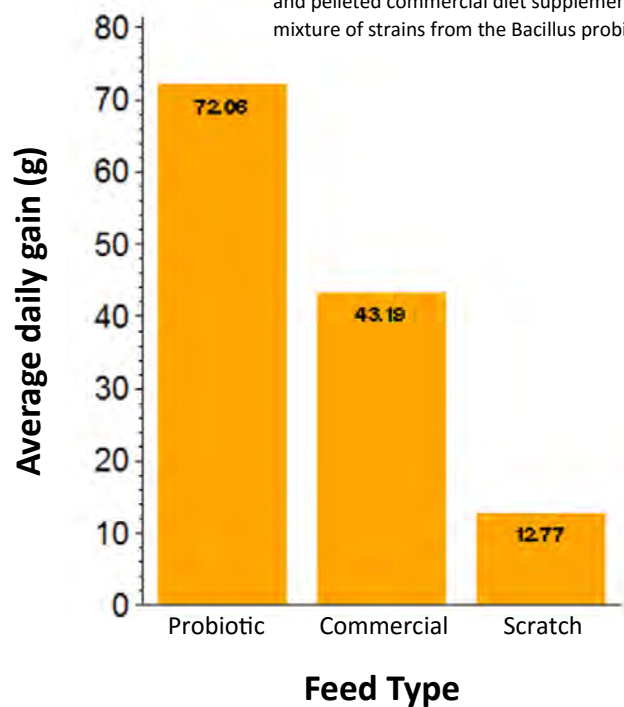


Figure 2. Average daily gain of broilers raised to 33 days of age

Predictive Food Microbiology: a Food Safety Tool for the Meat Industry

Written by Dr. Divya Jaroni & Joyjit Saha



The United States (U.S.) meat industry is the largest segment of U.S. agriculture, feeding both consumers and the economy. Meat production reached a record high of 93 billion pounds in 2012, with exports at 1.7 billion metric tons of beef and beef products. With the growing consumption and exports it becomes crucial to ensure meat safety, which has been facing a number of challenges. Multiple outbreaks and recalls of foodborne pathogens such as Shiga-toxicogenic *Escherichia coli* (STEC) and Salmonella in the U.S., along with the BSE scare in Europe, has led to concerns about the safety of beef among producers, processors and consumers. Meat is a perishable food product which requires proper processing, packaging and storage conditions. Raw meat is a potential source for microbial growth and violation of these conditions could create significant food safety risks. Traditional methods of meat inspection are currently not adequate to warrant public health safety. Systems designed and based on the quantitative

assessment of microbiological risks could assure consistent meat safety.

Current food safety programs in place for the meat production system have been successful, to a large extent, in reducing the risk of chemical residues in beef; however, meeting the “zero tolerance” policy for pathogenic microorganism such as STEC has been a tough task. Adequate research, including risk assessment studies, on the ecology of such foodborne pathogens at the pre-harvest level is essential to develop successful food safety programs.

Over the last decade, exponential growth of predictive modeling science has helped diversify its role in various domains, starting from finding odds in football games to microbiology. Predictive Food Microbiology (PFM) is a novel area within food microbiology, encompassing the disciplines of food science, mathematics, statistics, engineering and chemical sciences to study responses of foodborne microorganisms to environmental stresses through mathematical functions. The PFM techniques can be broadly classified into primary, secondary and tertiary models. Primary models

describe changes in microbial population with time under a specific set of environmental conditions. Secondary models describe the response of primary model parameters under different environmental and culture conditions. Tertiary models take modeling to its absolute form by integrating primary and secondary models into a user-friendly software package.

With recent applications relevant to the food industry, PFM serves as a powerful mathematical tool for assessment of microbial risks. Techniques in PFM help quantify and generate patterns for microbial behavior. They can also predict the fate of potential pathogens along the entire farm to fork continuum and help assess animal and human health hazards associated with food production. The primary goal of PFM is to assure both food safety and quality. In the meat industry, applicability of PFM techniques has significantly helped design Critical Control Points (CCPs) for slaughter house procedures and in-plant processing. These CCP’s, combined with corrective actions, could reduce the risk of transmission of foodborne hazards and contamination of products.

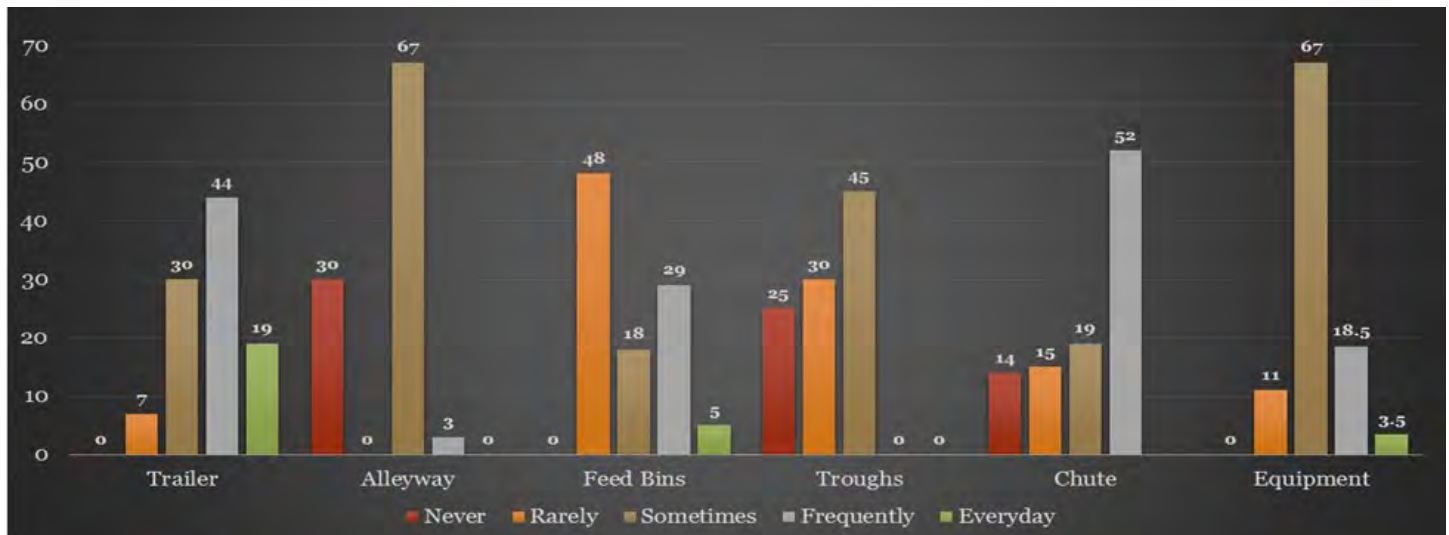


Figure 1. Cleaning frequency of common areas of cattle contact on cow/calf operations in Oklahoma

Although PFM techniques have come a long way and helped develop CCPs at the post-harvest level, limited research at the pre-harvest level cripples its scope. To assure meat safety, it is therefore essential to also evaluate the risks and design CCP's at the pre-harvest level. Effective risk prediction and assessment relies on necessary data. However, being a novel field, PFM is devoid of necessary data, especially at the pre-harvest level.

Together with collaborators from Texas Tech University (Lubbock, TX) and Southern University (Baton Rouge, LA), significant efforts have been made to enrich the database of pathogenic microorganisms for beef safety at the pre-harvest level, by gathering data from cow/calf operations in Oklahoma, Texas and Louisiana. Risk analysis of assimilated data involved three stages: assessment, quantification and communication. Assessment of data helped identify several management practices that influenced the prevalence of STEC in the farm-environment and associated animals. Risk quantification of the identified factors, such as water source for cattle, cattle feed, animal density, breed and

on-farm cleaning frequency, helped distinguish crucial ones. Recognition of the crucial factors will help identify CCP's and develop mitigation strategies to reduce on-farm contamination with foodborne pathogens. The PFM techniques have also been successful in other areas of food microbiology, such as shelf-life studies and product development. Recent studies have involved the development of antimicrobial products that could be used by the meat industry. One such product involves the use of bacteriophages in combatting the problem of biofilm-forming STEC in the meat industry. Bacteriophages are widely distributed, harmless viruses targeting specific pathogenic bacteria. They have been extensively beneficial in human and veterinary medicine; however, their application in food is still limited. The recent FDA-approval of *Listeria monocytogenes*-specific-phage in ready-to-eat (RTE) meat and poultry products has paved the way for development of phage-based antimicrobials for the meat industry. Their application in meat requires them to be thermally-stable, especially in RTE and cooked products, and

also be able to survive acidic and alkaline conditions. Bacteriophages, specifically targeting biofilm-forming STEC, were isolated from cattle operations in Oklahoma and were found to be pH and thermal stable. They were also found to have biofilm-disrupting capability on various food contact surfaces such as steel and high density propylene ethylene (HDPE). Effective application of primary and secondary PFM techniques on characterization aspects of isolated bacteriophages could help identify respective application parameters. Interdisciplinary collaboration of food microbiologists, food technologists, molecular microbiologists, mathematicians and statisticians will help PFM carve out its own niche and be sufficiently reliable to be used by food industry and regulatory authorities.

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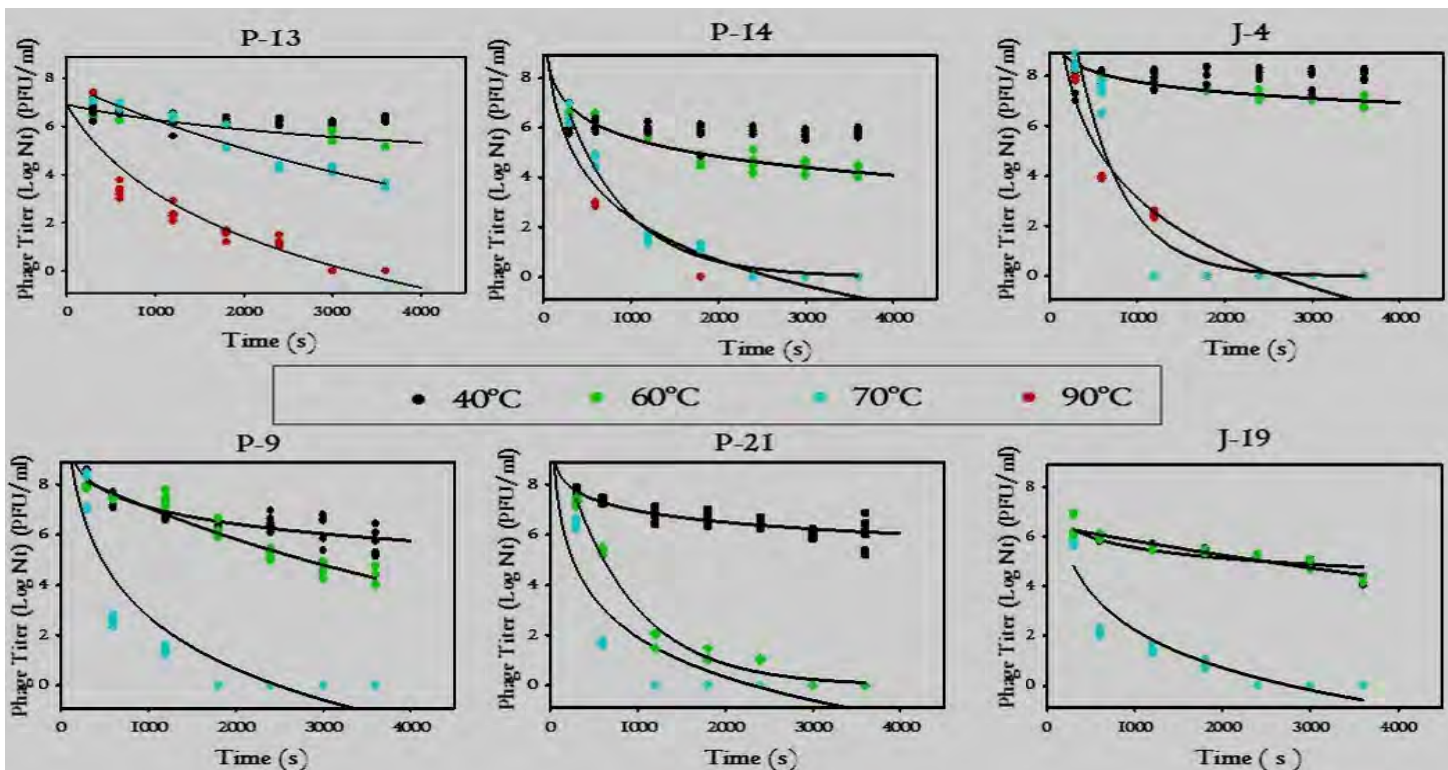
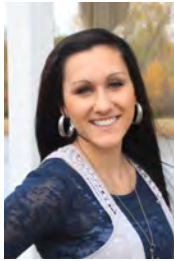


Figure 2. Thermal stability curves to evaluate D value of phages (time needed for 90% reduction of initial activity at a given temperature)

Direct Measurement of Enteric Methane Emissions From Cattle

Written by Emily Andreini, Jason White & Dr. Sara Place



Methane emissions from cattle and other ruminants have come under particular interest because methane is a greenhouse gas that is 28 times more potent at trapping heat in the Earth's atmosphere than carbon dioxide¹. Enteric (from the gastrointestinal tract) methane emissions also represent a loss of the gross energy value of feed.

Specialized research equipment is required to quantify enteric methane emissions from cattle and conduct research studies on methane mitigation strategies. To that end, a new ventilated head box system was designed and constructed at the OSU Department of Animal Science to measure enteric methane emissions directly from beef and dairy cattle (Figure 1).

Once the new system was constructed, a research trial was conducted to validate the system and compare methane emissions from Holstein heifers

when fed ad libitum or a restricted feed intake diet. Six Holstein heifers (n=6), initial live weight between 364 and 430 kg, were used to measure enteric methane emissions from two ad libitum intake periods (ADAPT and ADLIB) and one period (RESTRICT) with intake restricted to 2% of body weight on a dry matter basis. The same total mixed ration was fed all three periods. Heifers were housed individually in outdoor pens at the OSU Nutritional and Physiology Center to facilitate recording of individual dry matter intake. Periods were 21 days long with the last three days of each period used for a gas collection phase where the heifers were housed in the head box system. In the head box system, ambient air was circulated around the animal's head and expired air was collected. Emissions were determined by calculating the difference in gas concentrations between ambient and expired air. Intake was restricted four days prior to the gas collection phase in RESTRICT to account for the impacts of gut fill.

During ADAPT and ADLIB, dry matter intake of the heifers was 11.5 and 10.9% lower ($P < 0.0001$) during the three day gas collection phase as compared to when the heifers were housed in the individual pens. During RESTRICT, the heifers' dry matter intake in the individual pens did not differ ($P > 0.05$) from dry matter intake during the three day gas collection. Methane emissions were lower ($P < 0.05$) during RESTRICT as compared to ADAPT and ADLIB (Figure 2).

While methane emissions from enteric fermentation of beef and dairy cattle in the United States only represent 2.4% of the U.S.'s total greenhouse gas emissions according to the Environmental Protection Agency², the cattle industries will likely continue to come under scrutiny for their contribution to global climate change. The ability to measure enteric methane emissions directly will allow the Department of Animal Science to address misinformation, fill knowledge gaps, and enhance the efficiency and sustainability of cattle production.





Figure 1. Panel A shows the unoccupied ventilated head boxes positioned side-by-side at the OSU Nutrition and Physiology Center. Panel B shows a Holstein heifer consuming feed during a gas emissions collection period.

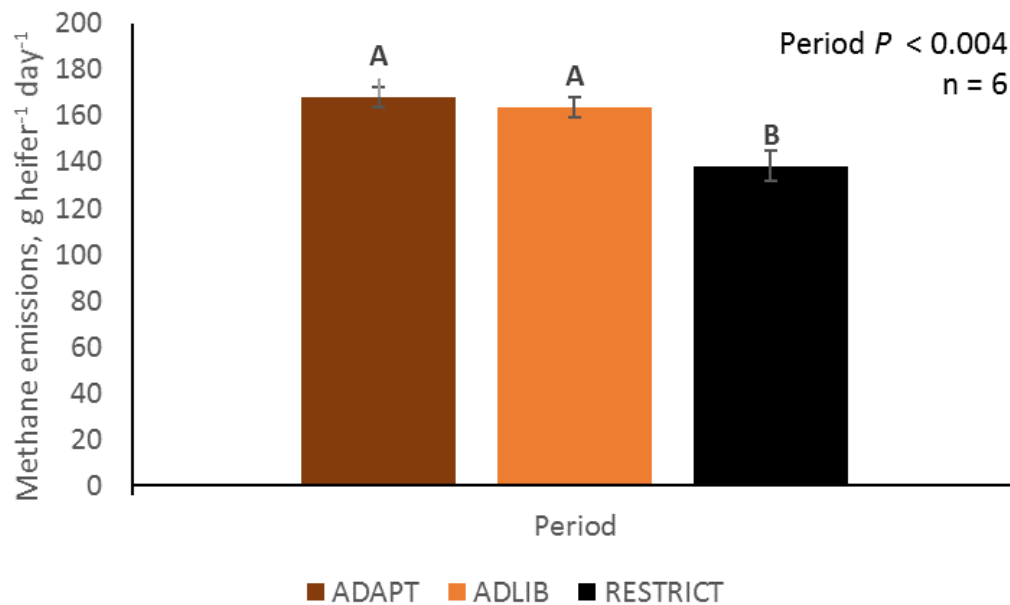


Figure 2. Mean enteric methane emissions in grams of methane/Holstein heifer per day measured over a three day gas emissions collection. Heifers were fed the same total mixed ration in all three periods, with heifers allowed ad libitum consumption in the ADAPT and ADLIB periods, and restricted to 2% of body weight in the RESTRICT period. Periods were 21 days long, with the gas collection occurring the last three days of each period. Error bars are equal to the standard error of the mean.

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²EPA. 2015. U.S. Greenhouse Gas Inventory Report: 1990-2014. Available from: <http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>

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New Developments at the Dairy Center Increase Research Opportunities

Written by the OSU Foundation

Growing up on a 70 cow commercial dairy farm in Upstate New York, dairy cattle and agriculture have always been a part of Dr. Sara Place's life even before she could walk and talk. She has had a strong interest in the intersection of animal agriculture and environmental issues. These interests led her to pursue her Ph.D. at the University of California, Davis. Dr. Place joined the faculty at OSU in 2013 where she has a research and teaching appointment.

"My research focuses on improving the sustainability of cattle production systems, with a particular emphasis on measuring and mitigating enteric methane emissions," said Dr. Place. "Sustainability is about meeting the needs of the present without sacrificing the ability of future generations to meet their own needs. Sustainability encompasses environment, economic and social concerns. My definition of dairy sustainability is producing safe, affordable and nutritious dairy products while maintaining the long-term business viability of dairy producers, stewardship of natural resources and responsibilities to community, family and animals."

Dr. Place's background and research in dairy production has been influential in the design of the new freestall barn that will soon be under construction at the Ferguson Family Dairy Center. "The new

freestall barn will be incredibly helpful for our research program in the department," said Dr. Place. "A truly unique part of the new barn will be an Insentec feeding system that will allow us to measure daily feed and water intake in a pen of up to 30 cows at once."

The system allows for not just total feed and water intake collection, but also the measurement of the frequency of feeding/drinking events and the size of individual meals. Multiple different feed rations can be fed to the animals in a single group, as each individual feeder can be programmed to allow access for only certain cows. The ability to capture such high quality feed and water intake data from a pen where cows can be normally housed (in a group setting, as they would be on a commercial dairy) will greatly enhance the department's research capacity.

"Our ability to conduct dairy cattle nutrition and feeding behavior research with this system will compliment my lab's current sustainability focus, as improving the efficient use of feed and water resources is a critical component of dairy sustainability. Most importantly, the new free stall barn will allow myself and others in the department to conduct research that serves the needs of dairy producers in Oklahoma and the greater Southern Great Plains region."

In addition to the research advantages the new barn will provide, the Ferguson Family Dairy Center will allow for the training of both graduate and undergraduate students. Graduate students will benefit from the greatly enhanced research capabilities of the new barn and the undergraduate student population will benefit two-fold. First, the Center employs students to conduct the day-to-day management activities on the dairy. Having a new, modern facility will greatly enhance the quality of the student's experience and help train the next generation of leaders in the dairy industry. Secondly, the Center is used in several classes in the department, most notably by the "Introduction to Animal Science" course that is routinely taken by 500 students per year both in the Department of Animal Science and across CASNR. The Ferguson Family Dairy Center is very visible to our students and the community at large. Having this modern facility where students can learn how a modern dairy operates and uses science and technology to enhance dairy cow productivity and well-being simultaneously will be invaluable.

To learn more about the Ferguson Family Dairy Center and view naming opportunities for the freestall barn, visit www.OSUgiving.com/dairy.

Future Free Stall Dairy Barn



OSU Ferguson Family Dairy Center

The Oklahoma State University dairy herd consists of approximately 100 registered cows, half Holstein and half Jersey, that average 70 pounds of milk per day with a 3.9% fat test. The OSU Ferguson Family Dairy Center produces around 2,372,500 lbs. of milk every year. The milking facility is a double-six herringbone parlor with automated cow identification, milk yield recording and milking unit detachers. The brick building that previously housed the milking parlor serves as a research and calf raising barn.

There are 92 stanchion or tie stalls that can be used to individually feed research animals or as individual calf raising pens. This building also contains 13 box stalls. Individual stalls also exist for raising calves in the east wing. The

former Bull Barn currently provides stalls for individually feeding or penning cows who may need isolation or attention for health purposes, or which may be used in embryo transfer or cooperative work with the Veterinary College.

The Dairy Center encompasses approximately 300 acres of pasture; an additional 80 acres of tillable land nearby is devoted to raising sorghum for silage. Research currently being conducted at the Dairy Cattle Center includes ruminant nutrition, reproductive physiology, and health and well-being of dairy cattle. Also of notable mention, the OSU Dairy Science Club at OSU was established in 1924 and is the oldest existing Dairy Science Club in the United States.



OSU President Burns Hargis, First Lady Ann Hargis, Kayleen Ferguson and Larry Ferguson



Future Dairy Student Housing

Patent Pending: Sanitation Process

An estimated 60% of all retail beef sales are in the form of ground beef, which is notoriously associated with foodborne pathogen outbreaks. There are existing protocols and control points in meat processing or retail operations, which specify the frequency and proper procedures for grinder sanitization. Current industry protocol is to disassemble and then clean meat grinders at the end of a shift. However, if contamination occurs between two cleaning operations, large amounts of product could be contaminated and subject to recall. An increase in the frequency of disassembling and cleaning the grinder may lead to less product being contaminated, but would also lead to increased operation costs and reduced productivity. Hence, there is a need to develop an intervention step to control contamination while grinding.

Dr. Ravi Jadeja has developed an antimicrobial ice based novel clean-in-place type process for meat grinders, which greatly reduces contamination and the chance of recall. The method is easily applied and does not require disassembly of the meat grinder. The entire process takes only a few minutes and has the potential to significantly increase productivity and reduce operational costs without compromising health and safety standards. A working method has been developed and a patent application has been filed.

Potential Areas of Application

- Meat processing
- Sanitation of moving equipment

Main Advantages

- No temperature increase
- No disassembly of grinder
- Effectively cleans/sanitizes
- Reduces cross-contamination

Research Interests

Patent Pending: Immune Boosting Dietary Compounds

In-feed use of antibiotics is a common practice for growth promotion and disease prevention in the livestock industry. However, it has the potential to drive up the emergence of antibiotic-resistant bacteria in humans. Therefore, FDA recommended withdrawal of medically important antibiotics by December 2016.

Effective alternatives to antibiotics are urgently needed. Dr. Glenn Zhang's lab has identified a large group of dietary compounds with a strong capacity to enhance antimicrobial peptide gene expression and host immunity, with potential for further development as a novel class of antibiotic alternatives for disease control and prevention in both food animals and humans. A provisional patent was filed to the US Patent and Trademark Office by OSU on March 8, 2016 (Application no. 62/305,242).

Competitive Advantages:

- Enhance host immunity without interacting directly with microbes or triggering bacterial resistance
- Anti-inflammatory with no negative impact on animal growth
- Broadly antimicrobial
- Broadly applicable to all animals and even humans

Potential Areas of Application:

- Supplementation in feed or water for growth promotion and/or disease control and prevention
- Supplementation in foods to boost immunity and disease resistance for young, elderly and immunocompromised patients

Scott Carter - Impact of diet on nutrient excretion and gaseous emissions; effect of alternative feedstuffs on growth performance and carcass traits; and effects of feed additives on growth performance and carcass traits.

Udaya DeSilva - Metagenomics of rumen and other microflora and microbial ecology of soil treated with animal manure.

Gerald Horn - Stocker cattle nutrition and management; and effects of grazing systems and application of technologies on subsequent feedlot performance and carcass value.

Divya Jaroni - Development of effective strategies to control foodborne pathogens at pre-harvest and post-harvest levels.

Clint Krehbiel - Tissue and whole-animal energy and protein metabolism in ruminants; regulation of lipid metabolism in ruminants; impact of animal health and immune function on animal growth and carcass merit; nutritional/management strategies of adapting and subsequently feeding beef cattle on high-concentrate diets while minimizing risk of metabolic disorders; and systems research to improve efficiency of nutrient utilization by growing and finishing ruminants.

David Lalman - Cow/calf and stocker cattle applied nutrition and management; cow efficiency and forage utilization; and beef production systems.

Gretchen Mafi - Prediction of meat tenderness and palatability; development of value-added meat products; and use of new technology to predict quality.

Peter Muriana - Use of natural antimicrobials to prevent spoilage and pasteurization of intact shell eggs to eradicate salmonella.

Adel Pezeshki - Animal metabolism and energy balance regulation, especially as applied to the mechanisms regulating energy expenditure.

Sara Place - Sustainability (environmental, economic, and social) of cattle systems; and measurement and mitigation of enteric methane emissions.

Ranjith Ramanathan - Postmortem muscle biochemistry and meat quality; application of metabolomics in meat quality research; role of mitochondria in beef color; and myoglobin and lipid oxidation.

Ryan Reuter - Forage-based beef cattle nutrition and management; effects of supplementation and grazing management on beef cattle production and sustainability; and incorporating technology into grazing systems.

Chris Richards - Feedlot/stocker cattle applied nutrition and management.

Leon Spicer - In vitro and in vivo approaches to study nutritional and hormonal control of ovarian function and follicular development including the study of insulin-like growth factor-I (IGF-I) as an endocrine factor linked to energy balance in early lactating dairy cows; and the study of metabolic factors such as leptin, IGF-I and the IGF system in ovarian follicular function and milk production.

Deborah VanOverbeke - Effect of management practices on meat yield, quality, palatability and sensory attributes; evaluation of post harvest management techniques to improve meat quality; and prediction of tenderness and palatability.

Blake Wilson - Applied beef cattle nutrition and management; health, immune function, and management of high-risk calves during the receiving/backgrounding period; and internal parasite control in sheep.

Glenn Zhang - Modulating synthesis of endogenous host defense peptides (HDPs) for disease control and prevention; structure-activity relationship studies of novel HDPs (bacterial killing and/or immunomodulation); and role of microbiota in animal health and productivity.

Research Grants

Below are active *continuing research grants* in our department that are nationally competitive.

Steven Cooper (PI). Land O'Lakes, Inc. Energex equine trial. 6/1/12 – Completion. \$17,392.

Clint Krehbiel (PI). Merck Animal Health. Effects of altering beef production systems on animal performance, carcass characteristics, production economics, heat stress, and animal behavior. 3/18/13 – Completion. \$112,200.

David Lalman (PI). Alltech, Inc. Effects of Optimase and Rumensin in beef cows. 1/1/13 – Completion. \$68,791.

David Lalman (PI). ADM Alliance Nutrition, Inc. Intake and in-field stability of monensin-containing Mintrate XL 20 pressed tubs fed to stocker cattle grazing summer pastures. 6/15/13 – Completion. \$56,059.

David Lalman (PI). Intervet, Inc. DBA Merck Animal Health. Effects of Ralgro on growth performance of suckling steer calves in Oklahoma when administered at 30-90 days of age. 4/21/14 – Completion. \$31,325.

David Lalman (PI). ADM Alliance Nutrition. 1425 ADM Alliance nutrition Rumensin tub study. 7/15/14 – Completion. \$60,233.

Gant Mourer (PI). Oklahoma Beef Council. Oklahoma Beef Quality Assurance (BQA) expansion initiative. 10/1/14 – 9/30/16. \$37,267.

Ranjith Ramanathan (PI). USDA/AFRI Competitive Grants Program. Application of metabolomics to determine the interrelationship between postmortem metabolite profile and beef color. 01/01/2015 – 12/01/2016. \$146,586.

Ranjith Ramanathan (PI). OCAST. Enhancing the value of dark cutting beef. 8/01/2015 – 07/01/2017. \$90,000.

Ryan Reuter (PI). USDA ARS. Sustaining beef production in the Southern Plains through managing greenhouse gas emissions by grazing cattle. 9/1/2015 – 7/31/20. \$71,685.

Chris Richards (PI). USDA. Beef cattle selection and management for adaptation to drought. 5/1/14 – 4/30/19. \$1,000,000.

Chris Richards (PI). TCFA. Use of systems research to improve beef cattle feed and water use efficiency. 9/1/14 – 8/31/19. \$3,360.

Deborah VanOverbeke (PI). Multisorb Technologies, Inc. Multisorb. 3/1/2015 – Completion. \$389,435.

Deborah VanOverbeke (PI). USDA ARS EI Reno. ARS meat quality. 9/1/2014 – 8/31/19. \$15,000.

Robert Wettemann (PI). SmartStock, LLC. Development of algorithms to determine an increase in ruminal temp in cattle. 6/1/13 – Completion. \$9,882.

Guolong (Glenn) Zhang (PI). OCAST. Development of next generation antibiotic alternatives. 8/1/2015 – 7/31/2018. \$300,000.

Guolong (Glenn) Zhang (PI). NIFA/USDA. National Needs Fellowship Program in application of genomic and computational biology to animal production. 2/1/13 – 1/31/18. \$238,500.

New Research Grants

Dr. Scott Carter (PI). MicroNutrients USA, LLC. Determination of the bioavailability of trace mineral sources for nursery pigs. 5/1/16 – 1/31/17. \$38,341.

Dr. Divya Jaroni (PI). TBDP. Phage-Technology to Control Bio-film-forming Shigatoxigenic *Escherichia coli* in the Food Industry. 4/15/16 – 4/30/17. \$20,000.

Dr. Clint Krehbiel (PI). Iowa State University. Investigating the Impact of Anti-Inflammatory Drug Treatment Prior to Shipping on Homeostasis, Immune Function, and Health of Feedlot Cattle. 7/1/16 – 8/31/17. \$75,436.

Dr. Blake Wilson (PI). Multimin USA. Evaluation of MULTIMIN 90 Injectable Trace Minerals on the Performance, Clinical BRD Incidence, and Mineral Balance in Calves in a Commercial Feedlot. 10/29/15 – 8/31/16. \$49,996.

Drs. Zhang & Mafi Receive Endowed Chair

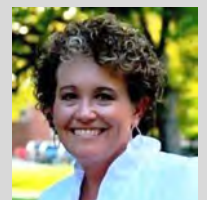
Drs. Glenn Zhang and Gretchen Mafi were bestowed with a Ralph F. and Leila W. Boulware Endowed Chair in Animal Science on July 1, 2016 to recognize their outstanding research at OSU. The Boulware Endowment will provide annual supplemental salary and funds to support the research activities in each of their labs.

Dr. Zhang's current research includes: Dietary approaches to modulate the synthesis of endogenous host defense peptides (HDPs); structure-activity relationship studies of novel HDPs; and role of microbiota in animal health and productivity.

Dr. Mafi's current research includes: Prediction of meat tenderness and palatability; development of value-added meat products; and use of technology to predict quality.



Dr. Glenn Zhang



Dr. Gretchen Mafi

Faculty Publications

Below are 2015 - 2016 research publications for our department. Our faculty members are indicated by *.

Albonico, M., L. F. Schütz, F. Caloni, C. Cortinovis, and *L. J. Spicer. 2016. Toxicological effects of fumonisin B1 alone and in combination with other fusariotoxins on bovine granulosa cells. *Toxicology* 118:47-53.

Beleski, K., R. A. Mancini, C. B. Van Buiten, and *R. Ramanathan. 2015. Effects of reverse electron transport on NADH formation and metmyoglobin reduction. *Meat Sci.* 105:89-92.

Dentis, J. L., N. B. Schreiber, J. N. Gilliam, L. F. Schutz, and *L. J. Spicer. 2016. Changes in brain ribonuclease (BRB) mRNA in granulosa cells (GC) of dominant versus subordinate ovarian follicles of cattle and the regulation of BRB gene expression in bovine GC. *Domest. Anim. Endocr.* 55:32-40.

Denton, J. J., S. Ravishankar, M. Friedman and *D. Jaroni. 2015. Efficacy of Plant-derived Compounds against *Escherichia coli* O157:H7 during Flume-washing and Storage of Organic Leafy Greens. *J. Food Process. Preserv.* doi:10.1111/jfpp.12523.

Elroy, N.N., J. Rogers, *G.G. Mafi, *D.L. VanOverbeke, S.D. Hartson, and *R. Ramanathan. 2015. Species-specific effects on non-enzymatic metmyoglobin reduction in vitro. *Meat Sci.* 105:113-118.

English, A.R., *G. G. Mafi, *D. L. VanOverbeke, and *R. Ramanathan. 2016. Effects of extended aging and modified atmospheric packaging on beef top loin steak color. *J. Anim. Sci.* 94:1727-1737.

Epplin, F. M., C. Haankuku and G. W. Horn. 2015. Technical Note: A method for assigning animals to treatment groups with unequal count per group that equalizes mean animal weight among groups. *J. Anim. Sci.* 93:4575-4579.

Goldstein, B.D., L. D'Abramo, G.F. Hartnell, J. Mench, *S. Place, M. Salman, D. Treacy, B. L. Turner II, G.W. Williams, and F. Wu. 2015. Critical Role of Animal Science Research in Food Security and Sustainability. The National Research Council of the National Academies Press, Washington D.C.

Harvey, B. M., M. Eschbach, E. A. Glynn, S. Kotha, M. Darre, D. J. Adams, *R. Ramanathan, R. A. Mancini, and K. E. Govoni. 2015. Effect of daily lithium chloride administration on bone quality and strength in growing broiler chickens. *Poultry Sci.* 94, 296-301.

*Horn, G. W. 2015. Effect of rate of weight gain of steers during the stocker phase. IV. Rumen fermentation characteristics and expression of genes involved in substrate utilization for fatty acid synthesis in adipose tissues of growing-finishing beef cattle. *J. Anim. Sci.* 93: 3055-3065.

Hou, C., H. Liu, J. Zhang, S. Zhang, F. Yang, X. Zeng, P.A. Thacker, *G. Zhang, and S. Qiao. 2015. Intestinal microbiota succession and immunomodulatory consequences after introduction of *Lactobacillus reuteri* I5007 in neonatal piglets. *PLoS One* 10:e0119505.

*Jadeja, R., *D. Jaroni, P. Vijayakumar, S. Chintagari. 2015. Application of Monoclonal Antibodies to Develop Rapid Immunoassays for *Vibrio vulnificus*: A Mini Review. *AASCIT J. Biology*, 1(4):48-54.

Linneen, S. K., A. L. McGee, J. R. Cole, J. S. Jennings, *D. R. Stein, *G. W. Horn, and D. L. Lalman. 2015. Supplementation of monensin and Optimase to beef cows consuming low-quality forage during late gestation and early lactation. *J. Anim. Sci.* 93:3076-3085.

Linneen, S. K., A. R. Harding, M. T. Smallwood, *G. W. Horn, J. S. Jennings, C. L. Goad, and *D. L. Lalman. 2015. In vivo ruminal degradation characteristics and apparent digestibility of low-quality prairie hay for steers consuming monensin and Optimase. *J. Anim. Sci.* 93:3941-3949.

Litt, P. K., S. Ravishankar, and *D. Jaroni. 2016. Use of fulvic acid formulations as flume-wash treatments for reduction of *Escherichia coli* O157:H7 on organic leafy greens. *J. Food Protection Trends*, 36(4): 284-292.

Liu, Y., X. Wang, H. Wu, S. Chen, H. Zhu, J. Zhang, Y. Hou, C.-A. Hu, and *G. Zhang. 2016. Glycine enhances muscle protein mass associated with maintaining Akt-mTOR-FOXO1 signaling and suppressing TLR4 and NOD2 signaling in piglets challenged with LPS. *American Journal of Physiology - Regulatory, Integrative and Comparative Physiology* 311:R365-R373. Lyu, W., A.R. Curtis, L.T. Sunkara, and *G. Zhang. 2015. Transcriptional regulation of antimicrobial host defense peptides. *Current Protein and Peptide Science* 16:672-679.

Matera, J., *B. K. Wilson, *J. A. Hernandez Gifford, D. L. Step, *C.R. Krehbiel, and *C.A. Gifford. 2015. Cattle with increased severity of bovine respiratory disease complex exhibit decreased capacity to protect against histone cytotoxicity. *J. Anim. Sci.* 93:1841-1849.

Maxwell, C. L., B. C. Bernhard, C. F. O'Neill, *B. K. Wilson, C. G. Hixon, C. L. Haviland, A. N. Grimes, *M. S. Calvo-Lorenzo, *D. L. VanOverbeke, *G. G. Mafi, *C. J. Richards, D. L. Step, B. P. Holland, and *C. R. Krehbiel. 2015. The effects of technology use in feedlot production systems on feedlot performance and carcass characteristics. *J. Anim. Sci.* 93:1340-1349.

Miller, L.P., G.A. Flory, R.W. Peer, E.S. Bendfelt, M.L. Hutchinson, M.A. King, B. Seekins, G.W. Malone, *J.B. Payne, J. Floren, E. Malek, M. Schwarz, and J. Bonhotal. 2015. Mortality composting protocol for avian influenza infected flocks. United States Department of Agriculture. https://www.aphis.usda.gov/animal_health/emergency_management/downloads/hpai/mortalitycompostingprotocol.pdf.

O'Bryan, C. A., P. Crandall, *D. Jaroni, S. C. Ricke, and K. E. Gibson. 2016. Assessment of Nitrogen and Phosphorus Loads Present in Environments Impacted by Alternative Poultry Processing Operations Utilized in Pasture-Raised Poultry Production. *J. Renew. Agr. Food Syst.*:1-10.

*Payne, J., R. Farris, G. Parker, J. Bonhotal and M. Schwarz, 2015. Quantification of sodium pentobarbital residues from equine mortality compost piles. *J. Anim. Sci.* 93:4:1824-1829.

*Payne, J., G. Guzman, and G. Fox. 2015. Surface runoff transport of *Escherichia coli* after poultry litter application on pastureland. *American Society of Agricultural and Biological Engineers*. <http://elibrary.asabe.org/azdez.asp?AID=30083&t=2>.

*Pezeshki A., R. C. Zapata, A. Singh, N. J. Yee, and P. K. Chelikani. 2016. Low protein diets produce divergent effects on energy balance. *Scientific Reports* 28;6:25145.

Pizzo, F., F. Caloni, N. B. Schreiber, L. F. Schutz, M. L. Totty, M. Albonico, and *L. J. Spicer. 2015. Direct effects of the algal toxin, domoic acid, on ovarian function: Bovine granulosa and theca cells as an in vitro model. *Ecotoxicol Environ Saf.* 113:314-320.

Pizzo, F., F. Caloni, L. F. Schutz, M. L. Totty, and *L. J. Spicer. 2015. Individual and combined effects of deoxynivalenol and α -zearalenol on cell proliferation and steroidogenesis of granulosa cells in cattle. *Environ Toxicol Pharmacol.* 40:722-728.

Pizzo, F., F. Caloni, N. B. Schreiber, C. Cortinovis, and *L. J. Spicer. 2015. In vitro effects of deoxynivalenol and zearalenone major metabolites alone and combined, on cell proliferation, steroid production and gene expression in bovine small-follicle granulosa cells. *Toxicol* 109:70-83.

Rada, X., J. Todd-Searle, M. Friedman, J. Patel, *D. Jaroni, and S. Ravishankar. 2016. Combining essential oils and olive extract for control of multi-drug resistant *Salmonella enterica* on organic leafy greens. *SDRP J. Food Sci. Tech.* 1(2).

Roberts, S. L., P. A. Lancaster, *U. DeSilva, *G. W. Horn, and *C. R. Krehbiel. 2015. Coordinated gene expression between skeletal muscle and intramuscular adipose tissue in growing beef cattle. *J. Anim. Sci.* 93:4302-4311.

Robinson, K., Z. Deng, Y. Hou, and *G. Zhang. 2015. Regulation of intestinal barrier function by host defense peptides. *Frontiers in Veterinary Science* 2:57.

Singh A., *A. Pezeshki, R. C. Zapata, N. J. Yee, C. G. Knight, U. I. Tuor, and P. K. Chelikani. 2016. Diets enriched in whey or casein improve energy balance and prevent morbidity and renal damage in salt-loaded and high-fat-fed spontaneously hypertensive stroke-prone rats. *The Journal of Nutritional Biochemistry* 37:47-59.

Sunkara, L.T., A.R. Curtis, and *G. Zhang. 2015. Biology, Expression, and Regulation of Host Defense Peptides: A Mini-review. *Advances in Animal and Veterinary Sciences* 3:9-20.

*Wilson, B. K., B. P. Holland, D. L. Step, M. E. Jacob, *D. L. VanOverbeke, C. J. Richards, T. G. Nagaraja, and *C. R. Krehbiel. 2016. Feeding wet distillers grains plus solubles with and without a direct-fed microbial to determine performance, carcass characteristics, and fecal shedding of *Escherichia coli* O157:H7 in feedlot heifers. *J. Anim. Sci.* 94:297-305.

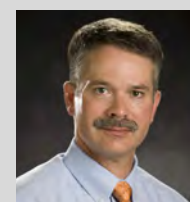
*Wilson, B. K., D. L. Step, C. L. Maxwell, J. J. Wagner, *C. J. Richards, and *C. R. Krehbiel. 2015. Evaluation of multiple ancillary therapies used in combination with an antimicrobial in newly received high-risk calves treated for bovine respiratory disease. *J. Anim. Sci.* 93:3661-3674.

*Wilson, B. K., M. Vazquez-Anon, D. L. Step, K. D. Moyer, C. L. Haviland, C. L. Maxwell, C. F. O'Neill, *C. A. Gifford, *C. R. Krehbiel, and *C. J. Richards. 2016. Effect of copper, manganese, and zinc supplementation on the performance, clinical signs, and mineral status of calves following exposure to bovine viral diarrhoea virus type 1b and subsequent *Mannheimia haemolytica* infection. *J. Anim. Sci.* 94:1123-1140.

Zhang, C., B. Li, *R. Jadeja, and Y. C., Hung. 2016. Effects of Electrolyzed Oxidizing Water on Inactivation of *Bacillus subtilis* and *Bacillus cereus* Spores in Suspension and Carrier Test – *Journal of Food Science.* 81(1):M144-9.

Zhang, L., L. Lu, S. Li, *G. Zhang, L. Ouyang, K. Robinson, Y. Tang, Q. Zhu, D. Li, Y. Hu, and Y. Liu. 2016. 1,25-Dihydroxyvitamin-D3 induces avian β -defensin gene expression in chickens. *PLoS One* 11:e0154546.

Dr. Krehbiel Receives ASAS Award

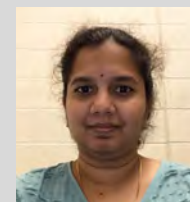


Dr. Clint Krehbiel received the AFIA Ruminant Nutrition Award at the ASAS Awards Ceremony on July 21st, 2016. The award is

given annually to an individual who stimulates research excellence in the nutrition of ruminant animals.

Dr. Krehbiel serves as the assistant department head for the OSU Department of Animal Science. He has served as our research coordinator since 2007 and has been on our research committee since 2000.

Dr. Kakani Named Postdoctoral Fellow



Dr. Radhika Kakani joined Dr. Glenn Zhang's lab as a post-doctoral fellow on July 12, 2016. Dr. Kakani received her Ph.D. degree in poultry science from Texas A&M University.

She is interested in finding alternative dietary strategies to replace traditional antibiotics, and is working on evaluating the efficacy of a group of immune boosting dietary compounds against necrotic enteritis and coccidia in chickens.

Invited Presentations

Below are the 2015 - 2016 **invited research presentations** for our department. Faculty members are indicated by *.

- Gautam, D., and *P. M. Muriana. "Chemical antimicrobial interventions against *E. coli* O157:H7 and *Salmonella enterica* on surface-inoculated raw beef." FAPC Research Symposium/OSU Research Week. Oklahoma State Univ., Stillwater, OK. Feb. 17, 2015.
- *Gifford, C. A., J. L. Chase, *J. Hernandez Gifford, *B. K. Wilson, B. I. Gomez, D. L. Step, M. A. Montelongo, A. W. Confer, *C. R. Krehbiel, and *C. J. Richards. "Type I interferon response in calves experimentally infected with bovine viral diarrhea virus type 1b and *Mannheimia haemolytica*." ASAS 2015 Midwestern Section Meeting and 2015 Proc. Midwestern Sec. Am. Soc. Anim. Sci. p. 148-149. 2015. Des Moines, IA. 2015.
- Haviland, C. L., B. C. Bernhard, C. L. Maxwell, *B. K. Wilson, D. L. Step, *C. R. Krehbiel, and *C. J. Richards. "Comparison of heat stress mitigation techniques and production systems used in feedlot cattle." Plains Nutrition Council Conference, San Antonio, TX. In: Proc. Plains Nutrition Council Symp. p. 113-114. Texas A & M Univ. Res. and Ext. Center, Amarillo, TX. 2015.
- *Jadeja, R., Li, B., Fang, J., and Hung, Y. C. "Effects of Bacterial Concentrations and Centrifugations on Sensitivity of *Bacillus subtilis* Vegetative Cells and *Escherichia coli* O157:H7 to Various Electrolyzed Oxidizing Water treatments." IFT, Chicago, IL. 2015.
- *Lalman, D. L. "Cow/calf and Stocker Implant Update." Fescue Summit Symposium. Southern Section, American Society of Animal Science. Atlanta, GA. Feb. 1, 2015.
- *Payne, J. "Survival and transport of bacteria from land-applied poultry litter." U.S. Poultry and Egg Association. Environmental Management Seminar. Destin, FL. Sept. 22, 2016.
- *Place, S. "Critical Role of Animal Science Research in Food Security and Sustainability." Oklahoma State University Department of Animal Science Seminar Stillwater, OK. Feb. 6, 2015.
- *Place, S., and *M. Rolf. "The role of animal science research in food sustainability." Farm to Fork Legislative Briefing Day. Stillwater, OK. May 11, 2015.
- *Place, S. "Beef sustainability: What is it and what does it mean?" Beef Improvement Federation Conference. Biloxi, MS. June 10, 2015.
- *Place, S. "Livestock Sustainability." Livestock Congress. San Carlos, Costa Rica. Aug. 9, 2015.
- *Place, S. "Beef sustainability: What does that mean?" Arizona Women in Agriculture Conference. Litchfield Park, AZ. July 17, 2015.
- *Place, S. "Ethics of Animal Research." Exchange college students from Mexico. Stillwater, OK. June 16-18, 2015.
- *Ramanathan, R. "The US Meat Industry: Processing, Strategies and Opportunities." Kancor Ingredients. Cochin, India. Jan. 5, 2015.
- *Reuter, R. "Enhancing rangeland ecosystem services using semi-confinement systems." McDonald Eng Foundation Symposium. Oklahoma City, OK. Sept. 17-18, 2015.
- *Reuter, R. "Designing grazing experiments that reliably detect meaningful differences." Southern Section, American Society of Animal Science. Atlanta, GA. Feb. 20, 2015.
- *Richards, C. "Performance Robbers: Anti-nutrients in Feed at Water." Cattle Trails Stocker Conference. Lawton, OK. July 28, 2015.
- *Richards, C. "Sulfur from water and feed: required and toxic." Grady County Marketing Meeting. Chickasha, OK. Aug. 4, 2015.
- *Richards, C. "Managing for Value." Creek County Cattlemen's Association Meeting. Kellyville, OK. Aug. 17, 2015.
- *Richards, C. "All-natural programs vs. Conventional beef production: impact on quantity and cost of beef production." OSU Beef Cattle Conference. Dewey, OK. Jan. 14, 2015.
- *Richards, C. "Intensified cow-calf systems in the Southern Great Plains." 5-State Beef Conference. Kenton, OK. Oct. 8, 2015.
- *Rolf, M. "Genetic Basis for Heat Tolerance in Beef Cattle." 2015 Beef Improvement Federation Meeting. Biloxi, MS. June 9, 2015.
- *Rolf, M. "Water Intake in Beef Cattle." 2015 Beef Improvement Federation Meeting." Biloxi, MS. June 11, 2015.
- *Rolf, M. "Genetic Considerations for Heat Stress in Black- Hided Cattle." 2015 Certified Angus Beef National Cattleman's Beef Association Roundtable. San Antonio, TX. Feb. 5, 2015.
- *Rolf, M. "Genomic-Enhanced EPDs." Oklahoma Brangus Field Day. Stillwater, OK. May 15, 2015.
- *Rolf, M. "Interactive Bull Selection Workshop." Alfalfa County producer meeting. Cherokee, OK. Sept. 24, 2015.
- *Rolf, M. "Project Update and Findings for the Identification and Management of Alleles Impairing Heifer Fertility While Optimizing Genetic Gain Grant." National Beef Cattle Evaluation Consortium's Brown Bagger Webinar. Oct. 14, 2015.

*Rolf, M. "Using genetics to adapt black-hided cattle to the southern US." Angus Bootcamp. Stillwater, OK. Oct. 15, 2015.

*Rolf, M. "Research on cattle adaptability." National Angus Convention. Overland Park, KS. Nov. 4, 2015.

*Spicer, L. J. "The hedgehog-patched signaling pathway and its function in the mammalian ovary." 48th Ann. Meeting of the Society for the Study of Reproduction, San Juan, Puerto Rico. June 20, 2015

*Spicer, L. J. "The role of growth factors in regulating cellular events during ovarian follicular development." 66th Ann. Meeting of the European Association for Animal Production, Warsaw, Poland. Sept. 3, 2015

Tiong, H. K., and *P. M. Muriana. "RT-qPCR identification of genes encoding surface-associated proteins for adherence of *Listeria monocytogenes* to abiotic surfaces." FAPC Research Symposium. Oklahoma State Univ., Stillwater, OK. Feb. 17, 2015.

Wills, K. M., A. R. English, *G. G. Mafi, *D. L. VanOverbeke, *C. Gifford, K. B. Bjugstad, and *R. Ramanathan. "Use of redoxSYS to measure oxidation reduction potential in beef." Recip. Meats Conference. Lincoln, NE. 2015.

*Zhang, G. "The art of writing a scientifically effective paper." College of Animal Science and Nutritional Engineering, Wuhan Polytechnic University, Hubei, China. June 12, 2015.

*Zhang, G. "Development of next-generation antibiotic alternatives." Sigma Xi Chapter Lecturer Award Lecture. Oklahoma State University, Stillwater, OK. Oct. 2, 2015.

*Zhang, G. "Dietary modulation of intestinal epithelial defense in chickens." Symposium on Gut Health in Production of Food Animals, Kansas City, MO. Nov. 9, 2015.

*Zhang, G. "Host defense peptide-inducing compounds as a new generation of antibiotic alternatives." Mini-symposium on Microbiome and Animal Health, Chicago, IL. Dec. 7, 2015.

*Zhang, G. "Dietary regulation of enteric mucosal defense." College of Animal Science and Nutritional Engineering, Wuhan Polytechnic University, Hubei, China. Dec. 14, 2015.

*Zhang, G. "The agricultural use of antibiotics in the U.S." Zhejiang Academy of Agricultural Sciences, Zhejiang, China. Dec. 17, 2015.

*Zhang, G. "Dietary modulation of intestinal defense." College of Animal Science and Technology, China Agricultural University, Beijing, China. Dec. 21, 2015.

Visiting Scholars & Faculty

Dr. Tao (Philip) Feng from the Institute of Animal Husbandry and Veterinary Medicine, Beijing Academy of Agriculture and Forestry Sciences, Beijing, China will be working in Dr. Spicer's lab until March, 2017.

Ms. Hong Li joined the Zhang lab on May 1, 2016 from Henan Agricultural University (HAU), China with financial support from the HAU. She is on a joint Ph.D. program and will be spending a year doing research in the lab from May 2015 to April 2016.

Xiao Ma arrived in the Zhang lab as a joint M.S. student on June 1, 2016. She came from College of Animal Science and Technology, Beijing University of Agriculture, China. She will be spending a year here working on the characterization of host defense peptide-inducing compounds.

Maria Chiara Perego from the Department of Health, Animal Science and Food Safety, University of Milan, Milan, Italy worked in Dr. Spicer's lab from July to September, 2015.

Denise Tsuzukibashi from the Department of Animal Breeding and Nutrition, Sao Paulo State University, Botucatu, Brazil worked in Dr. Spicer's lab from September to December, 2015.

Dr. Jing Wang, Associate Professor from Beijing Academy of Agriculture and Forestry Sciences, joined the Zhang lab in June 2016. Dr. Wang will spend a year here doing research on the development of antibiotic alternatives at OSU.

Xiaonan Yin joined the Zhang lab from the College of Animal Science and Technology, China Agricultural University, Beijing China. She will be working on the impact of antibiotics on the chicken gut microbiota from September 2015 to June 2016.

Long Zhang joined the Zhang lab in September 2014 after receiving a highly competitive Joint Ph.D. Scholarship from China Scholarship Council, Ministry of Education, China. Long came from Sichuan Agricultural University and will spend the next two years in the lab on research projects until September, 2016.

Dr. Huiling Zhu joined the Zhang lab on January 10, 2016 from College of Animal Science and Nutritional Engineering at Wuhan Polytechnic University, Hubei, China. Dr. Zhu is currently an Associate Professor and being supported by the Hubei Provincial Government ZAAS to work on gut health for six months in the Zhang lab from January to July, 2016.

Dr. Jose Zorrilla from the Universidad de Guadalajara, Jalisco, Mexico worked with Dr. Gretchen Mafi on evaluation of live cattle for slaughter as well as the grading of beef carcasses for quality and yield in July, 2016.

Thesis & Dissertations

The following M.S. and Ph.D. students graduated during the fall 2015, spring 2016 or summer 2016 semester.



Blanchefort Allahodjibeye received an M.S. in food science. He was advised by Dr. Ranjith Ramanathan.

Thesis: "Effects of packaging and temperature on metmyoglobin reducing activity of cooked ground beef patties."

Kristi Allwardt received an M.S. in animal science with a focus in genetics. She was advised by Dr. Megan Rolf.

Thesis: "Validation of a system for monitoring water intake and restricting water intake in group-housed steers."



Corbit Bayliff received his M.S. in animal science with a focus in nutrition. He was advised by Dr. David Lalman.

Thesis: "Energy requirements and production efficiency of lactating beef cows in a drylot system."

Justin Brooks received his M.S. in food science. He was advised by Dr. Divya Jaroni.

Thesis: "Evaluating the reusability of organic wash treatments in reducing *Escherichia coli* O157:H7 on organic leafy greens."



Belinda Gomez received a Ph.D. in animal science with a focus in reproductive physiology. She was advised by Dr. Hernandez-Gifford. Belinda is now a postdoctoral fellow at the United States Army Institute of Surgical Research studying burn trauma in combat casualties.

Thesis: "FSH and IGF-I signal VIA AKT to regulate beta-catenin accumulation and estradiol production in granulosa cells."

Morgan Neilson received her M.S. in animal science with a focus on meat science. She was advised by Dr. Gretchen Mafi. Morgan plans to continue her education at Oklahoma State University, working towards her Ph.D. in Animal Science.

Thesis: "Consumer preference of ground beef with varying percentages of finely textured beef."



Kassandra Pfeiffer received her M.S. in animal science with a focus in meat science. She was advised by Dr. Gretchen Mafi. Kass started her position as the director of operations at the Oklahoma Youth Expo in December of 2015.

Thesis: "Tenderness and sensory attributes of pasture versus grain fed beef aged 14 and 28 days."

Catherine Haviland received her M.S. in animal science with a focus in nutrition. She was advised by Dr. Chris Richards. Catherine is now pursuing her Ph.D. at OSU.

Thesis: "Rumen temperature as a predictor of water intake and indicator of thermal stress."



Katherine Satree received her M.S. in food science with a focus in meat science. She was advised by Dr. Deb VanOverbeke.

Thesis: "Effects of oxygen scavenger technology on visual appeal, microbiological counts, and lipid oxidation on ground beef and sirloin steaks."



Luis Schutz received his Ph.D. in animal science with a focus in physiology. He was advised by Dr. Leon Spicer. After graduation, Luis plans to seek postdoctoral positions.

Thesis: "Expression and role of fibroblast growth factor 9 (FGF9) in bovine folliculogenesis."



Alexandra Taylor received her M.S. in animal science with a focus in livestock well-being. She was advised by Dr. Sara Place.

Thesis: "The effects of extended water restriction on the hematological cell distribution of beef cattle in confinement."



Kyle Thompson received his Ph.D. in animal science with a focus in nutrition. He was advised by Dr. Clint Krehbiel. He took an assistant professor position in animal science with an emphasis in dairy at California State University Fresno.

Thesis: "Applied nutritional studies with zoological reptiles."



Hung King Tiong received his Ph.D. in food science. He was advised by Dr. Peter Muriana.

Thesis: "Identification of putative surface adhesins by relative comparison of surface-adherent phenotypes of *L. monocytogenes* using LC-MS/MS and RT-qPCR."



Lingna Zhang received her M.S. in animal science with a focus in physiology. She was advised by Dr. Leon spcier.

Thesis: "Regulation of tight junction proteins in ovarian theca cells of cattle."



Brody Wallis received his M.S. in animal science with a focus in nutrition. He was advised by Dr. Gerald Horn.

Thesis: "Stocker cattle performance and nitrogen use efficiency in Old World bluestem grazing programs."

Graduate Student Presentations & Scholarships

Manish Aryal received 3rd place at the FAPC Research Symposium in Poster Presentation, titled "Analysis of Biofilm on Boots from Workers on a Meat Slaughter Floor and Validation of the Effectiveness of an Automated Boot Washer" on February 16, 2016.

Corbit Bayliff won 1st place at the Graduate Student Competition (MS) for his oral paper presentation, titled "Energy Requirements of Lactating Beef Cows in a Drylot System," at the Southern Section American Society of Animal Science. He also received 1st place at the Department of Animal Science 2016 Dr. Joe V. Whiteman Award for Excellence in Oral Presentation of Scientific Information by Graduate Students.

Justin Brooks received 2nd place at the Department of Animal Science 2016 Dr. Joe V. Whiteman Award for Excellence in Oral Presentation of Scientific Information by Graduate Students. He also received 1st place at the FAPC Research Symposium in Oral Presentation, titled "Evaluating the Re-Usability of Organic Sanitizers in Reducing *Escherichia coli* O157:H7 on organic leafy greens" on February 16, 2016.

Blanchefort A. Djimsa won the 3rd place at the Department of Animal Science 2016 Dr. Joe V. Whiteman Award for Excellence in Oral Presentation, titled "Effects of packaging and temperature on metmyoglobin reducing activity of cooked ground beef patties" on February 17, 2016.

Andrea English was awarded 1st place at the Department of Animal Science Dr. Joe V. Whiteman Award for Excellence in Oral Presentation, titled "Effects of extended aging and modified atmospheric packaging on beef longissimus color" on February 19, 2015. She was awarded 1st place at the FAPC Research Symposium in Oral Presentation, titled "CO-MAP packaging to extend shelf-life of aged beef longissimus muscle" on February 17, 2015, and she won the Student Hardship Scholarship to attend the Institute of Food Technologists annual meeting at Chicago, July 2015.

Pushpinder Kaur Litt was awarded the Graduate and Professional Student Government Association Travel Award in December, 2015. Her Distinguished Graduate Fellowship was also renewed for the 2016-17 academic year.

Wentao Lyu and **Long Zhang** had successful poster presentations on "Identification of natural host defense peptide-inducing compounds using a cell-based high throughput screening assay" and "1,25-Dihydroxyvitamin D3 synergizes with butyrate in inducing host defense peptide gene expression in chickens," respectively, at the 2016 Annual meeting of the Poultry Science Association in New Orleans, LA between July 11-14, 2016.

Rachel Mitacek won the Feeding Tomorrow Student Scholarship to attend the Institute of Food Technologists annual meeting at Chicago, July 2016.

Miles Redden won 2nd place at the Graduate Student Competition (Ph.D.) for his oral paper presentation, titled "Effects of an intensified, semi-confinement cow/calf production system on feedlot performance of growing and finishing steers," at the Southern Section American Society of Animal Science.

Kelsy Robinson won a Graduate Student Research Paper Certificate of Excellence for her oral presentation, entitled "Regulation of host defense peptide expression and barrier function by butyrate and forskolin in broiler chicks," at the 2016 Annual meeting of the Poultry Science Association in New Orleans, LA between July 11-14, 2016.

Joyjit Saha received 2nd place at the FAPC Research Symposium for his Poster Presentation, titled "Predictive model for thermal stability of bacteriophages for futuristic food applications" on February 16, 2016.

Kendra M. Wills won the 1st place at the FAPC Research Symposium in Poster Presentation, titled "Effects of pomegranate rind extract on ground beef color." Food & Agricultural Products Center Research Symposium, February 17, 2016.

Undergraduate Research

UG Research Scholars Program

The Animal Science Undergraduate Research Scholars Program is designed to foster interest in science-based careers and graduate school. Animal Science Research Scholars participate in independent departmental research and are provided the unique opportunity to work alongside faculty experts in each discipline. Students gain hands-on research experience and often work with graduate students conducting research at a lab or farm unit.

The multi-year program is centered on the long-term development and engagement of undergraduates in research; it is set apart from other similar research programs on campus as students are given the opportunity to participate in research for up to four years as long as program requirements are met. Including undergraduates in research enables long-term development and engagement of the scientific methods, critical thinking and communication of scientific knowledge through poster and oral presentations.

The faculty's impressive involvement and support in this program is what makes it so successful. Many faculty members mentor multiple Research Scholars. Undergraduate research scholars are encouraged to present their research at a variety of local and national scientific venues. Working closely with faculty members and graduate students, undergraduate researchers choose a project to work on through the duration of the program.

Our department's research disciplines consist mainly of animal health, breeding and genetics, food safety, meat science, non-ruminant nutrition, physiology, ruminant nutrition and sustainability.



University Research Awards

Over the 2015-16 academic year, ten Animal Science students received semester Wentz Research Scholarships, totaling \$7,500 in awards.

2016 Wentz Recipients:

Libby Farney worked with Dr. Peter Muriana on her project entitled, "Effects of bacteriocins on shelf life of ground beef."

Shelby Spring worked with Dr. Ranjith Ramanathan on her project entitled, "Effects of lipid oxidation products on metmyoglobin reductase activity."

Olivia Taylor worked with Dr. Ravi Jadeja on her project entitled, "Novel antimicrobial ice-based cleaning-in-place meat grinder sanitization process development."

Spenser Becker worked with Dr. Scott Carter on her project entitled, "Effects of high and low concentrations of caffeine in fresh porcine semen on motility and longevity at various ages."

Savannah Byford worked with Dr. Sara Place on her project entitled, "Sustainable animal agriculture tradeoff opinion survey."

Molly Drakeley worked with Dr. Ryan Reuter on her project entitled, "Selection preferences of grazing livestock species."

Catherine Horsley worked with Dr. Craig Gifford on her project entitled, "Regulation of RTP4 protein in ovarian granulosa cells."

Yiling Ke worked with Dr. Ranjith Ramanathan on her project entitled "Understanding mechanism of antioxidant activity of probiotics in liposome and myoglobin solution."



Lindsay King worked with Dr. Jerry Fitch on her project entitled, "Perceptions of animal agricultural technologies related to college freshmen demographics."

Mary Temple-Lee worked with Dr. Ali Beker on her project entitled, "Factors associated with unhatched chicken eggs after incubation: fertility, temperature and humidity."

2016-2017 Full Wentz Recipients:

For the 2016-17 academic year, five Animal Science students received full Wentz Research Scholarships, totaling \$22,500 in awards.

Sage Becker, a former Freshman Research Scholar, received her first Wentz Research Scholarship for her proposal "Dietary modulation of host defense peptide synthesis." Sage will be working with Dr. Glenn Zhang.

Amber Hemple, an Undergraduate Research Scholar, received her first Wentz Research Scholarship for her proposal "FGFR 1 and 4 mRNA gene expression." Amber will be working with Dr. Leon Spicer.

Molly Meyer, an Undergraduate Research Scholar, received her first Wentz Research Scholarship for her proposal "Comparing white blood cell counts in cattle to predict bovine respiratory disease." Molly will be working with Dr. Blake Wilson.

Jacqueline Nichols, an Undergraduate Research Scholar, received her first Wentz Research Scholarship for her proposal "VEGF expression related to increased occurrences of ovarian cancer." Jackie will be working with Dr. Leon Spicer.

Sydney Stewart received her second Wentz Research Scholarship for her proposal "Regulation of tight junction proteins for a healthier gut." Sydney will be working with Dr. Glenn Zhang.



2015-2016 Freshman Research Scholars:

Three Animal Science students were selected as University Freshman Research Scholars in the 2015-16 academic year, totaling \$3,000 in awards. These students spent the year finding a faculty mentor and developing a unique research project. The students then presented their research at the annual Undergraduate Research Symposium in April.

Sage Becker worked with Dr. Glenn Zhang on her project entitled, "Induction of avian β -defensin 9 by quercetin."

Brittany Lippy worked with Dr. Megan Rolf on her project entitled, "Molecular evolution of arginine vasopressin in desert adapted and temperate adapted animals."

Alex Ralston worked with Dr. Megan Rolf on her project entitled, "Effects of water availability on behavioral indicators of welfare in beef cattle."

UG Research Scholars Accomplishments

Shiann Burns received an Honorable Mention Wentz Research Scholars Presentation for her project entitled, "Developing a genomic tool for searching pest resistance genes in sorghum." Shiann graduated this summer, and is continuing her research in the Department of Animal and Range Sciences at New Mexico State University.

Yiling Ke, a Wentz Research Scholar under Dr. Ranjith Ramanathan, attended Cornell University's ten-week Food Science Summer Scholar Program. Through this program, undergraduate scholars conduct research with a Cornell faculty member and learn about food ethics, post-graduation opportunities, and how to develop their research.



Jacqueline Ervin, a Wentz Research Scholar under Dr. Leon Spicer, will be attending Colorado State University this fall. Jackie graduated in May, and has been accepted into CSU's one-year Master of Science in Biomedical Sciences with a Specialization in Assisted Reproductive Technologies.

Lindsay King, a Niblack Research Scholar under Dr. Raluca Mateescu, and a Wentz Leadership recipient and Wentz Research Scholar under Dr. Jerry Fitch, graduated summa cum laude this spring. Lindsay will be continuing her research as a Masters student at Oklahoma State University under Dr. Fitch.

Carson Cooper, a Freshman Research Scholar and Wentz Research Scholar under Dr. Scott Carter, will be continuing her research as a Masters student at Oklahoma State University. Carson will be focusing on swine nutrition, and will be studying under Dr. Carter.

Julia Matera, a Freshman Research Scholar, two-time Niblack Research Scholar, Library Research Award recipient and Wentz Leadership recipient under Dr. Craig Gifford, graduated summa cum laude this spring. Julia will be attending medical school at the University of Missouri this fall.

Students Present Research at Joint Annual Meeting

Five members of the Gifford Lab presented research at the Joint Annual Meeting of the American Society of Animal Science and the American Dairy Society Association, and competed in the Western Section meeting, which was held concurrently.

Alexis Gullic, Niblack Research Scholar under Dr. Jennifer Hernandez Gifford, presented her research "Follicle-simulating hormone regulation of proenkephalin in granulosa cells."

Caleb Smith, Wentz Research Scholar under Dr. Jennifer Hernandez Gifford, presented his research "FSH dependent and IGF-1 independent phosphorylation of β -catenin is similar in bovine and human granulosa cells."

Catherine Horsley, semester Wentz Research Scholar under Dr. Craig Gifford, presented her research "Receptor (chemosensory) transporter protein-4 expression and regulation in bovine granulosa cells."

Kassidy Wilson, Undergraduate Research Scholar under Dr. Jennifer Hernandez Gifford, presented her research "Protein expression and localization of receptor (chemosensory) transporter protein-4 in the endometrium during early pregnancy in sheep and cattle."

Bahaa Aloqaily, Ph.D. student under Dr. Jennifer Hernandez Gifford, presented his research "Protein kinase A directly phosphorylates GSK3 β , and regulates in early gestation from dairy heifers undergoing embryo transfer."

Yiling Ke Chosen for Cornell University Food Science Summer Scholar Program

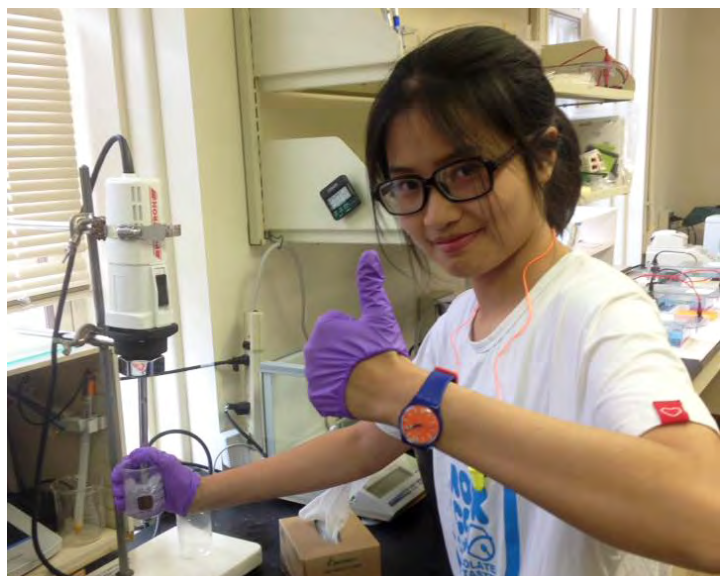
Undergraduate Research Scholar Yiling Ke was chosen to participate in the 2016 Cornell University Food Science Summer Scholar Program.

During her time in the program, Yiling was mentored by Cornell faculty member Dr. Elad Tako. In addition to her responsibilities in the lab, she was provided with opportunities to explore careers in food science, attend discussion luncheons and career forums. She also attended some day trips to visit area food industries, as well as the Institute of Food Technologist annual meeting in Chicago, IL July 15-19.

"During the industry visit, I saw the assembly lines, different offices and food product development and quality assurance laboratories," said Yiling. "I also listened to people's stories of how they entered into professions in food industry. Even though I am still not sure what I want to do after graduation from college, these plant visits served as a good introduction to the food industry for me."

In addition, the program provided multiple opportunities to network with various people in the food industry, faculty and fellow students.

"The program invited staff from career services in Cornell to teach us how to build up our resume and network with people in the profession," said Yiling. "Small tips such as good eye contact, firm hand shake and finding common background to start a conversation does help people become more confident in networking. To me, the most valuable thing I have got from the research program is tremendous growth in thinking and personality; growing to be more open minded, more confident, out of my shell and stepping out of my comfort zone."



Yiling Ke at the Cornell University Food Science Summer Scholar Program

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