

# LBRU Update



**USDA-ARS-MWA  
Livestock  
Behavior  
Research Unit**

**August 5, 2008**

## **Special points of interest:**

- *Research News*
- *Recent Publications*
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## **Prenatal stress in sows**

Prenatal stress, the stress imposed on a pregnant dam that may influence her subsequent offspring, has been shown to have profound effects on behavior and physiology of many species, including monkeys, rats, guinea pigs, goats, humans and swine. Research in our laboratory has shown that prenatal stress, from restraint and stress hormone injection of the sow, caused offspring to have altered neurohormones and adrenal gland morphology, greater plasma cortisol in response to stress and less ability to heal a wound. Prenatal stress has been shown to impair the immune function, increased the maximum binding capacity of glucocorticoids receptors in the central nervous system immediately after birth, and caused an increase in fetal cortisol which may be the mechanism by which prenatal stress causes its effects. The phenomena of prenatal stress demands our complete understanding in order to optimize both welfare and productivity in farm animals due to the fact that prenatal stress can affect both the physiology and behavior of animals, in addition to the observation that it affects a wide array of species. To further explore the phenomena of prenatal stress and its effects in swine, we subjected gestating sows to injections of a stress hormone or we subjected sows to rough handling during gestation. (continued p2)

## **Beak trimming in laying hens**

Beak trimming (also termed debeaking, beak mutilation or partial beak amputation) is a routine husbandry procedure practiced in the commercial poultry industry, particularly in broiler breeders and laying hens. The purpose of beak trimming is to reduce or inhibit feather pecking and aggressive pecking. Damage caused by pecking often leads to cannibalism in untrimmed flocks in all types of housing facilities. Until recently, conventional hot-blade beak trimming (HB) has been the preferred method used in the United States and in numerous other countries. It typically involves the removal of part of the upper and lower mandibles using a heated blade to cut and cauterize the beak tissue of chicks between 1 and 10 d of age. Worldwide, HB trimming solicits a great deal of debate pertaining to the relative impact of the practice on bird well-being. (continued p3).....



**Infrared Beak Trimmer**

## Prenatal stress in sows

Our data indicate that stress during gestation alters the physiology of a sow's subsequent offspring. Some housing environments are known to be stressful and in group housed sows, individuals that reside on the bottom of the hierarchy also could be producing litters of prenatally stressed piglets. This project has shown that prenatal stress in swine is likely caused not by cortisol alone but by other factors as well. This finding agrees with that in other species. Our data indicate that swine, exposed to pre-natal stress, can have alterations in sexual morphology and hypothalamic-pituitary-adrenal func-

tion; but with little effect on growth or immune function. These findings will aid scientists in un-

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*“Prenatal stress can affect both the physiology and behavior of animals.”*

derstanding the implications of prenatal stress and it identifies possible mechanisms of action.

## Enterobacteriaceae levels in finishing pigs subjected to a ractopamine feeding program

Food safety concerns regarding potential effects of feed additives are currently at the center of the public/consumer attention. Ractopamine has been widely used in the swine industry for its effects of improving production performance in finishing pigs. Although extensive research has been conducted on the growth performance and carcass benefits of using ractopamine, scarce information is available on its physiological consequences, and almost no information is available on the effects of this additive on intestinal microbial populations. Therefore, a study was conducted in our laboratory to determine the effect of a “step up” ractopamine feeding program (4.5g/ton for 2 weeks, followed by 9g/ton for 2 weeks) on *Salmonella* frequency and total *Enterobacteriaceae* levels during the last 4 weeks of the finishing production stage, and at slaughter. As expected, pigs fed ractopamine had significantly higher average body and carcass weights at slaughter compared to control pigs, in agreement with previous reports. Unfortunately, no *Salmonella* was found in any of the samples collected during the study. However, it was observed that pigs receiving ractopamine in the diet had a peak of *Enterobacteriaceae* shedding levels at the first week of feeding, and progressively decreased up to slaughter. Although *Enterobacteriaceae* shedding levels were only numerically higher for ractopamine pigs for all weekly fecal samplings, at slaughter, cecal and rectal levels of *Enterobacteriaceae* were significantly lower compared to control pigs. There was a significant main effect of day of sampling on *Enterobacteriaceae* shedding levels. Additionally, a significant

effect of gender was found, with gilts shedding higher levels of *Enterobacteriaceae* compared to barrows. Previous research conducted in our laboratory (coordinated by Dr. Marchant-Forde) showed that there are consequences to the use of ractopamine as a feed additive on the behavior and physiology of pigs subjected to handling and transportation. Some of the physiological alterations observed include elevated concentrations of epinephrine and norepinephrine, which have been linked to increased *in vitro* growth and virulence of *Escherichia coli* and *Salmonella enterica*. Our hypothesis is that animals fed a diet containing ractopamine, and consequently, with higher concentrations of catecholamines, would carry higher levels of bacteria in their intestinal tract, particularly *Salmonella*. Unfortunately, we were not able to detect *Salmonella* in any of the fecal and slaughter samples collected during this study, which was conducted under natural conditions (i.e., animals were not inoculated with the bacteria). Therefore, our hypothesis remains to be tested. Also, our finding of lower levels of bacteria being carried at slaughter and its potential food safety implications warrant further research.



## Beak trimming in laying hens (continued)

While the bestowed benefits of reduced damage from aggression, feather pecking, and cannibalism may indeed favor improved welfare in trimmed birds, there is a considerable body of morphological, neurophysiological, and behavioral evidence demonstrating the emergence of markers of acute and chronic pain, especially in adult birds. An obvious solution to HB is to introduce an alternative method that reduces acute, and prevents chronic, pain by limiting the tissue damage and inflammation associated with trimming before breeders are able to

*“There was no difference in egg production or bird body weight between the two treatments.”*

make selected non-peck bird strains commercially available.

Infrared lasers have been widely used for noninvasive surgical applications in human medicine and their results are reliable, predictable and reproducible. Infrared lasers have recently been designed with the expressed purpose of providing a less painful, more precise beak trimming method compared with conventional beak trimming. This study was designed to examine the potential of the infrared

(IR) beak treatment to provide a welfare friendly alternative to the conventional HB method in chickens. The birds were beak trimmed by IR at the hatchery or HB at 7 to 10 days of age in a commercial production setting, in accordance with standard procedure. The beak morphology and associated physiological characteristics including production and aggressive behavior of the birds were analyzed at 30 wks of age. There was no difference in egg production or bird body weight between the two beak trim treatments ( $P>0.05$ ). Birds also exhibited no difference in stress physiology measured in the study, such as fluctuating asymmetry ( $P>0.05$ ) and heterophil and lymphocyte profiles ( $P>0.05$ ). However, IR birds showed superior feather condition ( $P<0.05$ ) and reduced aggressiveness under high light intensity ( $P<0.05$ ), even though IR birds had longer beak stumps ( $P<0.05$ ). Similar findings from lab studies have been reported in 2008, in which HB trimming had a more pronounced impact on production and growth than IR treatment. Furthermore, HB trimming seems to inhibit FI and BW to a greater extent than IR treatment. These results may indicate that IR beak treatment may reduce the damage done by aggressive and feather pecking. Indeed, IR trimming may provide a more welfare friendly alternative to conventional beak trimming without compromising productivity.

## Beta-glucan and Vitamin C to improve calves' and piglets' growth

Some management practices used in the modern intensive livestock industry may cause animals to become stressed. However, sufficient methods to reduce or eliminate stress are lacking. Animal well-being can be improved by enhancing enteric health and immunity by reducing the stress response in farm animals through dietary immunomodulators. Research in our laboratory has shown that use of beta-glucan (a yeast cell-wall product) and Vitamin C can improve calves' and piglets' by reducing the impact of their stress response on immunity.

Beta-glucan, a yeast cell-wall product, can cross the epithelium and have local and systemic effects. Beta-glucan and ascorbic acid together were beneficial to enhance growth and the innate immune function of calves and piglets 3 to 4 weeks post-transport. This approach was so original and of po-

tential use to reduce antibiotics in food animal diets

*“Beta-glucan and Vitamin C can improve well-being by reducing the impact of stress response on immunity.”*

that a patent was granted and licensed. The product that is being marketed is presently in use by calf growers in Idaho, and is reported to be beneficial in reducing respiratory incidence. The future impact could be even greater because this product has the potential to be used in many livestock species.

## Aggressiveness and central biogenic amines in dominant and subordinate pigs fed a $\beta$ -adrenoreceptor agonist

Aggression in swine is among the most important farm animal welfare concerns due to its negative effects on the welfare of the individuals involved. The occurrence of aggression is affected by multiple factors including feed supplements such as ractopamine. Ractopamine (RAC), a  $\beta$ -adrenoreceptor agonist, is widely used in swine production for its enhancing effects on growth and carcass yield in finishing pigs. However, its effects on aggression, a topic of great concern for production and well-being due to its deleterious effects, ought to be explored. Thus, our goal was to evaluate the effects of (RAC), taking into account gender and social rank, on aggressiveness and link to concentrations of brain biogenic amines in finishing pigs. A total of 16 barrows and 16 gilts were assigned as either control (CTL) or RAC feeding at 5 ppm for 2 wk, then 10 ppm for another 2 wk (pen=4/gender). Dominant and subordinate pigs in each pen were determined by behavioral observation over 36 h post-mixing. Aggressiveness was measured by latency to first attack (bite) and cumulative frequency of attacks over 300 sec using resident-intruder tests performed on the wk prior to start, wk 2 and 4 of the trial. At the end of wk 4, amygdala (AMY),



frontal cortex (FC), hypothalamus (HYP) and Raphe nuclei (RN) were analyzed for concentrations of norepinephrine (NE), epinephrine (EP), dopamine (DA), serotonin (5-HT) and their metabolites using HPLC. A  $2 \times 2 \times 2$  factorial arrangement of treatment, gender and social rank was analyzed with repeated measures mixed models was computed and pair-wise comparison p-values adjusted by Tukey post-hoc test. Latency to attack was not affected by treatment, gender or social rank ( $p > 0.1$ ). However, results from frequency of attacks over the 300 sec showed that by 60 sec, dominant and subordinate RAC-fed gilts had performed more than 50 % of attacks ( $p < 0.001$ ). Control dominant gilts performed greatest percentage of attacks overall (96.71%) by the end of the test ( $p < 0.01$ ). Gilts had lower NE and DOPAC concentrations in the AMY and FC and when fed RAC, gilts showed lowest 5-HIAA and greatest DA turnover in the AMY ( $p < 0.05$ ). Serotonin concentration was lower in the FC of gilts and in

the RN of dominant gilts ( $p < 0.05$ ). Dominant barrows had higher EP than dominant gilts in HYP ( $p < 0.05$ ). Serotonin deficiency and enhanced DA metabolism in brain areas essential for aggression inhibition may be related to the greater impulsive aggression observed in gilts, especially when fed RAC. Although RAC is a valuable feed additive for enhancing growth performance in swine, its welfare effects must be considered.

## New Arrivals

### LBRU Welcomes...

- **Jean-Loup Rault.** Jean-Loup arrived this semester from Nantes, France. He received his BS in Animal Science from Ecole Superieure d'Agriculture d'Angers as well as his MS in Science in Agriculture, Environment and Food Sciences. Jean-Loup went on to achieve a second MS in Ethology from the University de Paris XIII. He has come to the Livestock Behavior Research Unit to work on his PhD in Animal Behavior and Stress Physiology.
- **Staci Weedman.** Staci started with the Livestock Behavior Research Unit in the Fall of 2007 as a graduate student. She received her BS in Neurobiology and Physiology here at Purdue University. Staci is working to achieve her MS in Immunology and Microbiology with advisors Dr. Susan Eicher, Dr. Marcos Rostagno, and Dr. John Patterson. She is currently working on the Diamond V study with Susan Eicher.
- **Andrea Hargarten.** Andrea joins the Livestock Behavior Research Unit as a Technician with major responsibility for the induced molting studies.
- **Kasey Perkinson.** Kasey rejoins the Unit to help with the pig project supported by Diamond-V that began in September.
- **Matt Horsman.** Matt joins the LBRU as a Technician with major responsibility for the sow aggression studies. An Illinois native, Matt has a BS from the University of Illinois and an MS from Western Kentucky University.



## Departures

- **Keelin O'Driscoll** returned to Ireland to finish her Ph.D. at UC Dublin. While working with the ARS she completed a study of dairy housing (rubber or concrete flooring) on indicators of lameness during the periparturient period when housed on bedded-pack. Keelin found several indicators expressed in leukocyte RNA that were associated with lameness or pain experiences.
- **Lauren Brueggeman**, a former technician with our group, has returned closer to home in Wisconsin to work as a Chemical Operator with Sigma Aldrich. Whilst with the LBRU, Lauren provided general technical help across a wide range of our projects and developed a major role in the analysis of vocalizations using specialized software.
- **Dr. Andrew Janczak** returned to Norway in January after accepting a position at the Norwegian College of Veterinary Sciences. There he will be involved with interdisciplinary research related to behavioral development, emotion and cognition in cattle, sheep, pigs, poultry and fish. Andrew was a scientist for the Heart Rate Variability study and while here, he finished Experiments 1 and 2 of the project enabling him to complete an abstract on the effectiveness of using telemetry devices to monitor responses to atropine and propranolol treatments and environmental stress.
- **Stephanie Brennan** served as the LBRU's program support assistant from May 2003 –August 2007. She served on the area PASTG. Stephanie received ARS Office Professional of the Year in 2004. Upon completion of her MBA through Purdue, she accepted a statistician position with the USDA Alabama Agriculture Statistics Service and transferred to Montgomery, Alabama.
- **Alan Fahey** returned to Ireland and has accepted a Faculty position at the College of Life Science/School of Agriculture, Food Science and Veterinary Medicine, University College Dublin. While working with Dr. Cheng he completed a study of genetic-social environmental effects on chicken well-being toward receiving the degree of Doctor of Philosophy.
- **Dr. Ruth Marchant-Forde** has left to work towards a DVM degree at Purdue University Veterinary School. Whilst with the LBRU, Ruth was largely responsible for the behavioral components of Dr. Cheng's research program on poultry. She also continued her interests in heart rate variability in pigs and was a major author on a number of successful externally-funded grants from USDA-NRI and NPB.

## Grants and Awards

### Grants

- **Jeremy Marchant-Forde, Don Lay, Ruth Marchant-Forde**, Joe Garner and Anna Johnson. Animal Compassion Foundation. \$35,000. "Understanding aggression when sows are mixed in indoor and outdoor housing systems".
- **Jeremy Marchant-Forde, Don Lay, Ruth Marchant-Forde**, Joe Garner and Anna Johnson. National Pork Board. \$75,952. "Understanding and reducing aggression using pre-exposure, when sows are mixed in a grouped gestation system".
- Doug Mann, Candice B. Kissinger, **Jeremy Marchant-Forde**, Lee Matthews and Greg Knipp. National Institute of Health. \$1,235,777. "Movement responsive cage for simultaneous pharmacology studies in minipigs".



### Awards

- **Alan Fahey** (Ph.D. student) G.W. Friars International Graduate Student Fellowship in Quantitative Genetics in Poultry and Fish (2007, Purdue University)
- **Rachel Dennis** (Ph.D. student) has received several awards including Early Graduate Career Award (2007, Purdue University); Student Certificate of Excellence for Presentation, Poultry Science meeting (2007); and the Graduate Student Excellence Award (2008, Purdue University).
- **Rosangela Poletto** (Ph.D. student) has received travel award from ISAE (2008) and The Humane Society of the United States (2008) and a LOUJA award from the Dept. of Animal Sciences, Purdue University (2008) to enable her to attend the forthcoming International Congress of the I.S.A.E., in Dublin, Ireland.

## Visitors

**Dr. (Jim) Wirawat Chaya.** Jim worked with the Livestock Behavior Research unit as a visiting scientist from October through December, 2007. Jim is from Bangkok, Thailand where he is a professor at the King Mongkut's Institute of Technology Ladkrabang teaching animal behavior to veterinary students. While working with us, he studied swine behavior to understand the differences in behavior of swine which either do or do not succumb to *Salmonella* infection.

**Dr. Heng-wei Cheng** as coordinator of the program named Summer Intern for Chinese Students and Taiwanese Students; had hosted nine students in the year 2007 and 20 students have been selected for the program for the year 2008.

## Activities

- **Dr. Lay** is participating as a Coordination Team Member for a "Coordinated Agricultural Project" to develop a systems approach to predicting the impact of changes to production systems, using the laying hen as a model. Project proposed by Michigan State University (J. Swanson), Funded by American Egg Board \$406,000.
- **Dr. Eicher** served a 3rd year as an Associate Editor for the Journal of Animal Science.
- **Dr. Lay** served as a committee member to revise "Chapter 1: Institutional Policies" Chapter of the "Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching."
- **Dr. Eicher** served as a committee member to revise "Chapter 6: Guidelines for Dairy Cattle Husbandry" in the "Guide for the Care and Use of Agricultural Animals in Agricultural Research and Training".

## Out and About

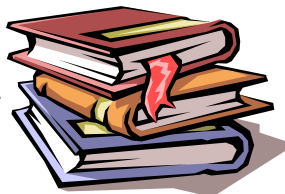
- **Dr. Donald Lay** chaired the W-173 meeting 'Stress Factors in Farm Animals and their Effects on Performance', August 6th to 8th in conjunction with S-1023 'Enhancing production and reproduction performance of heat-stressed dairy cattle' hosted by Dr. Bob Godfrey at the University of the Virgin Islands, St. Croix. 2007
- **Dr. Donald Lay** attended the International Society of Applied Ethology meeting in Merida, Mexico July 30th to August 3rd, and presented "Functional test of the hypothalamic-pituitary-adrenal axis of sows housed in various environments." 2007
- **Dr. Rostagno** attended the Conference of Research Workers in Animal Diseases (CRWAD) on December 2-4, 2007, in Chicago, IL. Dr. Rostagno presented "The effect of ractopamine on *Enterobacteriaceae* levels in finishing pigs".
- **Dr. Eicher** attended International Veterinary Immunology Symposium in Oero Preto, Brazil, August 15 – 19. Presented: "TLR4, IL-1, and iNOS expression in coconut meal-fed broilers after an oral challenge with *Salmonella*". 2007
- **Dr. Eicher** attended Conference for Research Workers in Animal Diseases, Dec. 2-4 in Chicago, 2007
- **Dr. Jeremy Marchant-Forde** attended the 41<sup>st</sup> International Congress of the International Society of Applied Ethology in Merida, Mexico, where he chaired a session, judged the student poster competition, and presented an oral presentation of Rosangela Poletto's work on Ractopamine and swine behavior.
- **Dr. Rostagno** attended the USDA FSIS-ARS Food Safety Meeting on February 20-22, 2008, in Shepherdstown, WV. Dr. Rostagno presented "Split marketing: A risk factor for *Salmonella* in market pigs" and "Effect of ractopamine on *Enterobacteriaceae* levels in finishing pigs".
- **Dr. Eicher** attended International symposium on Animal Genomics for Animal Health in Paris, Oct. 23-25. Presented: "Spleen cell TLR7 and iNOS RNA expression of coconut meal fed broilers following IBDV challenge". 2007

## Out and About

- **Drs. Donald Lay, Jeremy Marchant-Forde, and Heng-wei Cheng** attended joined ASAS-ADSA-PAS meeting in San Antonio, TX July 8th-12th.
- **Dr. Rostagno** participated as a committee member of the annual meeting of the American Association of Swine Veterinarians (AASV) on March 8-11, 2008, in San Diego, CA.
- **Dr. Donald Lay** participated as a committee member of the 'Sow Longevity Discovery Conference' held September 9-13 in Nashville IN. 2007
- **Drs. Jeremy Marchant-Forde, Heng-wei Cheng, and Susan Eicher** attended the annual meeting of the NC-1029 Committee on Applied Animal Behavior and Welfare, hosted by Dr. Joe Garner, Purdue University, IN.
- **Dr. Cheng** attended the Poultry Society meeting and presented "Genetic basis of different effects of chronic intermittent social stress on immune function and survivability in laying hens". 2007
- **Dr. Cheng** attended the International Society of Applied Ethology meeting in Merida, Mexico July 30th to August 3rd, and presented "Serotonin and aggressiveness in Chickens" 2007

## Recent Publications

- Williams, J.L., Minton, J.E., Patterson, J.A., **Marchant-Forde, J.N.** and **Eicher, S.D.** (2008) Lairage during transport has an impact on swine innate immunity and commensal bacteria diversity in intestines. *Journal of Animal Science*, **086**: 1232-1244.
- **Fahey, A.G., Marchant-Forde, R., and Cheng, H.W.** (2007). Correlations between Body Weight and Beak Dimensions in One-Day Old White Leghorn Chicks: Its Implications in Beak Trimming. *Poultry Science*. **86**: 1312-1315.
- Von Borrell, E., Langbein, J., Despres, G., Hansen, S., Leterrier, C., **Marchant-Forde, J.N., Marchant-Forde, R.M.,** Minero, M., Mohr, E., Prunier, A., Valance, D., Veissier, I. (2007) Heart rate variability as a measure of autonomic regulation of cardiac activity for assessing stress and welfare in farm animals – a review. *Physiology & Behavior*, **92**: 293-316.
- **Cheng, H.W.** and Jefferson, L. (2008). Different Behavioral and Physiological Response in two Genetic Lines of Laying Hens Following Transportation. *Poultry Science* **87**: 885-892.
- **Dennis, R.L., Fahey, A.G., and Cheng, H.W.** (2008). Different Effects of Individual Identification Systems on Chicken Well-Being. *Poultry Science* **87**:1052-1057.
- Daniels, K.J., Donkin, S.S., **Eicher, S.D.,** Pajor, E.A., and Schutz, M.M. (2007). Parturition Milking of Heifers Influences Future Production and Health. *Journal of Dairy Science*. **90**: 2293-2301.
- **Schenck, E.L., McMunn, K.A.,** Rosenstein, D.S., Strohshine, R.L., Nielsen, B.D., Richert, B.T., **Marchant-Forde, J.N.** and **Lay Jr., D.C.** (2008). Exercising stall-housed gestating gilts: Effects on lameness, the musculo-skeletal system, production and behavior. *Journal of Animal Science*.
- Bearson, B.L., Bearson, S.M.D., Uthe, J.J., Dowd, S.E., Houghton, J., Lee, I., Toscano, M.J., and **Lay Jr., D.C.** (2008). Iron regulated genes of *Salmonella enterica* serovar Typhimurium in response to norepinephrine and the requirement of fepDGC for norepinephrine-enhanced growth. *Microbes and Infection*. (continued p9).....



## Meetings Attended

- Conference for Research Workers in Animal Diseases, Dec. 2-4 in Chicago.
- International symposium on Animal Genomics for Animal Health in Paris, Oct. 23/25. Presented: "Spleen cell TLR7 and iNOS RNA expression of coconut meal fed broilers following IBDV challenge.
- International Veterinary Immunology Symposium in Oero Preto, Brazil, August 15-19. Presented: "TLR4, IL-1, and iNOS expression in coconut meal fed broilers after an oral challenge with *Salmonella*".

## Recent Publications

- **Dennis, R.L.,** Chen, Z.Q., and **Cheng, H.W.** (2008). Genetic Variations in Chicken Aggressive Behavior: The Role of the Serotonergic System. *Poultry Science*. **87**: 612-620.
- **Cheng, H.W.** and Muir, W.H. (2007). Mechanisms of Aggression and Production in Chickens: Genetic Variations in the Functions of Serotonin, Catecholamine, and Corticosterone. *World's Poultry Science Journal*. **63**: 233-254.
- **Marchant-Forde, J.N., Lay Jr., D.C., Marchant-Forde, R., McMunn, K.A.,** and Richert., B.T. (2008). Effects of r-salbutamol on behavior and physiology of finishing pigs. *Journal of Animal Science*, In Press.
- Gustafson, L.A., **Cheng, H.W.**, Garner, J.P., Pajor, E.A., and Mench, J.A. (2007). The Effects of Different Bill-Trimming Methods on the Welfare of Pekin Ducks. *Poultry Science*. **86**: 1831-1839.
- **Wilcox, C.S.,** Schutz, N.M., Donkin, S.S., **Lay Jr., D.C.,** and **Eicher, S.D.** (2008). Short Communication: Effect of temporary glycosuria on molasses consumption in Holstein calves. *Journal of Dairy Science*. 91:1-4.
- **Lay, Jr. D.C.,** Kattesh, H.G., Cunnick, J.E., Daniels, M.J., **McMunn, K.A.,** Toscano, M.J., and Roberts, M.P. 2008. Effects of prenatal stress on sow productivity and piglet response to weaning. *Journal of Animal Science*. 86:1316-1324.

## Events

### Prepared and planted



During the free time, we prepared the field and planted seeds to test better ways to grow vegetables. After harvest, we had a gourd contest.

### Harvests



Gourd contest



Awarded for best decoration



Awarded for best creation



Awarded for best original

## Abstracts

- Lake, R., **Eicher, S.,** Lemenager, R., Einstein, M., and Pyatt, N. Maternal natural source vitamin E supplementation on suckling calf performance and immune response.
- **Dennis, R.,** Chen, Z., and **Cheng, H.W.** (2007) Genetic Variations in Chicken Aggressive Behavior: the Role of Serotonergic System. *Poultry Science*. (Suppl 1): 133.
- **Weedman, S., Rostagno, M.,** Patterson, J., Kiess, A., and **Eicher, S.** Intestinal microbial affects of yeast products on weaned and transport stressed pigs.
- **Fahey, A., and Cheng, H.W.** (2007). Genetic Basis of different Effects of Chronic Intermittent Social Stress on Immune Function and Survivability in laying hens. *Poultry Science*. (Suppl 1): 362.
- O'Driscoll, K., Schutz, M. and **Eicher, S.** Effect of rubber flooring on leukocyte activation during the peripartuient period. Teagasc, Fermoy, Ireland, NUI Dublin, Ireland, Purdue University USDA-ARS, West Lafayette, IN.
- Rogers, C., Collins, J., **Lay Jr., D., Cheng, H.W.,** Sartin, J., Schwartz, D. (2007). Reduced expression of proteasome 26S in hypothalamus of heat stressed pigs and hypothalamic cells. *Expt. Biology*.



Poultry Science Building,  
Purdue University,  
125 S. Russell Street,  
West Lafayette, IN 47907

Phone: 765-494-4604

Fax: 765-496-1993

Email:

Katelyn.Delaplane@ars.usda.gov



*Finding solutions to  
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*The mission of the LBRU is to develop scientific measures of animal well-being, through the study of animal behavior, stress physiology, immunology, neuro-physiology, and cognition, that will allow an objective evaluation of animal agricultural practices. This method of study will allow the improvement of existing practices and invention of new practices that can enhance animal well-being and increase animal productivity. In addition, this unit will use and develop its knowledge of stress physiology and animal behavior to address concerns of pathogen contamination of livestock carcasses due to the stress of handling and transportation. The optimization of animal well-being will assist in improving animal health, increasing productivity and decreasing human exposure to dangerous pathogens.*

## Abstracts (continued)

- **Poletto, R., Rostagno, M., Richert, B., and Marchant-Forde, J.** (2007) Effect of ractopamine on *Enterobacteriaceae* levels in swine. In: 88<sup>th</sup> Annual Meeting of the Conference of Research Workers in Animal Diseases. *Proceedings Chicago, IL*. p.135
- **Wilcox, C., Schutz, M., Donkin, S., and Eicher, S.** Temporary glycosuria alters molasses consumption in Holstein calves. *Department of Animal Science, Purdue University, USDA-ARS Livestock Behavior Research Unit, West Lafayette, IN.*
- **O'Driscoll, K., Schutz, M., and Eicher, S.** Effect of rubber flooring on cow locomotion and gene expression. Teagasc, Fermoy, Ireland, NUI Dublin, Ireland, Purdue University USDA-ARS, West Lafayette, IN.
- **Hampsch, J., Peters, S., Mann, D., Guinn, R., Matthews, D., Kissinger, C., Marchant-Forde, J., and Poletto, R.** (2007) Prototype device for computerized blood sampling and data collection in freely moving swine. *Journal of the American Association for Laboratory Animal Science*, 46: 141.
- **Bewley, J., Boehlje, M., Gray, A., Hogeveen, H., Eicher, S., and Schutz, M.** Assessing the potential value of automated body condition scoring through stochastic simulation.
- **Schenck, E., McMunn, K., Rosenstein, D., Nielsen, B., Richert, B., Marchant-Forde, J., and Lay Jr., D.** (2007) Exercise increases bone density in the joints and limbs of gestating stall-housed gilts. *Journal of Animal Science*, 85 (Suppl 1): 364.
- **Cheng, H.W. and Dennis, R.** (2007). Serotonin and Aggressiveness in Chickens. *ISAE*, p.128.
- **Schenck, E., McMunn, K., Nielsen, B., Richert, B., Marchant-Forde, J. and Lay Jr., D.** (2007) The effects of exercise on production, interbirth intervals, and lying behaviours in gestating stall-housed gilts. In. (Eds. F. Galindo & L. Alvarez) *Proceedings of the 41<sup>st</sup> International Congress of the International Society for Applied Ethology*. P61.
- **Poletto, R., Richert, B., and Marchant-Forde, J.**(2007) Behavioral effects of "step-up" ractopamine feeding program on finishing pigs. In. (Eds. F. Galindo & L. Alvarez) *Proceedings of the 41<sup>st</sup> International Congress of the International Society for Applied Ethology*. p90.
- **Dennis, R., Fahey, A., and Cheng, H.W.** (2007) Different effects of individual identification systems on chicken well-being. *Poultry Science*. (Suppl 1): 362.
- **Bewley, J., Boehlje, M., Gray, A., Hogeveen, H., Eicher, S., and Schutz, M.** A stochastic simulation model for assessment of investments in Precision Dairy Farming technologies: model enhancements and utility demonstration.
- **Eicher, S., Schutz, M., Townsend, J., Daniels, K., Donkin, S., and Parkhurst, A.** Analysis of locomotion scores with altered periparturient management.
- **Dennis, R., Chen, Z., and Cheng, H.W.** (2007) Genetic Variations in Chicken Aggressive Behavior: the Role of Serotonergic System. *Poultry Science*. (Suppl 1): 133.