



LBRU Update

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Special points of interest:

- Research News
- Grants awarded
- New arrivals
- Presentations
- Visitors
- Publications

PigTurn® prototype undergoes development

The Livestock Behavior Research Unit has been collaborating with Bioanalytical Systems Inc. of West Lafayette, in the development of a unique research tool which enables the simultaneous collection of behavior and bio-fluids—the PigTurn® without human intervention.

As the biomedical industry becomes increasingly interested in the pig as a model for human clinical disease and for pharmaceutical development, there is a need for a system that can help collect refined data, so reducing the data variability and thus the animal and economic cost. In addition to the biomedical field impact, the system also has potential application in the animal well-being field, being used to answer important questions about an animal's internal state in response to certain stressors, such as, social isolation, feed deprivation or reaction to drugs commonly used in the farm animal industry.

The PigTurn® is a 'scale-up' of BASi's successful RatUrn®, in which the animal's pen counter-rotates in reaction to the animal's movement, thereby preventing any catheters from twisting and blocking. The project has attracted funding from the NIH, under the Small Business Innovative Research scheme and matched-funding from the Indiana 21st Century Fund, with BASi's Dr. Douglas Mann as Principal Investigator and James Hampsch as Project Engineer



A Gottingen minipig undergoing behavioral testing in the movement responsive PigTurn® prototype

and the LBRU's Dr. Jeremy Marchant-Forde and Rosangela Poletto as collaborators.

So far, the project has investigated the eight minipigs' behavioral responses to the novel pen system whilst stationary and also when set to counteract the pig's movement. Overall, the results have been encouraging, showing that there were no adverse behavioral responses to the stationary or to the movement-responsive novel pen. Further development is ongoing.

Acknowledgment: NIH Grant 1R43RR022489-01 and Indiana 21st Century Fund

NPB grant to study nursery pig growth

Dr. Marcos Rostagno, has been awarded a competitive grant from the National Pork Board to study growth and intestinal health in nursery pigs, together with colleagues from Purdue University, Drs. Scott Radcliffe, Brian Richert and Alan Sutton. As concerns about antibiotic resistance increase, there are calls for their use in livestock feeds to be limited. The threat of significantly reducing the availability of antibiotics for disease control may have a profound negative economic, performance and well-being im-

impact on pork production. Development of new disease control methods that are practical, consistent, economical and safe will greatly enhance the sustainability of pork production and allow the producer to provide a high quality product for the consumer. The research team will investigate the effects of water acidification and *Lactobacillus acidophilus* on nursery pig growth performance, gut health and integrity, and immune status in relation to Salmonella infection.

Piglet processing study completed

A National Pork Board-funded project looking at routine processing procedures and piglet well-being has been completed and a final report submitted. The multidisciplinary study investigated procedures that are commonly carried out on piglets soon after birth, such as teeth clipping, tail-docking, identification marking, iron administration and castration, and which may be associated with stress and pain.

In all these procedures, there are at least two alternative methods—one of which may be less 'stressful'. Our first experiments compared two alternatives of each of the five procedures in isolation—that is, with the piglet only exposed to a single procedure. From our measures of behavior, stress hormones and vocalization quality, we determined that teeth grinding was more aversive than clipping, hot-iron tail docking was more aversive than cold docking, ear notching was

more aversive than ear tagging and oral dosing with iron paste was more aversive than injecting. We also found that castration involving tearing the spermatic cords was more aversive than castration where the cords are cut by a scalpel.

Having identified the 'most' and least' aversive alternatives, we then looked at the cumulative effect of the procedures on well-being, with the 'most' aversive alternatives put together and the 'least' alternatives put together. When carried out in series, we found that there was little difference between the 'most' and the 'least', perhaps indicating that both sets of piglets were having near maximal stress responses. Our major finding was that in all cases, the 'most' aversive procedure was the one that took the longest to carry out, with the piglet therefore being subjected to longer handling and separation from its littermates and the sow.

We welcome 3 new team members, 4 move on

Welcome!

Rita Lockridge has joined us to be project-specific technician on Dr. Cheng's USDA-NRI molting study. Rita is a Registered Veterinary Technician and holds a B.S. from Purdue University

Lauren Bruggemann joins us from the University of Wisconsin—La Crosse where she just completed a B.S. in Biology. She will be giving technical help across all our ongoing projects.

Jessica Heinke has transferred from temporary to permanent biological technician, giving technical help across all our ongoing projects. She holds a B.S. in Animal Science from Purdue.

Farewell!!

Laura Hasenour has left at the end of her contract to join BASi as Animal Technician down at their Evansville unit.

Dr. Michael Toscano has completed his PhD under Dr. Lay and has moved to become Research Associate in the University of Bristol Behavioural Biology Group.

Sarah Peterson, biological technician has left to move back to Southern Indiana.

Kim Pohle, biological technician, has moved across to Purdue University to manage the herd of Ossabaw minipigs.

Chronic Stress study

Chronic social stress in chickens is a common and serious welfare concern in the laying industry. It impacts production, can result in higher levels of inter-bird aggression and may result in the emergence of abnormal and damaging behaviours, all of which can lower welfare.

Over the last 2 years Heng-wei Cheng, Ruth Marchant Forde and Alan Fahey, with Bill Muir from Purdue University, have been working to understand the behavioural, physiological, immunological, and neurobiological effects of stress in laying hens. They have focused on three genetic strains that are known to differ in their response to stress. These strains include a high producing strain exhibiting low levels of aggression but high productivity in groups, a low producing strain exhibiting higher levels of aggression but low productivity in groups and finally, a commercial strain, Dekalb XL, that are more ag-

gressive than the other two strains but maintain high productivity in groups.

At 17 weeks old, these strains were allocated to groups of either 4 or 10 birds with the 4 bird cages (213 cm²/bird) as controls and the 10 bird cages (175 cm²/bird) as our socially stressed treatment. Blood, brains, feather condition scores and body and organ weights were collected at 30, 45 and 60 weeks of age to evaluate the temporal effects of stress on growth, immunity and stress hormones. Preliminary results illustrate interactive effects of chronic stress with genetics that become more pronounced over time. We are continuing to work on unraveling genetic related differences in stress mechanisms that will greatly contribute to our overall understanding of stress responses and the development of strains that are less affected by stressors such as social stress.



"Is it better to transport piglets a long distance in one go or to break the journey up?"

Out and About

Dr. Lay has attended two meetings of the National Pork Board Animal Welfare Committee in Chicago and Des Moines. He has also attended the USDA-ARS Leadership Conference in St. Louis and carried out a research trip to West Virginia University as part of his ongoing collaboration with Dr. Matt Wilson on a chicken molting project.

Both Dr. Rostagno and Dr. Eicher attended the Conference for Research Workers in Animal Disease (CRWAD) in St Louis, MO in December 2005. Dr. Rostagno presented two papers on Salmonella infection in swine and turkeys, whilst Dr. Eicher presented papers on innate immune function in nursery-age pigs



during transport and on beta-glucan trafficking in the calf GI-tract.

In February 2006, Dr. Cheng traveled to China together with colleagues from Purdue University, where they visited Zhejiang University and Huazhong Agricultural University in order to establish collaborative links in both research and education. Presentations were made to over 600 faculty and students.

In March 2006, Dr. Rostagno was invited to present a paper on the prevalence of Salmonella at slaughter in swine, at the Annual Meeting of the American Association of Swine Veterinarians in Kansas City, MO.

Research results delivered
to global audiences

Visitors

We were very happy to host visitors from the Feed Research Institute, Chinese Academy of Agricultural Sciences, Beijing, China in December 2005. Dr Susan Eicher hosted Dr Qi Guanghai, Professor Gan and Professor Gao during a 2-day

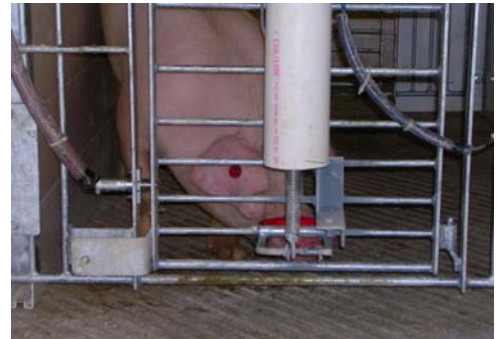
visit, during which time they learnt about our past and current research programs, and toured our facilities both on the Purdue University campus and out at the Farm Animal Behavior Laboratory.

Determination of hunger in swine

Dr. Mike Toscano's PhD thesis was successfully defended in late 2005. His body of work sought to characterize physiological, neurological, behavioral, and pharmacological responses to increasing periods of feed deprivation, and to identify the severity of hunger in terms of practical and objective data.

Market weight castrated swine underwent periods of feed deprivation ranging from 21 to 57 h. At specific time points within that feed deprivation, data were collected to assess neurological, physiological, behavioral, and pharmacological responses to the imposed feed deprivation. It was found that the physiological measures of insulin, glucagon, insulin:glucagon, and non-esterified fatty acids (NEFA) confirmed that food deprived animals were in a catabolic state. However, behavioral differences between food deprived and control animals were not observed until after 33 h of fasting when it became apparent that feed deprived animals were more active.

This time period also coincided with increased production of NEFA and ketone bodies which serve as alternative energy sources. When looking at neurohormone concentrations, cholecystokinin fell from an initial high and then remained constant for the entire experiment. Met-enkephalin concentrations in the hypothalamus and in the amygdala appeared in an inverse pattern to one another in response to feed depriva-



tion. This pattern may be linked to a proposed role for the opioid system to blunt prolonged periods of negative feeling, although this requires further investigation.

Dr. Toscano has proposed a system whereby his collected data could be used objectively to classify animals within different gradations of hunger. Ideally, future research in dietary manipulations can compare their responses to the data generated from the current study and draw conclusions based on which range of deprivation their animals most closely resemble.

The study has given researchers and producers a more thorough understanding of the adaptive capacity of animals to metabolic challenges as well as the foundation for an objective means to assess hunger.

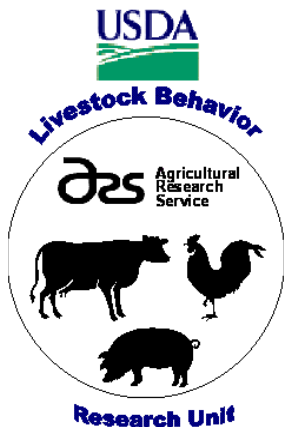
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The mission of the LBRU is to develop scientific measures of animal well-being, through the study of animal behavior, stress physiology, immunology, neuro-physiology, and cognition, that will allow an objective evaluation of animal agricultural practices. 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.

We're on the web:
www.ars.usda.gov



Finding solutions to
agricultural challenges

Long-term dairy lameness project reaches half-way

A longitudinal study of the benefits or problems that may be associated with using rubber mats in front of feed bunks of dairy cattle is underway. Heifers are placed on the study flooring, concrete or rubber, immediately after their first calving. Behavior in the free stall area, pedometer readings, hoof health, locomotion scores, and physiological measures including endocrine responses,

neurological indicators of chronic pain, immunological indicators of acute or chronic inflammation will be determined for cows with concrete throughout the free stall area compared to those with the rubber mats. The first group has completed their first year and started their second lactation and will finish the study when they reach 180 days post-calving.

Publications this quarter

Refereed Journal Articles

Poletto, R.; Steibel, J.P.; Siegford, J.M.; and Zanella, A.J. (2006) Effects of early weaning and social isolation on the expression of glucocorticoid and mineralocorticoid receptor and 11beta-hydroxysteroid dehydrogenase 1 and 2 mRNAs in the frontal cortex and hippocampus of piglets. *Brain Research* 1067: 36-42.

Poletto, R.; Siegford, J.M.; Steibel, J.P.; Coussens, P.M.; and Zanella, A.J. (2006) Investigation of changes in global gene expression in the frontal cortex of early-weaned and socially isolated piglets using microarray and quantitative real-time RT-PCR. *Brain Research* 1068: 7-15.

Sorrells, A.D.; **Eicher, S.D.**; **Scott, K.A.**; Harris, M. J.; Pajor, E.A.; **Lay, D.C.Jr.**; Richert, B.T. (2006) Postnatal behavioral and physiological responses of piglets from gilts housed individually or in groups during gestation. *Journal of Animal Science* 84: 757-766.

Refereed Meeting Abstracts

Rostagno, M.H.; Hurd, H.S.; McKean, J.D. (2005) Resting pigs on transport trailers: Potential intervention to reduce *Salmonella* prevalence at slaughter? In: 86th Annual Meeting of the Conference of Research Workers in Animal Diseases, 2005. *Proceedings...* St. Louis, MO., p.125, Abst.85.

Rostagno, M.H.; Wesley, I.V.; Trampel, D.W.; Hurd, H.S. (2005) Prevalence of *Salmonella enterica* in market-age turkeys. In: 86th Annual Meeting of the Conference of Research Workers in Animal Diseases, 2005. *Proceedings...* St. Louis, MO., p.125, Abst.84

Williams, J.L.; **Eicher, S.D.**; Patterson, J.A.; **Marchant-Forde, J.N.** (2005) Effects of lairage during transport on innate immune function of swine. In: 86th Annual Meeting of the Conference of Research Workers in Animal Diseases, 2005. *Proceedings...* St. Louis, MO., p.133, Abst.129.

Eicher, S.D.; **Cary, D.C.** (2005) Fluorescently labeled beta-glucan traffics from jejunal and ileal tissue to mesenteric lymph and spleen. In: 86th Annual Meeting of the Conference of Research Workers in Animal Diseases, 2005. *Proceedings...* St. Louis, MO., p.98, Abst.P62.

