

540 Odor preference of pre-weaning piglets to biologically relevant and non-relevant odors. N. Krebs* and J. McGlone, *Texas Tech University, Lubbock.*

The sense of smell is highly developed in pigs and could reduce weaning stress. To determine which odors were attractive, piglets were separated from their mother, grouped and exposed to different odors for 24 h and weight loss was measured over the same period. Two separately ventilated rooms (with 2 pens each) were used to test a single odor per room per block. A wick soaked with a single odor was placed in the back of the feeder so that the fan blew the odor from the wick through the feeder at piglet's height in the pen. Enough liquid was provided that the wick was soaked by capillarity for 24h. The air movements in the room were symmetrical to avoid pig preference for parts of the pen. In each experimental unit (total 43, average 4 replications/odor), four 15-to-20-d old pigs (2 males and 2 females) from four litters were put in a pen. Treatments randomly assigned to one side of the pen were: amyl acetate (AA), n-butanol (n-BUT), ammonia (NH₃), phosphate buffered saline (PBS), maternal feces (FECES), maternal pheromone Suiience (MPH), androstenone (ANDRO), isopropyl alcohol (IA), lactose (LACT) and milk replacer (MILK). The position of the pigs was observed continuously for 24 h and a preference index (PI) was calculated for each treatment (=time spent in the half of the pen closer to the odor/total time). Pigs had a preference (PI > 50%) (P < 0.0001) for ANDRO compared to FECES (73.16% + 9.92 vs 45.88% + 7.50). There were no significant differences in PI among other treatments. Pigs significantly preferred (P < 0.001) at multiple hours for ANDRO, NH₃, and n-BUT. The PI was not significantly different (P > 0.10) from 50% at any time for PBS, MPH, LACT, MILK, or FECES. Pigs lost less (P < 0.05) weight over 24 h when exposed to NH₃ than PBS (-.245 vs -.158 ± 0.027 kg). In conclusion, according to these preliminary data, newly weaned piglets spent more time near ANDRO. Piglets were attracted at times of the day to NH₃ and n-BUT. Odors can be used to direct the behavior of weaned pigs and might be used as a tool to improve performance.

Key Words: Pigs, Odors, Weaning

541 Performance and behavior of calves reared in groups or individually following an accelerated-growth feeding program. M. Terre*¹, A. Bach^{2,1}, and M. Devant¹, ¹Unitat de Remugants-IRTA (Institut de Recerca i Tecnologia Agroalimentàries), Barcelona, Spain, ²ICREA (Institut Catalana de Recerca i Estudis Avançats), Barcelona, Spain.

Nineteen calves were reared in individual pens (IP), and 20 calves were grouped in 4 pens of 5 calves each (GP) to study the effects of rearing calves in groups or individually on behavior and performance. All calves were on an accelerated-growth feeding program and had unlimited access to starter. Total DMI, BW, serum urea, NEFA and glucose concentrations, and immune response to vaccination were measured. Also, behavior was monitored by continuous recordings of 20 min twice weekly following the morning and afternoon milk replacer consumption. After weaning, the observations were conducted at the same time as in the preweaning period (0730 and 1730). Behavior patterns were categorized in: non-nutritive sucking, cross-sucking, inter-sucking, and self-grooming. Performance and serum data were analyzed using a mixed-effects model

543 Assessment of Antibiotic Usage in Dairy Herds in Pennsylvania. A. Sawant*, L. Sordillo, and B. Jayarao, *Pennsylvania State University, University Park.*

A survey of 113 dairy herds from 13 counties in Pennsylvania indicated that fifty percent of dairy farms maintained antibiotic treatment records. Only 21% had written plans for treating sick animals. Antibiotics were mostly administered (93%) by the owner/manager or designated herdsman, but only 32% of

with repeated measures. Behavior differences between and within treatments before and after weaning were assessed with a Mann-Whitney test and a Wilcoxon test, respectively. There were no differences in final BW and total DMI between treatments. The decrease of ADG during the week following weaning was more pronounced (P < 0.05) in GP than in IP calves. Serum NEFA concentrations tended (P = 0.06) to increase the week after weaning in GP calves. Serum urea concentrations were greater (P < 0.05) in GP than in IP calves 1 wk before (21.3 vs 16.6 mg/dL, respectively) and after weaning (27.2 vs 16.0 mg/dL, respectively). After weaning, non-nutritive behaviors increased (P < 0.05) in both treatments, but GP calves increased (P < 0.01) self-grooming behavior and decreased (P < 0.001) cross-sucking and inter-sucking behaviors. Positive immune response 3 wk after vaccination tended (P = 0.08) to be greater in IP (84%) than in GP calves (55%). Calves housed in groups struggled more at weaning, and appeared to mobilize more body reserves and have a slower immune response than calves housed individually.

Key Words: Calves, Behavior, Growth

542 Weaning cattle in two stages reduces the behavior changes typically associated with weaning stress. D. B. Haley*^{1,2} and J. M. Stookey¹, ¹Western College of Veterinary Medicine, Saskatoon, SK, Canada, ²Alberta Agriculture, Food & Rural Development, Red Deer, AB, Canada.

Our objective was to evaluate a novel two-stage weaning procedure against the traditional method of abrupt weaning. Pairs weaned in two stages were prevented from nursing (stage 1) for either 8 d (n=6) or 4 d (n=6) prior to physical separation (stage 2). Anti-sucking devices worn by calves prevented nursing. Control calves (n=6) nursed until they were abruptly weaned by separation. Behavior was recorded for 4 d prior to initiating the two-stage treatment, on all 4 d that two-stage pairs were prevented from nursing, and for 4 d following cow-calf separation. Activity was recorded directly by instantaneous sampling every individual animal at 10-min intervals, from 0700 to 1900 h. Also, for 2 min during each 10-min interval, we recorded the number of vocalizations by individual animals. The mean values below (calls/h, min/d) were calculated to represent the entire 12-h observation period based on results from interval sampling. The two-stage treatments produced similar results whether nursing was prevented for 8 or 4 d. Both groups showed a reduced behavior response to weaning compared to controls. When nursing was prevented, two-stage animals were more vocal than controls, but treatment differences may be of questionable biological significance (two-stage treatments combined vs. controls: cows=5.1 vs. 0.6 calls/h, P<0.01; calves=1.5 vs. 0.1 calls/h, P<0.001). Compared to controls, following separation, two-stage cows called 84% less (14.3 vs. 89.4 calls/h, P<0.0001), spent 60% less time walking (28.5 vs. 70.8 min/d, P<0.001) and 13% more time lying (165.2 vs. 146.3 min/d, P<0.05). After separation, compared to controls, two-stage calves called 97% less (1.9 vs. 56.0 calls/h, P<0.0001), and spent 30% more time eating (267.9 vs. 206.3 min/d, P<0.01). Use of the anti-suckling device for 4 d prior to physical separation offers a practical solution to reducing the signs of distress shown by cattle when they are weaned abruptly. Benefits of this procedure such as reduced calling, reduced walking, and increased time spent eating can be achieved simply by preventing nursing between cows and calves for 4 d, before separating them.

Key Words: Beef Cattle, Weaning Stress, Behavior

Animal Health II

farms sought a veterinarian's advice before administration. Only 24% of dairy producers followed label instructions. The majority of dairy producers used extralabeled antibiotics, with guidelines from a veterinarian; separated and visibly marked treated cows; and milked treated cows last with a separate milking unit. Records of 33 farms indicated that the most common conditions were pneumonia and enteritis in calves; mastitis, metritis, and foot rot and in cows; and mastitis and pneumonia in dry cows. Antibiotics were mostly used for treating

enteritis in calves (36%), followed by pneumonia in calves (25%) and foot rot in cattle (16%). Twenty four antibiotics including beta-lactams, spectinomycin, and florfenicol were widely used for therapy whereas oxytetracycline and neomycin were used in milk replacers for prophylaxis. Feeding medicated milk replacers to calves (70%) was widely practiced. Beta-lactam antibiotics were mostly used for dry cow therapy, clinical mastitis, and on some farms for pneumonia and metritis. Ceftiofur was also used as an extralabel drug on 18% farms for mastitis therapy. This study suggests that beta-lactams and tetracyclines were the most widely used antibiotics. Extralabel use of antibiotics was practiced on many farms. Current practices related to the antimicrobial usage on farms could contribute to the development of antibiotic resistant bacteria

Key Words: Antibiotics, Mastitis, Management

544 The early detection of bovine respiratory disease (BRD) with infrared thermography and treatment with nitric oxide. A. L. Schaefer^{*1}, B.J. Perry², N.J. Cook³, J. S. Church³, C. Miller², and A. Stenzler², ¹Agriculture and Agri-Food Canada, Lacombe, Alberta, Canada, ²Pulmonox Medical Inc, Edmonton, Alberta, Canada, ³Alberta Agriculture Food and Rural Development, Lacombe, Alberta, Canada.

Bovine respiratory disease (BRD) is one of the most costly health afflictions affecting the beef industry. Unlimited treatment with antibiotics either before or following the appearance of clinical signs is not optimally effective and moreover, is raising concerns globally regarding the promotion of resistant micro organisms. Clearly, an earlier, more targeted treatment and prudent selection of medications is needed. In the present pilot study the early detection of BRD with infrared thermography (IRT) and treatment either as a prophylactic or upon IRT detection with nitric oxide (NO) was investigated. Thirteen weaned and transported calves weighing 450 lb were used. Eleven of these calves were exposed for three days to a commercial herd known to display a number of BRD viruses. These eleven calves were then allocated to single daily treatments as; prophylactic (n=4) with a NO respiratory treatment of 600 breaths of 160-200 ppm NO administered via a nasal tube for three consecutive days immediately following exposure to the commercial herd; early detection (n=4) with the NO treatment applied only upon the calves showing thermal (IRT) signs of infection or thirdly, a clinical group (n=3) where NO was applied only upon the appearance of clinical signs. Two calves served as uninfected controls. The presence of BRD was verified by a bank of clinical signs as well as hematology and serology data. All calves treated with NO either as a prophylactic or upon early detection displayed orbital IT temperatures (36.35 ± 0.89 SD) similar to controls but significantly lower than the clinical treatment group (37.1 ± 1.02 ; $P < 0.01$). Other clinical health data followed this same pattern. The data suggest that IRT may assist with the earlier detection of BRD in cattle and that nitric oxide may be an effective treatment for BRD.

Key Words: Bovine respiratory disease, Infrared, Nitric oxide

545 Cytokine expression of T cell subsets in bovine peripheral blood. S. Tanaka^{*}, K. Miyazawa, K. Watanabe, S. Ohwada, H. Aso, and T. Yamaguchi, Tohoku University, Sendai, Japan.

Bovine T cells are classified into T cell subsets, CD4⁺, CD8⁺, WC1⁺ $\gamma\delta$ and WC1⁻ $\gamma\delta$ T cells, based on the existence of CD molecules and T cell receptors. The percentage of T cell subsets in peripheral blood and the distribution of T cell subsets in lymphoid organs have been reported by several researchers. However, cytokine expression of individual subsets in bovine T cells is not still cleared. In the present study, we tried to investigate T cell activation marker, CD25 expression, and cytokine mRNA expression of CD4⁺, CD8⁺, WC1⁺ $\gamma\delta$ and WC1⁻ $\gamma\delta$ T cells. The peripheral blood was collected from Holstein caws (n=3). T cell subsets were isolated by magnetic cell sorting (MACS) method and were cultured with or without 4 $\mu\text{g/ml}$ concanavalin A (ConA). After 12 hrs, the cells were stained with anti-CD25 mAb and CD25⁺ cells were analyzed by flow cytometry. Total RNA was prepared from CD4⁺, CD8⁺, WC1⁺ $\gamma\delta$ and WC1⁻ $\gamma\delta$ T cell cultures. The cytokine mRNA expression of IL-2, IL-3, IL-4, IL-

6, IL-10, IFN- γ , GM-CSF, TNF- α and TGF- β was analyzed by PCR method using bovine cytokine primers. The results showed that CD25 expression was increased in CD4⁺, CD8⁺ and WC1⁺ $\gamma\delta$ T cells but decreased in WC1⁻ $\gamma\delta$ T cells after ConA stimulation. In CD4⁺ T cells, IL-2, IL-6, IL-10, TNF- α and TGF- β mRNA were expressed without ConA stimulation and the mRNA of all cytokines were expressed after ConA stimulation. In CD8⁺ T cells, IL-6, TNF- α and TGF- β mRNA were expressed without stimulation. After stimulation with ConA, IFN- γ and GM-CSF mRNA expression were newly detected in the T cells. In $\gamma\delta$ T cells, WC1⁺ $\gamma\delta$ T cell subset expressed IL-2, IL-6, TNF- α and TGF- β mRNA. Following stimulation with ConA, the mRNA of cytokines except for IL-3 and IL-4 were expressed. Whereas WC1⁻ $\gamma\delta$ T cells expressed only TGF- β mRNA with or without ConA stimulation. These results demonstrated that cytokine production of T cell subsets was intrinsically different and suggested that WC1⁺ $\gamma\delta$ T cells may be more functional than WC1⁻ $\gamma\delta$ T cells.

Key Words: T cell subset, cytokine, $\gamma\delta$ T cell

546 Probiotics affect the establishment of T lymphocytes in the gut and prevent bacterial translocation in pigs. M. Lessard^{*1}, M. Dupuis¹, N. Gagnon¹, J. Matte¹, J. M. Fairbrother², E. Farnworth³, and J. Goulet^{4,5}, ¹Agriculture and Agri-Food Canada, Dairy and Swine Research and Development Centre, Lennoxville, Qc, Canada, ²Montreal University, St-Hyacinthe, Qc, Canada, ³Agriculture and Agri-Food Canada, Food Research and Development Centre, St-Hyacinthe, Qc, Canada, ⁴Laval University, FSAA, Québec, Qc, Canada, ⁵Institut Rosell Lallemand inc., Montreal, Qc, Canada.

In this study, the influence of *Pediococcus acidilactici* (PA) and *Saccharomyces cerevisiae boulardii* (SC) on immunity and bacterial translocation was evaluated in piglets. Thirty litters were allocated at birth to the following treatments: 1) Control without antibiotic (C) or 2) with tiamulin as antibiotic added into feed (C+A), 3) PA, 4) SC and 5) PA+SC. During lactation, probiotics (10^9 CFU) were given orally three times a week. Piglets were weaned at 21 d of age. After weaning, probiotics were added into the diet (10^9 CFU/kg). Three piglets per litter were slaughtered at 18 and 24 days of age, respectively (weaning period), or at 56 days of age after challenge with an enterotoxigenic *E. coli*. Blood, ileum and mesenteric lymph node (MLN) samples were analysed by flow cytometry to characterize mononuclear cell populations during the weaning period. IgA levels were determined in ileal flush and bacterial translocation was measured in MLN. Growth of piglets was not affected by treatments. In the gut, a significant interaction between treatments and weaning period ($P = 0.08$) indicated that the percentage of CD4⁺CD8^{low} cells in the ileum was higher in pigs treated with PA than in those of groups PA+SC and C before weaning whereas there was no treatment effect after weaning. In the MLN, a similar interaction showed that the number of CD4⁺CD8^{high} cells was increased before weaning in PA compared to SC and C groups. In blood, CD8⁺ populations were not affected by treatments and weaning whereas percentage of CD4⁺ cells in PA and PA+SC pigs was lower ($P = 0.07$) than in C pigs after weaning. After *E. coli* challenge, bacterial translocation was significantly reduced ($P \leq 0.05$) in pigs treated with PA, SC, PA+SC or antibiotic compared to control group. In pigs treated with PA, PA+SC or antibiotic, IgA concentration in the ileum tended to be lower ($P = 0.11$) than in controls. In conclusion, probiotic treatments appear to affect the establishment of CD8⁺ cells in the gut and to protect the host against bacterial translocation. Probiotics could be considered as a reliable tool to prevent intestinal bacterial infections.

Key Words: Probiotics, Immunity, Pigs

547 Long-term effects of weaning age on immune function of pigs. S. R. Niekamp^{*}, M. A. Sutherland, and J. L. Salak-Johnson, University of Illinois, Urbana.

Weaning is a common stressful event that involves abrupt social, nutritional, and environmental changes that cause an acute stress response and compromises well-being. The objective of this study was to evaluate the impact of weaning age on pig immune responses and growth through the finishing phase.

Piglets were weaned at 14 or 28 d of age and housed by litters until they reached 20 wk of age. Pig BW and blood samples were taken at weaning, 1, 7, and 14 d post-weaning and 8, 12, 16, and 20 wk of age. Cortisol (CORT), total white blood cell counts (WBC), lymphocyte counts (Lymph), neutrophil counts (Neut), lymphocyte proliferation (LPA), natural killer cell cytotoxicity (NK), neutrophil chemotaxis (CHTX) and phagocytosis (PHAG), and IgG concentrations were all measured. Pigs weaned at 14 d of age had higher total WBC ($P < 0.001$) and Lymph ($P < 0.001$) at 8 wk of age and higher Neut ($P < 0.001$) at 16 wk. In general, pigs weaned at 14 d had higher ($P < 0.001$) NK activity at various times throughout the study. They also had higher ($P < 0.001$) LPA response at weaning and 7 and 14 d post-weaning ($P < 0.001$). Pigs weaned at 28 d of age were heavier at weaning ($P < 0.001$) and until 8 wk of age ($P < 0.001$) than those weaned at 14 d of age. Total WBC ($P = 0.005$) and Lymph ($P < 0.001$) were higher at 24 h and 14 d post-weaning among pigs weaned at 28 d. CORT was also higher at weaning, 24h and 14d post weaning ($P = 0.017$) in these pigs. These data provide support that weaning age may have long-term consequences on pig immune function.

Key Words: Pig, Immune, Weaner-finisher

548 A comparison of serum harvesting methods and different instruments for total solid refractometry in calves to determine failure of passive transfer. B. Jarvie, M. Wallace, N. Perkins, and K. Leslie*, *University of Guelph, Guelph, ON, Canada.*

Successful transfer of antibodies in neonatal calves is determined by the amount, quality, and absorption of colostrum ingested within the first 24 hours of life. It is critical to the health of the calf and should be monitored routinely. Refractometry on serum from calves at 1 to 7 days of age to measure total solids (TS) is a valid technique for measuring failure of passive transfer of immunoglobulins (FPT) that can be adapted for on-farm use. However, the necessity of having a centrifuge to harvest serum has kept this method from widespread adoption. In the current study, serum TS refractometry results were compared between duplicate blood samples that were centrifuged and non-centrifuged prior to harvesting the serum. A total of 234 calves from 61 dairy herds across southern Ontario were enrolled in this study. The mean serum TS concentration was 5.5 g/dl and 5.4 g/dl for the centrifuged and non-centrifuged serum, respectively. The Spearman rank coefficient assessing the linearity between TS results from centrifuged and non-centrifuged methods of serum harvesting was 0.95, indicating a high degree of correlation between the two sources of serum. Using less than 5.0 g/dl as the cut-off value for defining FPT, 25% and 28% of the serum TS values from centrifuged and non-centrifuged samples, respectively, were identified as having FPT. A two-tailed Fisher's exact test indicated that the TS results, in categories of success and failure of passive transfer, did not differ significantly between the serum harvesting methods ($p=0.53$). On a subset of 164 calves, the serum TS was measured using both digital and hand-held refractometry instruments. The Spearman rank coefficient was 0.96, indicating that a high degree of correlation between the two measurement methods. The results of this study suggest that serum TS refractometry, as measured from non-centrifuged serum and with two different refractometry instruments, can be successfully used to identify calves at risk of FPT.

Key Words: Refractometry, Calves, Failure of passive transfer

549 Effects of OmniGen-AF on growth and innate immune function in growing rats: identification of a mechanism of action. E. Georges*, Y. Wang, and N. Forsberg, *Oregon State University, Corvallis.*

The goal of this study was to evaluate the effects of OmniGen-AF on innate immune status and on growth in healthy and in immuno-deficient rats. The study was conducted as a 3X2 factorial with 6 rats per treatment. Six male rats (ca. 300g) were randomly assigned to a control diet or an OmniGen-AF-supplemented diet (1% of diet DM: Factor 1) and to one of three levels of dexamethasone (DEX) treatment (0, 0.1 or 1.0 mg/kg of BW/day: Factor 2). Animals were maintained on these treatments for a period of 14 days after which they were

weighed and anesthetized. Under anesthesia, 10 ml of blood were taken and neutrophils were purified using Percoll gradient centrifugation. RNA was extracted from neutrophils using Trizol reagent after which concentrations of mRNA encoding L-selectin, a neutrophil adhesion molecule, and B-actin were assessed using quantitative real-time PCR. Injection of both concentrations of DEX resulted in substantial weight loss ($P < 0.05$). Rats injected with 0.1 and 1.0 mg/kg/d lost approximately 3.5g and 8g of BW/day, respectively, irrespective of diet. Control animals gained 2 g/hd/day whereas OmniGen-AF increased weight gain ($P < 0.027$) in control-fed rats from 1.9 to 2.8 g/hd/day. The benefit of OmniGen-AF on gain was not mediated by an increase in intake. Instead, OmniGen-AF-fed rats had significantly improved feed efficiency. Effects of the six treatments on innate immune function were assessed using L-selectin as a marker. L-selectin mRNA was expressed as a ration of a housekeeping gene (B-actin). Injection of DEX caused marked reductions (immunosuppression) in the L-selectin/B-actin ratio. Immunosuppressive effects of DEX were not countered by addition of OmniGen-AF to the diet. In control-fed animals, however, OmniGen-AF increased the neutrophil L-selectin/B-actin mRNA ratio by 6-fold ($P < 0.01$). The data indicate that OmniGen-AF increases growth in male rats by improving feed efficiency. Further, the feed additive boosted an index of innate immune function. The ability of this feed product to reduce incidence of disease in livestock may be related to its ability to augment innate immune function.

Key Words: OmniGen-AF, Innate immunity, Non-ruminant

550 The process of porcine M cell differentiation within the follicle-associated epithelium. K. Miyazawa*, A. Hisashi, K. Takashi, K. Taketomo, K. Watanabe, S. Ohwada, and T. Yamaguchi, *Tohoku University, Sendai, Japan.*

Aim: The follicle-associated epithelium (FAE) is important for antigen sampling system. The FAE is different from the surrounding villous epithelium and contains membranous cells (M cells). M cells are believed to act as an antigen sampling cells from the gut lumen. It has been reported that cytokeratin 18 (CK 18) is a marker for M cells of pig. However, the origin, differentiation system and death of M cells are still a matter of controversy. Therefore, we addressed on the process of porcine M cell differentiation. *Methods:* Three-way crossbred female pigs aged 3-6 month were used for this study. After slaughter, the fresh ileum was removed immediately and used for several experiments. The anti-CK 18 and anti-PCNA antibodies were used for immunohistochemical study. Alkaline phosphatase (ALP) activity was detected by enzyme histochemistry. Cell migration was detected by BrdU injection. Apoptotic cells were detected by TUNEL method. *Results:* In porcine ileum, M cells were mostly observed until the FAE periphery. On the other hand, M cells were hardly detected in the FAE apex. These were supported by the results of SEM examination. By mirror sections method, CK 18⁺/PCNA⁺ proliferative M cells were detected in the FAE side of the crypt. BrdU analysis indicated that the life span of ileal epithelial cells was almost similar in the crypt-FAE axis and the crypt-villus axis. Apoptotic cells were detected exclusively at the FAE apex. In mouse, rat and human, M cells are lack or very weak for the staining of ALP activity on their brush border. Double staining for ALP activity and CK 18 showed that ALP activity was not or weakly stained in CK 18⁺ M cells of the FAE periphery in porcine ileum. In addition, we observed CK 18⁺/ALP⁺ cell that was transient cell type from M cell to enterocyte. *Conclusion:* Our findings provide the evidences described as follows: The porcine M cells are directly derived from stem cells and committed as a distinct cell lineage in the crypts. The committed M cells are differentiated to mature M cells at the FAE periphery. Finally, M cells trans-differentiated to enterocytes at a near position of the FAE apex and are excluded by apoptosis.

Key Words: Swine, Intestine, M cells

551 Comparison of direct-fed microbial and antibiotic supplementation on peripheral blood immune cell populations of weanling pigs. M. E. Davis*, D. C. Brown¹, C. V. Maxwell¹, Z. B. Johnson¹, and T. Rehberger²,

A study was conducted to determine the effect of an antibiotic and direct-fed microbials on peripheral blood immune cell populations in pigs. At farrowing, pigs were provided milk supplement during lactation with or without *Lactobacillus brevis* (IE1). Treatments were continued during the nursery period, in which pigs administered IE1 in lactation continued to receive IE1 through the watering system. During the nursery, pigs were fed: 1) a control diet (CON), 2) CON supplemented with *Bacillus* (BAC), or 3) Carbodox (CARB), in a 2 × 3 factorial arrangement. On d 10, 20, and 38 after weaning, blood was collected from 12 pigs (2 pigs/trt) for flow cytometric analysis of immune cells. Monoclonal antibodies against the cell surface markers CD3 (70% T cells), major histocompatibility complex class II (MHCII; antigen-presenting cells), CD4 (T helper cells), CD8 (cytotoxic T cells), TCR1 (T cell receptor $\gamma\delta$), and CD25 (lymphocyte activation) were used to detect leukocyte populations. The proportion of CD3⁺MHCII⁺ cells on d 20 was higher ($P < 0.05$) in pigs administered IE1 and CON, compared to pigs fed CON and BAC without IE1 and those fed BAC and CARB with IE1. However, on d 38, pigs fed BAC with and without IE1 had a higher proportion of CD3⁺MHCII⁺ than any other treatment (IE1 × diet × day, $P < 0.05$). The proportion of T cells with TCR1 did not differ among treatments on d 10 or 38, however, on d 20, pigs fed CARB without IE1 and CON with IE1 had a higher ($P < 0.05$) proportion of T cells with TCR1 than pigs fed CON or BAC without IE1 and those fed BAC with IE1 (IE1 × diet × day, $P < 0.05$). On d 10, pigs fed BAC without IE1 had a higher proportion of CD25⁺CD4⁺CD8⁻ T cells than pigs fed CON without IE1. However, the proportion of CD25⁺CD4⁺CD8⁻ T cells was higher ($P < 0.05$) in pigs fed BAC with IE1 compared to pigs fed BAC and CARB without IE1, and CON and CARB diets with IE1 on d 38 (IE1 × diet × day, $P < 0.05$). This study indicates that IE1 and the combination of IE1 and BAC initiate similar peripheral blood immune cell populations as those present in the CARB-supplemented pigs.

Acknowledgements: Funding provided by the National Pork Board

Key Words: Swine, Probiotics, Immunity

552 Effects of weaning age on pig immune response to mixing stress. S. R. Niekamp*, M. A. Sutherland, and J. L. Salak-Johnson, *University of Illinois, Urbana*.

Mixing is a stressful event that often occurs throughout the grower/finisher phase of swine production which may have negative consequence on health and performance. The objective of this study was to evaluate the effect of weaning at different ages on the immune response of pigs subjected to mixing stress later in life. Piglets were weaned at 14 or 28 d of age and remained as litter groups until mixing. Pigs were assigned to no mixing (control), once mixing (at 8 wk), or twice mixing (at 8 and 16 wk). Blood samples were taken at 3 and 24 h post-mixing. Cortisol (CORT), total white blood cell counts (WBC), lymphocyte counts (Lymph), neutrophil counts (Neut), lymphocyte proliferation (LPA), natural killer cell cytotoxicity (NK), neutrophil chemotaxis (CHTX) and phagocytosis (PHAG), and IgG concentrations were all measured. In general, pigs mixed once had higher WBC ($P = 0.004$), Neut count ($P = 0.015$), and CORT ($P < 0.001$) at 8 wk of age. At 3 h post-mixing, pigs weaned at 28 d of age had higher WBC ($P = 0.05$) and Neut counts ($P = 0.05$) while those weaned at 14 d of age had higher CORT ($P = 0.02$) and tended to have higher NK ($P = 0.096$) at 8 wk. At 16 wk of age, pigs weaned at 14 d had higher Neut counts ($P < 0.001$) and lower Lymph counts ($P < 0.001$) compared to those pigs weaned at 28 d. Similarly, at 3 h post-mixing, Neut counts were higher ($P = 0.06$) and Lymph counts lower ($P = 0.009$) in pigs weaned at 14 d and mixed either once or twice. CORT was highest ($P = 0.03$) at 3 h post-mixing in pigs weaned at 28 d and mixed twice. These data provide support that a pig's immune response may be indicative of their ability to cope with stressors evoked later in life.

Key Words: Stress, Immune, Weaning age

553 Effects of Melengestrol Acetate on bovine inflammatory response during *Mannheimia haemolytica* challenge. M. Corrigan*, J. Drouillard, D.

Mosier, M. Spire, J. Minton, J. Higgins, E. Loe, B. Depenbusch, and J. Fox, *Kansas State University, Manhattan*.

Previous research from our lab indicated that Melengestrol Acetate (MGA) improved growth rates and reduced chronicity in heifers naturally challenged with bovine respiratory disease. This study was completed to provide further insight into the possible immunomodulatory effects of MGA. Crossbred heifers ($n=47$; 232 ± 5.5 kg) were used in a randomized complete block design to determine effects of MGA on lung pathology and markers of inflammation in cattle following *Mannheimia haemolytica* (MH) challenge. On day 0, cattle were stratified by weight and randomly assigned, within strata, to diets (54% concentrate) that provided 0 or 0.5 mg MGA per heifer daily for the duration of the experiment. Twenty ml of inoculum containing between 1.3×10^9 and 1.7×10^9 CFU MH were instilled at the bifurcation of the trachea on day 14. Blood samples were taken, clinical observations were made, and rectal temperatures were recorded for each animal at 0, 12, 24, 48, 72, 96, 120, and 138 hours after inoculation, and analyzed as repeated measures. Heifers fed MGA had greater levels of eosinophils and post-challenge levels of segmented neutrophils and white blood cells ($P < 0.01$) compared to controls, as well as elevated plasma protein, serum haptoglobin, and fibrinogen after MH challenge ($P < 0.01$). Heifers fed MGA had lower plasma glucose ($P < 0.01$), higher plasma urea nitrogen ($P = 0.02$), and elevated respiratory indices ($P < 0.01$) compared to controls. Necropsies performed on day 6 after inoculation suggested that MH challenge was relatively mild, as lesions were confined to a small portion of the lungs. On a 0 to 100 scale, lung lesion scores were 3.08 and 1.04 for MGA-fed and control groups, respectively ($P > 0.05$). Contrasting outcomes of this experiment and our previous study with naturally-exposed cattle challenges our hypotheses concerning immunomodulatory effects of MGA, suggesting that additional research is needed.

Key Words: Melengestrol Acetate, *Mannheimia haemolytica*, Heifers

554 Peripheral and core body temperature sensing using radio-frequency implants in steers challenged with lipopolysaccharide. E. D. Reid* and G. E. Dahl, *University of Illinois, Urbana*.

Early detection of disease can influence timely administration of treatments, alter the health status of animals and on a larger scale, prevent the spread of disease through a herd. Immune stimulation is often manifested as elevated core body temperature, as measured by rectal temperature. Injectable radio frequency implants (RFI) are now produced with the ability to remotely monitor temperature at the site of implantation, yet the fidelity of peripheral site values relative to core temperature is unknown. We hypothesized that in response to lipopolysaccharide (LPS), patterns at three peripheral implantation sites are similar to rectal (REC) temperature patterns in weaned steers ($n=4$; BW 77 +/- 2 kg). These three sites were 1) under the scutiform cartilage at the base of the left ear (EAR) 2)s.c. on the midline, posterior to the poll (POL) and 3)s.c. on the midline beneath the umbilical fold (UMB). Animals were housed in controlled temperature rooms (2/room) and fed ad libitum cubed alfalfa and water and 2 kg/d of pelleted grain. Room temperature and humidity were logged every 15 min, and REC, EAR, POL and UMB temperatures were collected every 8 h daily. On d 7, 21, 22, 36 and 37, temperatures were taken every 5 min for 6 h, every 15 min for 3 h and every 30 min for 15 h. On d7 steers were placed on either short day photoperiod (8 h light:16 h dark) or long day photoperiod (16 h light: 8 h dark) and photoperiod was switched on d22. To test the RFI during a simulated immune system challenge, 0.1 ug/kg of LPS (e. coli 055:B5) was injected i.v. at 1000 h on d 22 and 37. Mean basal temperatures ($^{\circ}\text{C}$) were REC (38.7 ± 0.3), EAR (36.7 ± 1.3), POL (35.9 ± 0.7), and UMB (36.1 ± 1.4). REC temperature rose rapidly to $40.0 \pm 0.3^{\circ}\text{C}$ after LPS injection, but EAR, POL and UMB declined in similar fashion. The drop in peripheral temperature was biphasic and consistent among sites. These data do not support the hypothesis that core and peripheral temperature move in synchrony after LPS challenge. However, RFI have potential for use in the early detection of diseases that alter basal temperature.

Key Words: RFID, Temperature