129 Prediction of composition on the live animal and carcass. D.F. Waldron*, *Texas Agricultural Experiment Station, Texas A&M University System, College Station.*

A value-based marketing system that rewards producers of superior carcasses has the potential to quickly bring about dramatic changes in the US sheep industry. In order to capture the economic rewards in a value-based marketing system, producers must be able to identify animals with superior carcass composition. Accurate evaluations of composition are important in management and breeding decisions. An ideal method of evaluating composition would have minimum cost and maximum accuracy.
A lack of economic incentive to produce superior carcasses has been one reason why genetic improvement for carcass traits has been limited. Genetic improvement for carcass value should be based on a selection objective chosen with a long-term outlook. The selection criteria may change over time as measurement technology changes.
Carcass composition changes as a function of maturity and feeding regimen. Management practices should be tailored to the genetics of the animals to capture economic rewards of the market.
Lamb producers must be able to realize economic rewards from producing superior carcasses. They, in turn, must be willing to invest in breeding stock of superior genetic merit. Genetic improvement, based on genetic evaluations for improved carcass value, will require consistent, clear market signals that are translated from the processor to the producer to the breeder and an economical, accurate evaluation of composition in live animals.

Key Words: Lamb, Genetic, Carcass

130 Use of sire referencing schemes to select for improved carcass composition. G Simm*[1], R M Lewis[1], J E Collins[2], and G Nieuwhof[3], [1]*SAC, UK,* [2]*Signet, UK,* [3]*Meat and Livestock Commission, UK.*

Objective genetic improvement in specialised meat breeds of sheep in Britain is based largely on the performance recording and genetic evaluation service provided by Signet. This includes the use of ultrasonic scanning and a selection index to identify animals with high genetic merit for lean growth. Substantial responses to selection (about 2% per annum in the unscaled index) have been achieved in an experimental flock in which selection was based on this index. There is also good experimental evidence that sires selected on this index produce purebred and crossbred progeny with improved carcass lean:fat ratio, at a range of degrees of maturity, and in a range of feeding systems. Over 20 sire referencing schemes have been established in Britain during the last 12 years, mainly in specialised meat breeds. These schemes account for about half of the performance-recorded flocks in Britain. The larger schemes involve around 6,000-7,000 ewes in 60-80 flocks. These cooperative breeding schemes create genetic links between flocks and years through the shared use of elite rams (reference sires), often via artificial insemination. Multi-trait animal model BLUP is then used to provide across-flock genetic evaluations. These in turn allow increased selection intensities and increased response to selection. In the specialised meat breeds, the lean growth index mentioned above is a primary selection criterion. High responses to selection for lean growth (about 1.75% per annum in the larger schemes) and other measures of performance are being achieved. These schemes also provide an ideal structure for the cost-effective adoption of new technologies, such as advanced methods for *in vivo* estimation of carcass composition and molecular genetic markers. The formation and growth of these schemes has been stimulated by (i) the national availability of relevant performance-recording services/selection criteria, (ii) the improved success of laparoscopic artificial insemination with frozen semen, (iii) the wider availability of genetic evaluation software and powerful computers, and (iv) research, and interaction with breeders, on the optimal design and operation of schemes, including a measure of connectedness among flocks.

Key Words: Sire referencing schemes, Carcass composition, Sheep

ANIMAL BEHAVIOR AND WELL-BEING

131 Stress and immune responses in loose and cross-tied horses during transport. C. Stull*[1] and A. Rodiek[2], [1]*University of California, Davis,* [2]*California State University, Fresno.*

Ten mature, healthy riding horses were used in a cross-over design to study stress and immunological responses to 24-hours of road transport in a commercial van during hot summer conditions. The study consisted of two trial periods of four days each, with a pre-transit day to collect baseline data, followed by the day of transport, and two days of recovery. In the first trial, six horses were individually cross-tied while two pairs of horses were loose in a single compartment. The treatments were reversed for the subjects in the second trial, but their placement in the trailer was similar. Similar floor area was available to both the cross-tied (2.2 sq. meters/horse) and loose horses (2.7 sq. meters/horse). The van traveled a total of 1800 km primarily on interstate highways, stopping only for blood collections and to offer horses water from buckets. All horses had access to hay while in transit. Venous blood samples were collected at 0800, 1100 and 2000 h each day. On the day of travel, an additional sample was collected at 0700 h prior to loading at 0800 h. Blood samples were analyzed for cortisol, alpha- glycoprotein, white blood cell counts (WBC), neutrophil to lymphocyte (N:L) ratio, glucose, and the dehydration measure of total protein. The effects of either loose or cross-tied treatments were evaluated using repeated measures ANOVA with treatment and time as factors. All blood parameters showed time effects ($P < .05$)over the four day study. Significant time x loose/cross-tied interactions were shown for cortisol ($P = .0003$), WBC ($P < .0001$), N:L ($P = .0008$), and glucose ($P< .0001$) but not for alpha- glycoprotein or total protein($P > .05$). Comparison by Student's t-test of blood samples collected at 0700 and 0800 h on the day of transit showed significant loading effects (loose, $P = .003$; cross-tied, $P = .007$) only for cortisol. All parameters returned to pre-transit levels by the conclusion of the 48-hour recovery period. This data implies that cross-tying horses for long periods of road transport is more stressful and has greater impact on the immune system during transport and recovery than horses transported loose with similar floor area.

Key Words: Horse, Transport, Stress

132 Welfare of surplus calves in the dairy industry. S.T. Millman*, *The Humane Society of the United States, Washington, DC.*

Neonatal calves present unique problems for those transporting and marketing them. Recently, the dairy industry has been criticized for failing to ensure adequate care for surplus calves. In this review of the scientific literature, attention is drawn to factors affecting the welfare of surplus calves in transit, and suggestions for improvement are presented. According to the USDA, approximately nine million dairy cows and heifers calved during 1999. Assuming that 50/% of these calves were males, 4,500,000 bull calves were culled or marketed. Of the 1,042,000 calves that were slaughtered in federally inspected plants, 42.9/% were bob veal and 52.4/% were formula fed calves. If federally inspected plants are representative of the industry, there were at least 1,017,000 neonatal calves transported during 1999, either to a formula fed veal production unit or directly to slaughter facilities. Neonatal calves are particularly vulnerable during transportation and marketing. Calves have behavioral needs that differ from needs of older livestock. For example, calves spend 18 hours per day resting. Young calves also have specialized feeding requirements, and may fail to recognize milk and water, even when they have been provided. Furthermore, calves respond differently to methods used to handle other types of livestock. Since calves lack strong motivation to herd together and lack strong fear reactions, they cannot be driven away from handlers. Neonatal calves are also particularly sensitive to pathogens and environmental temperatures. In the United States, legislation protecting the welfare of surplus calves is limited. The dairy industry seems unable to address this issue, since the low value of surplus calves provides producers with little economic incentive for improvement. Countries in the EU have developed legislation in response to the welfare problems associated with transportation of

young calves, and Canada has developed recommended codes of practice. Possible mechanisms for improvement within the US dairy industry are discussed.

Key Words: Transportation, Calves, Welfare

133 Genetic parameters for behavioral traits related to the temperament in German Angus and Simmental cattle. H. Mathiak, M. Gauly*, K. Hoffmann, R. Beuing, M. Kraus, and G. Erhardt, *Department of Animal Breeding and Genetics, Justus-Liebig-University of Giessen, Germany*.

Behavioral traits related to the temperament were studied and the genetic variability of these parameters were estimated in German Angus (Aberdeen Angus x German dual purpose breeds) and Simmental cattle. Temperament was defined as the animal's behavioral response to handling by a person. Five progeny groups of both breeds (Simmental, n = 123; German Angus, n = 109) were tested two weeks after weaning (225-245 days of age). The weaner calves were tested with a combination of a non-restrained and a restrained test, where they were able to move in small test areas in the presence or absence of a handler. One animal was separated first from a group of 10 animals (separation pen: 100 qm) into a smaller area (restraint pen: 25 qm). Total separation time (TST), time spent running during handling (TSR) in the restraint pen, and time spent in a corner (TSC) directed by the handler were recorded. Analysis of variance was performed with a model including breed and sex as fixed effects and a regression on the age of the calf. The model for estimating heritabilities included the sire as a random effect and sex as a fixed effect. Least square means for TST were 29.6 s for German Angus and 39.4 s for Simmental ($P < 0.05$). TSR were 12.1 s and 18.6 s, respectively ($P < 0.05$). TSC were 27.2 s and 22.6 s, respectively ($P < 0.05$). Heritabilities estimated for these characteristics were 0.12 ($\pm$ 0.20), 0.28 ($\pm$ 0.28) and 0.09 ($\pm$ 0.78) for German Angus and 0.27 ($\pm$ 0.30), 0.07 ($\pm$ 0.18) and 0.23 ($\pm$ 0.28) for Simmental. Simmental cattle were more difficult to handle than German Angus regarding these parameters. The estimated heritabilities of the behavioral traits open a way of selection for temperament in German Angus and Simmental cattle assuming the high standard errors were caused in majority by the limited number of animals.

Key Words: Temperament, Heritability, Beef cattle

134 Nursing behavior of pigs related to litter growth. G. E. Bressner, S. W. Kim*, and R. A. Easter, *University of Illinois, Urbana*.

Twenty-eight primiparous sows and litters were used to study nursing behavior of pigs as it relates to litter growth. Sows were fed ad libitum during the 21 d lactation and litter size was set to 10 pigs by cross-fostering as needed within 48 h postpartum. Weights of sows and nursing pigs were recorded weekly. Sows were separated into two groups of fourteen sows. Each litter from the first group of fourteen sows (control) was weaned on d 21 of lactation. On d 13, teat order of litters from the second group of fourteen sows was determined and on d 14, the five heaviest pigs (avg 4.34 kg body weight) from each sow in the second group were weaned leaving five small pigs (avg 3.46 kg body weight). Teat order for the remaining five nursing pigs from each litter in this group was determined again on d 21 of lactation and the pigs were weaned. Pigs suckled anterior (first to third pairs) and middle (fourth and fifth pairs) mammary glands more frequently ($P < .05$) (79.8 and 75.0%, respectively) than posterior (sixth to eighth pairs) glands (42.3%). However, the distribution of mammary glands suckled either by heavy pigs or by light pigs was the same ($P > .05$). One week after partial weaning, the majority of the remaining five small pigs tended to continue to suckle the same mammary glands (58.9%) even though these pigs had access to other, presumably superior, glands that had been suckled by heavier pigs. The weight gain of the five light weight pigs from the partially weaned sows was greater ($P < .05$) than that of the five light weight pigs suckling sows in the control group. This study suggests that the preference for a specific mammary gland is relatively strong and the pig does not choose to relocate when given the opportunity. There was no significant relationship between birth weight of pigs and the location of the suckled mammary glands. Finally, it appears that output from a specific gland may increase when the blood supply of nutrients is increased.

Key Words: Pigs, Nursing Behavior, Mammary Gland

135 Bedding material preferences of dairy cattle. D.M. Falconer, D. Fraser, J.M. Matias, C.B. Tucker*, and D.M. Weary, *University of British Columbia Vancouver, Canada*.

Two experiments examined the bedding preferences of dairy cattle. In experiment 1, pregnant Holsteins (n = 12) were individually housed with access to 3 free stalls each bedded with a different substrate: deep-bedded sawdust, deep-bedded sand, and a geotextile mattress. After 1 week of access to all 3 materials, substrate preference was determined by stall use and lying times, recorded for 24 h with time-lapse video recording. Each animal was then restricted to either sand or mattress for 2, 5, or 10 days. Average lying time and number of transitions between standing and lying were significantly ($P < 0.05$) less when the heifers were restricted to sand or mattress. After the restriction phase, animals were again allowed access to all 3 bedding types and final preference was determined. Ten of 12 animals continued to choose sawdust. In experiment 2, 12 more animals were tested with sand, sawdust (both as described above), and geotextile mattresses covered with 2-3 cm of sawdust. Initial and final preference tests as described above showed that 8 of 12 cows preferred sawdust. In the middle stage of the experiment, all animals were restricted to each bedding material in turn for 2 days. Average lying time, time spent in the stall, and transitions to lying were significantly ($P = 0.02$) lower for the sand-bedded stalls, but there were no differences between the other two surfaces. These results indicate that (1) cows prefer deep-bedded sawdust, (2) that lying time, time spent in the stall, and number of lying transitions are affected when cows are provided with sand or bare mattresses, but not with mattresses covered with 2-3 cm of sawdust.

Key Words: Cow comfort, Well-being, Behavior

136 A synthetic maternal pheromone stimulates weanling pig feeding behavior and weight gain. D. L. Anderson*[1], D. Thiabaud[2], and J. J. McGlone[1], [1]*Texas Tech University, Lubbock,* [2]*Ceva Sante Animale, Libourne, France*.

Onset of feeding behavior in the weaned pig is slow due to changes in environment and diet. The objective of this study was to determine the effects of a synthetic maternal pheromone on the behavior and performance of weanling pigs. Maternal secretions were studied and a product formulated that mimics maternal odors. A total of 108 pigs were weaned at an average of 18 days in conventional indoor farrowing and nursery buildings (mechanical heating and ventilation, woven wire flooring). Pigs were randomly assigned to one of three treatments, based on litter and gender. Treatments included a 30 mL application of vehicle control (CONT), pheromone applied to the feeder (FEED) or pheromone on the pigs' snout (SNOUT). Behavior was video taped in time lapse for 48 h after weaning and a scan sampling technique was used to summarize pig behavior. Pig weights and feed intake were recorded weekly for 4 weeks. Pigs were kept 3 per pen in single-sex pens and 12 blocks of three treatments were examined (36 experimental units) for performance data and 10 blocks were examined for behavior (30 experimental units). Linear contrasts were used to compare CONT with PHER (FEED+SNOUT) treatments. PHER pigs had increased ($P = .01$) % time feeding compared with CONT pigs (2.0 vs. 1.1 % $\pm$.27), but PHER spent less ($P = .003$) time in contact with the waterer than CONT pigs (0.28 vs. 0.84% $\pm$.13). PHER pigs spent less ($P = .03$) % time engaged in agonistic behaviors than CONT pigs (.86 vs. 1.69 $\pm$.30). Over the entire 28-d growth period, PHER pigs had higher ADG (.244 vs. .198 $\pm$.01 kg/d; $P = .001$), heavier ending weight (11.8 vs. 10.6 $\pm$ .35 kg; $P = .01$) and improved feed:gain ratio (2.08 vs. 2.65 $\pm$ .13; $P = .002$) compared with CONT pigs. In conclusion, PHER stimulated postweaning feeding behaviors and reduced apparent drinking and agonistic behaviors while improving ADG and feed:gain ratio. Applying PHER to the feeder or snout of the pig were equally effective at modulating behavior and performance of weanling pigs.

Key Words: Pigs, Stress, Behavior

137 Effects of bedding on behavior and milk production of dairy buffalo. S. H. Raza*[1], S. M. Raza[2], and M. S. Khan[1], [1]*University of Agriculture Faisalabad, Pakistan,* [2]*Hi-Tech Feeds, Rawalpindi, Pakistan.*

Twelve lactating Nili-Ravi buffaloes of almost same age, lactation stage, and weight were randomly allocated to 3 bedding; A (concrete floor), B (concrete floor + sand) and C (concrete floor + paddy straw) for a period of 26 weeks in a Completely Randomized Design, at University of Agriculture, Faisalabad, Pakistan. Feeding of roughage was free of choice and was offered 10% extra than previous day intakes. Concentrates were fed according to the milk production level of buffaloes. Sand and paddy straw were raked two to three times daily for aeration. Dry matter intake did not differ among all treatments. Milk yield was higher ($P < .05$) in treatments B (6.40 ± .22 kg) and C (6.07 ± .26 kg) than A. Milk fat percentage was 6.39 ± .12, 7.26 ± .11 and 6.60 ± .17 for A, B and C, respectively. The bedding showed a significant effect ($P < .05$) on milk fat percentage. Buffaloes in B treatment showed the highest ($P < .05$) fat percentage and produced 12% and 9% more milk fat than buffaloes in A and C, respectively. Buffaloes in C treatment spent 40% of their time sitting and 24% lying. While, buffaloes in A and B spent the minimum time lying. Sand bedding buffaloes spent less ($P < .05$) time (34%) standing than buffaloes in other treatments. Buffaloes in A and C treatments were found standing for more than 50% of the time. Sand bedding proved to be the more comfortable bedding material and animals preferred clean and cozy surroundings to exhibit their normal behavior. The paddy straw bedding showed a disadvantage of warping during nighttime and served as a harboring place for insects and mosquitoes and disturbed the normal behavior of the animals. The increase in milk yield in B could be due to the fact that buffaloes in this group spent most of their time lying.

Key Words: Water Buffalo, Bedding, Behavior

138 Correlation coefficients among productive, physiological and hormonal responses and temperature-humidity index in heat stressed Holstein cows. A. Correa*[1], D. V. Armstrong[1], D. E. Ray[1], R. M. Enns[1], C. M. Howison[1], H. G. González[2], F. J. Verdugo[2], and A. P. Márquez[2], [1]*University of Arizona,* [2]*Universidad Autnoma de Baja California, Mexico.*

Data from an environmental modifications study conducted at the University of Arizona, Tucson, AZ, were used to estimate correlation coefficients among milk yield, milk fat, milk protein, rectal temperature (RT), respiration rate (RR) and triiodothyronine concentrations (T_3) with the daily maximum and minimum temperature-humidity index (THI). The correlation coefficients were calculated from records of 37 Holstein lactating cows during 120 d (May-September). The means and standard deviations were 80.6±2.7, 66.9±5.4, 36.4±8.2, 3.1±0.5, 2.9±0.2, 39.1±0.6, 66±19, 1.9±0.7 for maximum THI, minimum THI, milk yield, milk fat, milk protein, RT, RR, and (T_3) in milk, respectively. The correlation between maximum THI and milk yield was similar to a previous report. RT had a very low correlation ($P>.10$) with the maximum THI, probably due to an effect of the environmental modifications (cooling systems). However, the minimum THI presented a moderate correlation with RT and RR supporting the importance of nights with low THI to reduce heat stress.

Correlation Coefficients

	Milk Yield (kg)	Milk Fat (%)	Milk Protein (%)	RT (°C)	RR br min^{-1}	T_3 ng ml^{-1}
Max THI	-.24*	-.04	.24*	.02	.25*	-.15*
Min THI	-.11**	-.03	.04	.18*	.19*	.03

* $P<.01$; ** $P<.05$.

Key Words: Heat stress, Dairy cows, Correlation

139 Effects of social stressors on belly-nosing behavior in early-weaned piglets. J.M. Gardner and T.M. Widowski*, *University of Guelph, Ontario, Canada.*

Belly-nosing is a behavior pattern commonly observed in early-weaned piglets. Although, belly-nosing has been referred to as an indicator of stress, the factors involved in its causation are unknown. The objectives of this study were: 1) to create varying degrees of stress by subjecting pigs to different combinations of social stressors; and 2) to determine if there is an influence on the development of belly-nosing behavior in pigs weaned at 12-14 days. The experimental design was a 2x2 factorial with group composition (mixed litters vs. littermates) and density (0.15 m^2/pig (HD) vs. 0.4 m^2/pig (LD)) as the main factors. Six replicates per treatment combination, of 6 pigs/replicate were conducted over three, 3-week trials (n=144). Aggressive behavior and belly-nosing were recorded every 5 min during one 4-h period on day 1 and during two 4-h periods on days 3, 7, 10, 14, 17 and 21 post-weaning. Blood was collected on days 3 pre-weaning and 3 and 10 post-weaning, from half of the pigs, for neutrophil:lymphocyte ratios (N:L) and plasma cortisol concentrations. Contrary to what was expected, aggression was greater for pigs housed at LD than those housed at HD, on days 10 ($P\leq.05$) and 17 ($P\leq.10$) post-weaning. These differences in aggression were reflected in both mean plasma cortisol concentration and variation in N:L. On day 3 post-weaning, variation in N:L was greater for pigs weaned with littermates ($P\leq.05$) and pigs housed at LD ($P\leq.05$). On day 10 post-weaning, both mean plasma cortisol ($P\leq.05$) and variation in N:L ($P\leq.05$) were higher for pigs housed at LD. Although plasma cortisol, N:L and aggression were all suggestive of a greater stress response in pigs housed at LD, there were no differences in belly-nosing for any treatment combination ($P\geq.10$). Belly-nosing did develop across all treatments by day 7 post-weaning, and the amount of belly-nosing was consistent with that observed in other studies (about 2% of the time) for pigs weaned at 14 days. Belly-nosing does not appear to be a general behavioral indicator of stress.

Key Words: Piglets, Social stress, Behavior

140 Influence of split marketing on the physiology, behavior and performance of finishing swine. L.V. Scroggs*[1], H.G. Kattesh[1], J.L. Morrow-Tesch[2], K.J. Stalder[1], J.W. Dailey[2], and J.F. Schneider[1], [1]*The University of Tennessee, Knoxville,* [2]*USDA-ARS, Lubbock, TX.*

One hundred twenty high-lean, high-health barrows (20.3 kg BW) were randomly assigned in a randomized complete block design to one of three treatments: SM (split marketed), 6 pigs/pen (1.1 m^2/pig); C (control), 6 pigs/pen (1.1 m^2/pig); or MC (modified control), 3 pigs/pen (2.2 m^2/pig). The heaviest (120.3 kg) one half of SM animals were removed one wk prior to penmates (116.3 kg) marketing. C (119.2 kg) and MC (121.8 kg) penmates remained grouped together until marketing. Animals were videotaped 72 h after placed on trial (t1), prior to (t2) and following (t3) removal of pigs in SM group. A blood sample was collected from each animal upon completion of t1, t2, and t3. After implementing a model including the fixed effect of treatment and the random effects of block and repetition using PROC MIXED of SAS, MC exhibited poorer ($P < .0001$) feed efficiency (1.56 ± .04 kg) and ADFI (2.88 ± .06 kg) compared to C (1.06 ± .04, 1.96 ± .06 kg) or SM treatments (1.07 ± .04, 2.00 ± .06 kg) over the entire study. The remaining penmates in the SM group had higher ADFI (3.32 ± .43 kg; $P < .05$) when compared to C (1.70 ± .43 kg) or MC treatments (1.90 ± .43 kg) during the last week of the trial. Regardless of treatment, animals were more ($P < .0001$) active (feeding, walking/standing) at t1 than at t2 or t3. Neutrophil:lymphocyte ratio and plasma haptoglobin levels were greater ($P < .0001$) at t1 compared to t2 and t3 but did not differ between treatments. No treatment or time differences were detected in total plasma cortisol. These results indicate that hogs remaining after SM have greater ADFI when compared to the performance of hogs managed in the same way with respect to group size prior to and after marketing of SM animals. Significant differences in performance between the treatment groups cannot be attributed to any physiological or behavioral measures as reported here.

Key Words: Swine, Behavior, Production system

141 Effects of prenatal exposure of dairy cattle to a low magnetic field on open-field behavior and relationship to humans. J. Broucek*[1], M. Uhrincat[1], C. W. Arave[2], T. H. Friend[3], S. Mihina[1], A. Sandor[1], A. Hanus[1], and S. Marencak[1], [1]*Research Institute of Animal Production, Nitra, Slovakia,* [2]*Utah State University, Logan,* [3]*Texas A&M University, College Station.*

An experiment was conducted using 24 Holstein calves. The dams of trial calves were exposed to a low magnetic field (MF) at the flux density ranging from 42.1 μT (head) to 21.9 μT (hind part) during days 196-258 of gestation, while the dams of control calves were in an environment with a zero MF. An open-field test was applied at three ages:

A1 (16 weeks), A2 (25 weeks) and A3 (12 months) in an arena marked off into 9 squares. In A1 and A2, the size of arena was 4.5x4.5 m and two buckets with concentrate were placed there in. There was a red bucket in square 7 and a green one in square 9 (A1). At A2, the positions of the buckets were mutually changed. The calves were given four 5-min tests during two consecutive days. The animals were subjected to six, 10-min tests during 3 consecutive days at the A3 age in a 10x10 m arena. A gray manger was placed in square 8. The animals were exposed to isolation and silence in the first two tests, and to an unfamiliar person sitting on square 4 in the third and fourth tests. Noise (110dB, 1kHz) was used as a stress factor in the last two tests. The longest stay of both groups occurred in square 7 for ages A1 and A2. The stay was significantly ($P<0.01$) higher in the trial group (145 s vs. 89 s)for the average of all tests. Calves in both groups preferred the red bucket with 70 % of sniffing by trial group and 60 % by control group animals. There were no differences between the times of first eating or the length of feeding. A lower frequency of staying at the manger and concentrate sniffing (9.5 vs. 12.2) and a shorter time of feeding (203 s vs. 313 s) were found in the trial group in all A3 tests. There were no differences between groups in frequencies or lengths of staying in square 4, but slightly higher values were recorded in a control group. Contact behavior, measured by the frequency (1.1 vs. 1.6) and length of sniffing of the person (16 s vs. 12 s) was not different. We conclude that magnetic field exposure to gestating cows has no impact on their calves as determined by open-field behavior and relationship to man.

Key Words: Dairy cattle, Magnetic field, Behavior

142 Effects of rearing methods of calves prior to weaning on subsequent open-field behavior at 28 weeks of age. J. Broucek*[1], M. Uhrincat[1], T. H. Friend[2], C. W. Arave[3], S. Mihina[1], A. Hanus[1], S. Marencak[1], and P. Kisac[1], [1]*Research Institute of Animal Production, Nitra, Slovakia,* [2]*Texas A&M University, College Station,* [3]*Utah State University, Logan.*

Holstein heifer calves (n = 92) were assigned to one of five rearing treatments after having nursed their dams for 24 hours: A) a hutch until 7 days of age followed by group housing with a machine milk feeder until weaning at 8 weeks; D) penned with dam until 7 days of age followed by group housing with a machine milk feeder until weaning; H) a hutch until weaning; M) penned with dam for the first 7 days followed by a hutch until weaning; N) penned with dam for the first 7 days followed by penning with a nursing cow until weaning. Open-field testing commenced at 28 weeks of age in an indoor 4.5 x 4.5 m arena divided into 9 grids. Animals were subjected to four 5-minute tests on 2 consecutive days. A person unfamiliar to the calves was sitting at the midpoint of a wall facing the arena. In the first test, a red bucket was placed at one end of the arena and a green bucket at the opposite end (B1). In the second test (B2), the buckets were placed 1.2 m from the person. In test B3, the green bucket was placed within the reach of the left hand (0.5 m) of the person. A colored ball was also hung above the midpoint of the arena at the height of the calf's head (B3). In test B4, the buckets and ball were placed in the same place of the arena. The average number of the grid crossings in all tests was highest ($P<0.01$) in D (19.6) and the lowest in N (12.1). The highest occurrence of animals sniffing the person was found in D and M (56 %), while animals from N displayed the lowest occurrence (29.4 %). The ranking of animals with regards to the total number of sniffing was as follows: M (46), D (35), H (21), A (16), N (5). Differences were significant ($P<0.01$) between M, D and N. There were no differences in the number of encounters with the ball in test B3. In test B4, treatment M displayed the highest ($P<0.05$) number of encounters (88 % animals) and treatment N (29.4 %) the lowest. In the evaluation of the entire test, heifers from groups D and M displayed the best relationship to man (sniffed the person the most) while heifers from group N displayed the worst. Play behaviour were most strongly expressed in groups M, D and A and the lowest in group N. Preweaning environment greatly alters open-field behavior and willingness to approach a man 20 weeks later.

Key Words: Calves, Rearing, Behavior

143 Comparing dairy cow behavior in new and old free stall facilities. R. J. Norell*, J. H. Packham, and W. F. Cook, *University of Idaho, Idaho Falls, Montpelier, Emmett, ID.*

The objective of this study was to compare cow behavior in old and new free stall facilities. Four dairy operations with old and new design free stalls were evaluated in Trials 1 and 2. Old stalls had limited lunge space to the side and front of the stall. New free stalls had large loop stall dividers, open stall fronts, and were mounted 1.02m above the curb in Trial 1 and 1.22m above the curb in Trial 2. In both trials, 50 Holstein cows were observed per housing facility for 8h (2x herds) or 5.5h (3x herds) after two consecutive evening milkings. Behavioral observations were made every 15 minutes. Data were analyzed as a completely randomized design within farm and aggregated within trial in a completely randomized split plot design. Mean %stall occupancy, %laying in stall, %eating, %loafing, and %cow comfort index for new and old stalls were: (Trial 1) 73.9, 73.1, 58.2, 55.6, 13.5, 12.1, 12.6, 13.2, 78.1, and 74.1 and (Trial 2) 78.3, 71.3, 68.7, 58.3, 13.2, 13.7, 8.5, 15.7, 87.7, and 81.4, respectively. New stalls in trial 1 did not enhance stall occupancy nor %resting time ($p>0.10$) but slightly improved cow comfort index ($p<0.05$). New stalls in trial 2 improved stall occupancy, %resting time, and cow comfort index ($p<0.001$) and decreased %loafing time ($p<0.001$). Cow behavior was improved in new free stalls with large loop stall dividers mounted 1.22m above the curb.

Key Words: Free Stalls, Cow Behavior

144 Study of neuroendocrine consequences of very early weaning in swine through the study of urinary excretion of corticosteroids and catecholamines. M. Hay*[1,2], P. Orgeur[3], and P. Mormède[1], [1]*Neurogenetics and Stress, INRA, Bordeaux,* [2]*National Veterinary School, Toulouse,* [3]*Animal Behavior lab., Nouzilly, France.*

The investigation of physiological adaptive responses to husbandry practices is often difficult in pigs, especially in field conditions. This is due to a limited access to blood and also to the functional characteristics of neuroendocrine systems such as pulsatility and sensitivity to handling. Therefore, we recently developed a new approach through the measurement of corticosteroids and catecholamines in urine. We investigated the consequences of very early weaning of piglets. Sixty piglets from eight litters were either weaned on postnatal d 6 (early weaning, or EW piglets) or left with their dam until normal weaning at d 28 (control piglets, or C). On d 5, d 7, d 11, d 14 and d 19, urine was collected between 0700 and 0800 for the measurement of catecholamines, glucocorticoids, and creatinine. Compared with C, EW piglets displayed a transient increase in urinary cortisol on the day following separation from their dam (d 7) ($P < .05$). Urinary norepinephrine (NE) was three times lower in EW compared to C piglets from d 7 until d 14 ($P < .01$) but there was no difference between the two groups on d 19. Urinary epinephrine (EPI) did not differ between C and EW piglets on the day after weaning. Thereafter, EW piglets displayed a three times drop in urinary EPI as compared to C piglets until the end of the period ($P < .01$). Weaning induced an immediate reduction in growth rate and at d 28, the body weight of EW piglets was 1.60 kg lower than that of C piglets ($P < .0001$). The marked and prolonged suppression of the release of catecholamines likely reflects physiological adaptation to insufficient energy intake after weaning. The transient increase in cortisol excretion in weanlings may be caused by both emotional distress and acute food deprivation. This experiment shows the interest of this approach to monitor the physiological adaptive responses to husbandry practices.

Key Words: Stress Neuroendocrinology, Urine Analysis, Animal Welfare

145 Effect of transportation on young pigs. J. Morrow-Tesch*[1], J. McGlone[2], J. Dailey[1], and D. Anderson[2], [1]*USDA-ARS,* [2]*Texas Tech University, Lubbock.*

Many early-weaned piglets are removed from the sow and transported to a separate location. There are currently no recommendations for the transport of segregated early weaned (SEW) pigs. Eight sows and their litters were used in this study. Three male and 3 female pigs (7 to 10 d of age) were selected from each litter and randomly assigned to treatments. Treatments were: control (C), pigs left in the farrowing crate with the sow (N = 16); isolated (I), pigs moved to a separate building and placed in a straw-bedded kennel for 8 hr without access to creep

feed and water (N = 16, 0.08m^2/pig); and transport (T), pigs placed in a straw-bedded kennel and transported for 8 hr (N = 16, 0.08m^2/pig). Behavior, temperature and humidity were continuously recorded in each of the three environments. Blood samples were collected by jugular venipuncture prior to moving the animals, and at 1, 4 and 8 hr and analyzed for hematocrit, total white and red blood cell counts, and whole blood glucose. Rectal temperatures and individual body weights were also collected. Data were analyzed using GLM within SAS. Transported pigs spent more time lying than C or I (50.6, 70.3 and 84.2% for C, I and T respectively) and time spent lying increased over time for C but decreased for I and T pigs ($P < .001$ for time by treatment interaction). Standing behavior increased over time for all three treatments ($P < .05$). Only C pigs showed nursing or agonistic behavior ($P < .01$). Pig weights were similar at the beginning of the study but C pigs gained 0.15 kg while I and T pigs lost .21 and .04 kg, respectively ($P = .059$, SE = .05 kg). Rectal temperatures were lowest for T pigs (39.16, 38.92 and 38.14 $\pm$ .10 $^\circ$ C for C, I and T; $P<.01$). Glucose values were lowest for I pigs (129.6, 116.2 and 127.4 $\pm$ 2.36 mg/dl for C, I and T; $P <.01$). Transported pigs preferred to lie down during transport. Transport also caused a reduction in ability to maintain body temperature and weight without impacting glucose levels. Isolation of pigs at 7-10 d of age appears to play a large role in transport stress.

Key Words: Transport, Stress, Pig

146 Effect of transportation and commingling on the acute phase protein response of newly weaned calves.

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Cattle producers, who have had positive experiences with retained ownership, often notice that their calves perform well if not commingled prior to or immediately after transport. The objective of this study was to investigate the effect of transportation and commingling on the acute phase protein (APP) response in newly weaned calves. Thirty-two calves were randomly allotted into one of four treatments (2 x 2 factorial design, transportation x commingling). Transported calves were loaded onto trailers within 3 h after weaning and shipped for 6 h. Commingled calves were penned with out-sourced, newly weaned calves of a similar age. Body weight, rectal temperature, and jugular blood were collected at weaning, immediately after shipment (d 0), and 1, 3, and 7 d after arrival. Feed and water intake within pen were recorded daily. Plasma fibrinogen and haptoglobin, and serum ceruloplasmin concentrations were determined. Neither transportation nor commingling affected water and feed intake over the 7 d study period. Transportation, but not commingling, affected body weight change by d 7 (-9.8 and 1.8 kg for transported and non-transported calves, respectively). Although not significant ($P>.20$), transported calves experienced a gradual increase in body temperature, dropping after d 3. This resulted in a greater ($P<.01$) decrease in body temperature (d 7 - d 0) in transported vs. non-transported calves (-1.55 vs. 0.84 $^\circ$C). Transported calves had higher ($P<.01$) plasma fibrinogen concentrations compared to non-transported calves on d 0, 1, and 7. Similarly, serum ceruloplasmin concentrations were higher ($P<.05$) in transported vs. non-transported calves on d 7. Commingling did not influence fibrinogen or ceruloplasmin concentrations. Plasma haptoglobin concentrations were higher on d 7 in non-commingled calves compared to commingled calves, regardless of transportation. There was a significant transportation x time interaction, whereas transported calves had lower haptoglobin concentrations on d 3 compared to non-transported calves. These data suggest that the APP response is reactive to the stressors associated with calf weaning and transport.

Key Words: Transportation, Commingling, Calves

147 Effects of orientation on balancing ability during horse transportation.

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Several studies have attempted to determine the effects of orientation on a horse's ability to maintain balance during transportation. The results have often been contradictory because of differences in trailer design and lack of simultaneous comparisons. To determine the effect of orientation on a horse's ability to maintain balance while traveling in the forward or rear-facing direction, horses were transported over a standardized course and each animal's total forward and backward motion during transport was determined. The course consisted of four laps around a 3.6-km rectangular course, each lap reversing direction, totaling 14.4 km. To mimic realistic travel, the course had artificial bumps, three turns (90°, 45°, and 135°), five straight-aways, and a hard stop at the end of each lap. Four separate stalls were mounted in a 16-m long commercial straight-deck trailer (16 wheels). Two forward-facing and two rear-facing horses were transported at the same time to allow for simultaneous comparisons. At the end of the first run, the orientation of each horse was reversed for the second run. A total of twelve horses were transported in each of the two orientations. The trials were recorded using a video camera positioned perpendicular to the length of the horse. During video analysis, a digital scrolling distance reader was placed on the television monitor over the shoulder or hip of the horse to record all forward and backward movement of that point for the entire course. Movement while forward-facing ranged from 4.75 m to 34.48 m, averaging 12.95 m; when rear-facing, movement ranged from 8.13 m to 35.21 m, averaging 16.99 m. Distance moved was not statistically influenced by orientation ($P = .799$) due to high variation between individual horses. Individual horses were relatively consistent in the distance they moved regardless of orientation. Thus, background and the individual characteristics of a horse may play a larger role than orientation in the ability to maintain balance during transport.

Key Words: Horse, Orientation, Transportation

148 Shade and water misting effects on behavior, physiology, performance and carcass traits of heat stressed feedlot cattle.

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Eighty crossbred feedlot heifers were used during Summer, 1999 to assess the impact of heat stress and its relief by shade and water misting on behavior, physiology, performance, and carcass traits. Treatments were: (1) no shading or misting (CONT); (2) only misting (MIST); (3) only shading (SHADE); and (4) shading and misting (SHMI). Head in feed bunk, head in or above waterer, walking, standing, and lying behaviors were observed using a 10-min scan sampling method and analyzed on a daily and hourly basis. Rectal temperature, respiration rate as well as performance and carcass measures were taken. Lying and walking behavior did not differ among treatments, but CONT cattle spent less time ($P < 0.01$) standing than SHADE and MIST cattle. Cattle in the MIST treatment performed less ($P < 0.05$) head-above-waterer behavior than CONT. Rectal temperatures did not differ among treatments, but respiratory rate was lower in shaded than in unshaded heifers ($P < 0.05$). Shaded compared with unshaded heifers had higher DM intake (9.46 vs. 8.80 $\pm$ 0.14 kg/d, $P < 0.01$) and ADG (1.6 vs. 1.4 $\pm$ 0.1 kg/d, $P < 0.01$). Heifers provided with shade reached their target weight 20 d earlier than the unshaded heifers and differed in final live weight (547 vs. 520 $\pm$ 6 kg, $P < 0.01$). Gain:feed, and calculated NEg and NEm concentrations were similar among treatments. Carcass traits were similar among treatments except actual and adjusted preliminary yield grade and hot carcass weight, which were greater for the SHADE heifers ($P < 0.05$). In conclusion, CONT cattle had a physiological and behavioral stress response to heat that negatively affected productivity. Providing shade decreased physiological responses to heat stress and reduced the negative effects of heat on performance, whereas misting was largely ineffective.

Key Words: Cattle, Heat Stress, Shade

149 Reducing pain after dehorning in dairy calves.

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Behavioral responses after dehorning and a sham procedure were investigated in 20 Holstein calves aged 4-8 weeks. Calves either received a non-steroidal anti-inflammatory drug (ketoprofen) before dehorning as well as 2 and 7 h after the procedure, or were assigned to a control group. All calves received a sedative (xylazine) and local anaesthetic (lidocaine) before dehorning or sham dehorning, and responses were scored over 24 h after the procedure. After sham dehorning, behavior of the control and ketoprofen treated calves were similar and frequencies of pain related behaviors (head shaking, ear flicking and head rubbing) were near zero. After hot-iron dehorning, calves treated with ketoprofen also showed little head shaking or ear flicking but control animals showed much higher

frequencies of these behaviors, with both responses peaking 6 h after dehorning. Differences between the treatment groups remained statistically significant ($P < 0.05$) until 12 h (head shaking) and 24 h (ear flicking) after dehorning. A low frequency of head rubbing was observed in both treatment groups, but control calves were more frequently observed engaged in this behavior. There was no statistically significant effect of treatment on any of the other behavioral measures. Calves treated with ketoprofen also tended ($P = 0.07$) to gain more weight (1.2 $\pm$ 0.4 kg) during the 24 h after dehorning than did control calves (0.2 $\pm$ 0.4 kg). These results indicate that ketoprofen, an inexpensive and readily available drug, mitigates pain after hot-iron dehorning in young dairy calves.

Key Words: Well-being, Analgesia, Behavior

150 Effects of exogenous corticosterone during development on the physiology and behavior of chickens. D.C. Lay, Jr.*[1], M.F. Haussmann[1], and M.E. Wilson[2], [1]*Iowa State University, Ames,* [2]*West Virginia University, Morgantown.*

The inability of researchers to control the maternal compounds that may affect the fetus has hindered the elucidation of mechanisms responsible for prenatal stress. Thus, we designed the following experiment to determine if the chicken could be developed as a model for prenatal stress due to its developmental autonomy. On d 16 of incubation, chicks (105 per treatment) were exposed to one of three treatments: 1) 60 ng of corticosterone (CORT), 2) elevated temperature (40.60°C) for 24 h (HEAT), or 3) no treatment (Control). At 7-d of age, 30 chicks per treatment were subjected to an isolation test. Latency to move, vocalization rate and incidence of defecation were recorded. At 14-d of age, a blood sample was obtained and chicks (n=30 per treatment) were weighed and beak-trimmed. Chicks were weighed and sacrificed at 21- and 70-d of age and adrenal glands were collected. Behavioral observations were conducted at 16-wk of age to record agonistic encounters and vocalizations. During the isolation test at 7-d of age, no differences were found for latency to move, vocalization rate, or defecation rate ($P>.20$). Adrenal weight and weight gain during the 7-d post-beak trimming were not different between treatments ($P>.20$); however, CORT chicks were heavier than the HEAT chicks ($P<.005$) but not Control chicks ($P>.20$) at 21-d of age. In addition, plasma corticosterone concentrations tended to be greater for CORT chicks as compared to Control or HEAT chicks ($P<.06$). At 10-wk of age, HEAT chicks had heavier adrenal glands than Control chicks ($P<.006$) but not CORT chicks ($P<.30$), and CORT chicks tended to have heavier adrenal glands than Control chicks ($P<.08$). At 16-wk of age, Control chicks performed more pecking aggression compared to either HEAT or CORT chicks ($P<.01$). Administration of exogenous corticosterone to chicks during incubation replicated some, but not all, of the effects seen in prenatal stress in mammals. Further development of this model may prove invaluable in furthering our knowledge of the mechanism for prenatal stress.

Key Words: Prenatal, Stress, Chicken

151 Monitoring adrenal activity and stress in dairy cows using fecal cortisol metabolites. C. J. Morrow*[1], E.S. Kolver[2], G.A. Verkerk[2], and L.R. Matthews[1], [1]*AgResearch, Hamilton, New Zealand,* [2]*Dairying Research Corporation Ltd., Hamilton, New Zealand.*

The aim of the study was to stimulate adrenocortical activity in dairy cows and measure fecal cortisol metabolites comparing two immunoassays (i) 11-oxoetiocholanolone EIA and (ii) corticosterone RIA. The validity of measuring fecal cortisol metabolites was investigated by demonstrating that (i) injection of ACTH led to a significant increase in plasma and fecal cortisol metabolite concentrations in 5 nonlactating cows, and (ii) the translocation of 4 grazing cows to indoor stalls resulted in a 1.6 fold increase in fecal cortisol metabolite concentrations ($P<0.01$). Plasma cortisol concentrations exhibited a 6-16 fold increase above basal concentrations 30 mins after $ACTH_{(1-24)}$ (0.05 mg i.v; Synacthen) injection ($P<0.001$) and remained elevated for 4.0-4.5 h. Basal fecal cortisol metabolite concentrations were 567.5 $\pm$ 101.8 ng/g and 11.2 $\pm$ 0.8 ng/g feces (mean $\pm$ SEM, $P=0.005$) for the 11-oxoetiocholanolone (measuring 11,17 dioxoandrostanes) and corticosterone assays, respectively. Fecal cortisol metabolites began to increase 8 h after ACTH injection and peaked between 14-18 h at 3565 $\pm$ 188.2 ng/g 11,17 dioxoandrostanes and 33.1 $\pm$ 3.2 ng/g corticosterone. Peak concentrations were more than 2.5 fold higher than basal ($P\leq0.001$ for both assays). Fecal cortisol metabolite concentrations remained elevated for 16 h (range, 11.9-18.5 h). The median digesta transit time between the bile duct and the rectum was 15.8 h (range, 9.6-44.1 h), as measured by transit of 3x5 cm nylon bags inserted via a duodenal fistula. Median transit time was aligned with peak fecal cortisol metabolite excretion. Despite the significantly higher absolute concentrations of cortisol metabolites detected by the 11-oxoetiocholanolone EIA, the response curves of both assays to ACTH injection were parallel and accurately reflected changes in plasma cortisol. Measuring cortisol metabolites excreted in the feces is a useful, alternative approach to evaluating stress in dairy cattle.

Key Words: Dairy cows, Fecal cortisol, Stress

152 Elevation of the percentage of cattle that vocalize is associated with handling and equipment problems in slaughter plants. T. Grandin*, *Colorado State University, Fort Collins.*

Aversive events such as prodding cattle with electric prods will increase the percentage of cattle that will vocalize during movement through chutes, stun boxes and restrainer conveyors. A total of 5,806 cattle were observed in 47 commercial slaughter plants with line speeds of 5 to 390/hr. Each animal was scored as either a vocalizer or a non-vocalizer while it was being moved through the system. In 20 plants (42 percent) 0 to 1 percent of the cattle vocalized, in 12 plants (26 percent) 2 to 3 percent vocalized, in 12 plants (26 percent) 4 to 10 percent vocalized and in 3 plants (6 percent) more than 10 percent vocalized. In two plants 12 percent and 17 percent of the cattle vocalized when they refused to move and they were prodded repeatedly with electric prods. Simple modifications of equipment significantly reduced vocalization percentages in 721 cattle observed in 5 plants (Chi square = 28.6 < .0001). In the five plants, vocalization percentages were reduced from 7 to 2 percent, 8 to 0 percent, 9 to 0 percent, 17 to 2 percent and 23 to 0 percent, respectively. The following modifications were made. In the first plant electric prod voltage was reduced. In the second, third and fourth plants, balking by cattle at the entrance of a conveyor restrainer was reduced by illuminating the entrance or installing a false floor to eliminate the visual cliff effect.In the fifth plant, pressure exerted by a neck restraint device was reduced. In 70 percent (33) of the plants 3 percent or less of the cattle vocalized. All the cattle in these plants moved easily with a minimum of electric use. Scoring the percentage of cattle that vocalize could be used to identify handling problems which may compromise animal welfare.

Key Words: Cattle, Vocalization, Slaughter

153 The use of choice tests to evaluate dairy cow handling practices. E.A. Pajor*[1], J. Rushen[2], and A.M. de Passille[2], [1]*Department of Animal Sciences, Purdue University, West Lafayette, IN,* [2]*Agriculture and Agri-Food Canada, Lennoxville, Quebec.*

Aversive handling of dairy cattle can result in reduced productivity, animal welfare and injuries to animals and handlers. Our objective was to study the aversiveness of dairy cattle handling practices by allowing animals to choose treatments in a y-maze. Animals were first trained to expect one treatment on one side of the maze and another treatment on the other side of the maze. Animals were then allowed to choose between the two sides. In the first experiment we validated the use of the y-maze, using 34 heifers who chose between a) pail feeding vs control b) hit/shout vs control and c) hit/shout vs pail feeding. Calves chose a) pail feeding significantly more often than hitting and shouting ($P<0.001$), b) pail feeding more often than control ($P<0.001$), and c)control more than hit/shout ($P<0.001$). This demonstrates that animals can choose between treatments. In a second experiment, 3 groups of 8 animals were given choices between various handling treatments thought to be aversive a) shout vs hit , b) shout vs electric prod, and c)control versus tail twist. No significant difference was found in any of the three comparisons. In a third experiment 2 groups of 8 cows were used to determine if cows had a preference for hand feeding, or gentling over control. Cows showed no preference between control and gentling treatments but chose hand-feeding significantly ($P<0.05$) more often than control. In a fourth experiment, 24 calves were used to determine if a preference existed for gentling, pail feeding, or hand feeding over control. In contrast to the adult cows, calves showed no preference between control and hand feeding. However, calves chose pail feeding more often than the control treatment ($P< 0.01$). Calves also showed no preference between control and gentling. In a final experiment, 24

cows were used to compare talking in a gentle voice, shouting and control. Cows showed no preference between talking in a gentle voice and control but chose control and talking in a gentle voice more often than shouting ($P<0.05$). The results of these experiments demonstrate that the y-maze is an empirically valid method to compare handling treatments. Cattle show no obvious preference for physical gentling but are sensitive to the quality of the voice used when moving them.

Key Words: Dairy cattle, Behavior, Handling

154 Use of remote bunk monitoring to record effects of breed, feeding regimen and weather on feeding behavior and growth performance of cattle. K. S. SchwartzkopfGenswein[1], D. J. Gibb*[2], R. Silasi[2], S. Atwood[2], and T. A. McAllister[2], [1]*Alberta Agriculture, Food and Rural Development, Lethbridge, AB,* [2]*Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB.*

Thirty Charolais and 29 Holstein steers (432 ± 30 kg) were blocked by weight and breed and randomly assigned to four feedlot pens to study the effects of breed, feeding regimen and weather on feeding behavior and growth. The pens were equipped with radio frequency identification systems that monitored bunk attendance (time, frequency, and duration of visits) by individual animals. In four 21-d periods directly following adaptation to an 80% barley grain:20% barley silage diet, steers were fed to meet ad libitum intake (AL), restricted to 95% of DMI from the previous 21 d (RF), returned to AL, then restricted (RF) once again. Steers were weighed every 21 d for calculating growth parameters. Weather data (air temperature, AT; relative humidity, RH; barometric pressure, BP; and wind speed, WS) were recorded over the 84 d. Charolais steers made fewer visits to the bunk and spent less time there than Holsteins ($P < .0001$), but their ADG and feed efficiency (FE) were higher ($P < .0001$). Bunk visits were less frequent ($P < .0001$) and total daily attendance (TDA) was lower ($P < .0001$) with AL than with RF, irrespective of breed. Charolais and Holstein steers both had higher ($P < .0001$) ADG with AL than with RF, but this did not improve FE. Growth performance was better for Charolais than for Holstein steers on either feeding regimen. Highest TDA values were recorded for Charolais steers during AL ($P < .0001$), and lowest for Holsteins during RF ($P < .0001$). Weather effects varied with feeding regimen and breed. In terms of reduced TDA, Charolais steers were more sensitive than Holsteins ($P < .0001$) to changes in weather (AT, RH and BP), but this did not compromise growth performance. Long term data collection will be required to relate the impact of weather on feeding patterns of feedlot cattle over different seasons and in different geographic locations.

Key Words: Cattle, Behavior, Radio Frequency Identification (RFID)

155 New technology for remote identification and 3D localization of livestock. I. Halachmi*[1,2] and M. Braiman[1], [1]*InfoRay Technologies, Israel,* [2]*SAE Afikim, Israel.*

A novel high frequency range Radio Frequency Identification (RFID) based on passive transponders has been developed and evaluated. Compared with the current state-of-the-art technology on the market the new technology has the following additional features: · The reading distance is more than 40m · The 3D co-ordinations (x,y,z) are available · Up to 1000 tags can be read simultaneously · The uniqueness of the tag is ensured by measuring the behavior of the coded signal. These options can be available to the market at no extra cost compared to the current RFID systems. The 3D coordination of an object is new technology that has potential for tracking and tracing animals. In cooperation with leading research institutions in Europe (IMAG-DLO, Wageningen, Holland) and Israel (Volcani center, A.R.O) an experiment was conducted. The aim of the study was (1) test and report to the public on the potential of the new technology; (2) develop a solution for the attachment of the electronic device to the animal; and (3) develop livestock health and welfare monitoring tools. The experimental farm is located in Kefar Yehoshua (Israel), and the experiment period was September 99 to July 2000. This research is part of a large-scale EU research proposal that has been submitted to EC, Brussels (Belgium). The technology can warn owners that animals have left their intended location as well as enabling efficient and mobile identification of animals from a distance. The potential has been studied for cattle, pig and sheep. The results suggest that the new technology has the potential for (1) monitoring beef cattle activity behavior on pasture; (2) estrus detection in beef cattle as well as dairy cows; (3) cheaper identification in large milking parlors; (4) early detection of health problems; (5) early lameness detection; (6) security and rapid theft detection; (7) contaminated cubicle (mastitis) detection; (8) monitoring and control over food intake; (9) alerting for "sucking cows"; and (10) animal inventory and control throughout the food chain.

Key Words: RFID, Cow, Identification

ANIMAL HEALTH

156 Effect of immunization with ferric citrate receptor FecA from *Escherichia coli* on experimentally induced coliform mastitis. K. Takemura*, J. S. Hogan, and K. L. Smith, *Ohio Agricultural Research and Development Center, The Ohio State University, Wooster, OH.*

The effect of immunization with FecA on intramammary infection and clinical mastitis following intramammary challenge of cows with *E. coli* 727 was investigated. Twenty-one cows were assigned to 7 blocks of 3 cows based on expected parturition. Cows within block were randomly assigned to one of 3 treatments: 1) FecA immunization, 2) J5 immunization, and 3) unimmunized controls. Immunizations were: 1) subcutaneous injection at 14 d prior to drying off, 2) intramammary infusion at 7 d after drying off, and 3) subcutaneous injection at 28 d after drying off. Challenge was by infusion of approximately 50 cfu of *E. coli* 727 into one uninfected mammary gland between 13 and 31 d after parturition. Cows within block were challenged on the same day. FecA immunized cows had greater immunoglobulin (Ig) G titers in serum and in mammary secretion against FecA antigen at calving, immediately prior to challenge, and 7 d after challenge than J5 immunized and control cows. FecA immunization also increased IgG titers against whole-cell *E. coli* 727 antigen in serum and in mammary secretion at calving compared with other treatments. Serum IgM titers against FecA antigen were greater in FecA immunized cows than in other groups immediately prior to challenge. FecA immunized cows tended to have lower bacterial colony-forming units, shorter duration of bacterial isolation in milk from challenged quarters, and lower rectal temperature compared with J5 immunized and control cows. Milk SCC from challenged quarters were greater in FecA immunized cows than in J5 immunized cows at 6 h after challenge. Milk SCC were greater in FecA and J5 immunized cows at 168 h after challenge compared to control cows. Milk production and DMI did not differ among treatments. FecA immunized cows had reduced clinical severity in challenged quarters and shorter duration of clinical symptoms compared with J5 immunized and control cows. FecA was immunogenic in cows, and the antibody response was related to reduced clinical signs following experimental *E. coli* intramammary infections.

Key Words: Mastitis, Vaccine, FecA

157 Evaluation of the California mastitis test for screening dairy cows for intramammary infection at calving. J.M. Sargeant[1], K.E. Leslie*[2], J.E. Shirley[1], M.E. Sheffel[1], G.H. Lim[2], and B.J. Pulkrabek[1], [1]*Kansas State University, Manhattan,* [2]*University of Guelph, Ontario, Canada.*

Monitoring of the prevalence of subclinical intramammary infection status at calving, and the specific pathogens involved, allows producers to evaluate the effectiveness of dry cow programs. However, culturing milk of all cows at the time of calving can be expensive and has not been widely adopted by the dairy industry. California mastitis test(CMT)has not been recommended for use in recently fresh cows. The objective of the present study was to examine the use of CMT for selecting quarters in fresh cows for milk bacteriological examination. Cut-points for defining a positive CMT test and length of time post-calving were evaluated. The study group consisted of 81 cows calving at the Kansas State University research dairy herd, and 50 cows calving at the University of Guelph dairy research herds. Quarter milk samples were collected for standard bacteriological culture on days 1 and 3 post-calving. A positive quarter was defined as one with a bacterial mastitis pathogen present at either day 1 or day 3 post-calving. CMTs were performed at cow side on