

## ENVIRONMENT AND BEHAVIOR

**81 Equine utilization of secondary reinforcements during response extinction and acquisition.** C. A. McCall\* and S. E. Burgin, *Auburn University, Auburn, AL.*

Thirty-eight horses were used to examine equine utilization of a secondary (learned) reinforcement signal. Phase I of the study investigated whether the secondary reinforcement could prolong extinction of a learned task. Phase II utilized the secondary reinforcement to train the horses to perform a new task. Horses were paired by age, sex and breed. All horses were taught to push a lever to obtain a feed reward. One horse of each pair served as the control (CON, feed reward only, no secondary reinforcement) and the other was given a feed reward paired with an auditory buzzer as a secondary reinforcer (SR). In phase I, horses were given 30 trials of continuous reinforcement daily for 3 d. On d 4 and 5, extinction trials occurred in which horses did not receive any feed reward for pushing the lever, but the buzzer was still delivered to SR horses. Extinction of the learned response was defined as 5 min with no lever press. Responses and time to extinction were recorded for each horse. After 2 days of rest, horses were retrained to the lever and this procedure was repeated. In phase II, horses were given 40 reinforcements on a variable-ratio 5 reinforcement schedule for 3 d. On d 4 and 5, the lever was removed and the horses were shaped for 30 min daily to push a flap using the secondary reinforcer. Numbers of reinforcements and responses were recorded for each horse. Data from CON and SR horses in both phases of the study were compared utilizing a paired t-test. No differences were found in responses ( $P > .7$ , or time ( $P > .2$ ) to extinction in phase I. In phase II, SR horses had more reinforcements during shaping on d 4 than CON horses (means = 29.3 and 12.9, respectively,  $P = .02$ ). SR horses also tended to have more responses than CON horses (means = 12.6 and 5.4, respectively,  $P = .14$ ). Results suggest that secondary reinforcements may not prolong extinction of a learned response in horses, however they may facilitate learning.

**Key Words:** Horse, Secondary reinforcement, Learning

**82 The effect of weaning age on behavior of commercial crossbred pigs.** L. M. Hohenshell\*, D. C. Lay, Jr., D. R. Zimmerman, and J. E. Cunnick, *Iowa State University, Ames.*

Segregated- and medicated-early-weaning are technologies used to optimize the health of pigs. However, these practices prevent pigs from satisfying their drive to suckle and therefore, may cause aberrant behaviors that jeopardize the pigs' welfare. Thus, differences in behaviors between early and late weaned pigs were investigated. Early weaned (EW) pigs were taken from their dams at 8 to 13 d of age and late weaned (LW) pigs were taken at 27 to 34 d of age. Pigs were mixed between litters and housed in groups of four in 16 pens (eight pens per treatment). Pig weights were recorded at birth, weaning, and at approximately 42 d of age. Behaviors were recorded using time-lapse photography on 2, 3 and 4 d after weaning. Data were collected for 10 min at 1000 and 1400 to measure frequency of feeding and drinking and time spent play-fighting. Direct observations of each pig were conducted for 5 min at approximately 41 d of age to compare behaviors that included time spent lying, standing, sitting and play-fighting, as well as frequency of belly-nosing, metal biting and manipulation of another pig (nosing, biting, or pushing the head, ear, flank etc.). The EW pigs gained more weight from birth to 42 d of age compared with LW pigs (14.1 vs 10.9 kg, respectively;  $P < .001$ ). Over the 3 d sampling period after weaning, there were no differences between the number of pigs feeding or drinking ( $P > .56$ ). However, time spent play-fighting was greater in EW than LW pigs ( $P < .04$ ). There were no treatment differences during direct observations for time spent lying, standing, sitting, or play-fighting, nor frequency of belly-nosing, or metal biting ( $P > .14$ ). The EW pigs did manipulate pen mates more frequently than did LW pigs (7.2 vs 2.5, respectively;  $P < .01$ ). Increased weight gain, greater incidence of play-fighting, and more manipulations of other pigs may be indicators that early weaning caused pigs to be more active, subsequently influencing performance of a variety of behaviors.

**Key Words:** Swine, Behavior, Wean

**83 Effects of remote and contact weaning on behaviour and weight gain of beef calves.** J. M. Stookey\*, K. S. Schwartzkopf-Genswein, C. S. Waltz, and J. M. Watts, *University of Saskatchewan, Saskatoon.*

Natural weaning in mammals is a normal stage in the transition to independent adulthood. In beef production a newly-weaned animal is denied not only its dam's milk but also social contact with her and other adults. In this study we ask if stress is reduced by allowing calves some access to cows after weaning. At the end of the grazing season (d0), crossbred beef calves (n=139) were weighed and divided into 2 weaning treatments. Contact (C) calves were placed in 2 feedlot pens adjacent to a larger pen into which their dams were placed. They were able to see, hear, smell and touch cows through the adjoining fence, but could not suckle. Remote (R) calves were placed in 2 similar pens and their cows moved 1km away. All calves were fed grain and hay ad libitum. Calves were weighed on d3, 7, 14, 21 and 28. Behaviour was observed on d1 and 2 from 0700 to 1900 and on d4-6 and 8-10 from 0700 to 0900 and 1700 to 1900. Numbers of calves standing still, walking, lying and eating were recorded by 10 min interval instantaneous scan sampling, the number of vocalizations heard in each pen was then counted over 2 min. There were significant day effects (P<.01) for all behaviours for both groups. Calves stood, walked and vocalized more often and ate and lay less on d1 and 2 than on later days. R calves vocalized (P<.01) and walked more (P<.01) on d1 than C calves. On d2, R calves stood (P=.0526) and walked (P<.01) more and lay less (P<.01). There was no difference in the frequency of eating, nor were any treatment differences seen after d2. Between d0 and 3, R calves gained less weight than C (0.74 ± 0.36 kg/day vs 1.66 ± 0.37 kg/day, P<.01). After d3 there was no difference in weight gain between R and C. These results indicate that there is a 2 or 3 day period of adjustment to the stress of abrupt weaning. There are no long-term benefits on growth rate, however on behavioural indicators of comfort, the wellbeing of newly-weaned calves is improved if they are allowed social contact with cows.

**Key Words:** Beef, Weaning, Stress

**84 Behavior of feedlot cattle in a commercial environment throughout the year.** J. Morrow-Tesch<sup>1\*</sup>, J. J. McGlone<sup>2</sup>, J. Dailey<sup>1</sup>, J. K. Blackshaw<sup>2</sup>, A. W. Blackshaw<sup>2</sup>, S. Fullwood<sup>2</sup>, and M. A. Heup<sup>2</sup>, <sup>1</sup>USDA-ARS Livestock Behavior Research Unit, W. Lafayette and <sup>2</sup>Texas Tech University, Lubbock, TX.

A total of 5,565 crossbred (predominantly European) steers in 31 pens were observed hourly for 24-h periods for seven mo (July through January) to quantify their behavior. Cattle were located in a large commercial feedlot in the panhandle of Texas. Average number of steers per pen was 180 and days on feed was 67.7. Live and video observations were collected from the top of an RV about 4 m above the ground. One or two observers noted the behavioral state of each animal. The RV was outfitted with video equipment including monitors, VCR's and a camera attached to a 10 m high rotating tripod. Cattle pens could be observed from inside the lab by using a joy stick to operate the camera. Night vision scopes were used to record nocturnal behavior when the video camera could not be used, thus avoiding the use of artificial lights that might disturb behavior. Behaviors recorded included feeding, drinking, standing, lying, walking, agonistic, bulling and social behavior. Across the seven months of the study, most morning activity was feeding behavior and evening activities were primarily social and aggressive behaviors. Frequencies of drinking (P < .001), standing (P < .001), lying (P = .008), walking (P < .004), agonistic (P < .001) and social (P < .001) behaviors all differed across mo. October was the coldest mo with the occurrence of a blizzard while observations were being taken. During October, cattle spent less time (P < .05) drinking, walking, and in agonistic activities compared to any other mo. These data provide the first undisturbed 24-h summary of commercial cattle behavior in this region and the data-base serves to generate hypotheses to be tested in future studies.

**Key Words:** Cattle, Feedlot, Behavior, Buller steer syndrome

**85 Use of physiological measurement, behavioral observations and vocalizations to determine the aversiveness of electroejaculation in Angus bulls.** B. Voisinet, T. Grandin\*, R. Mortimer, and C. Rusk, *Colorado State University, Fort Collins.*

The aversiveness of electroejaculation in cattle has never been fully examined. The purpose of this study was to determine if electroejaculation is aversive to bulls and determine if the use of a machine which uses lower voltages and a more gradual stimulation curve will be less aversive. Both behavioral and physiological measures were recorded on 69 Angus bulls. The bulls were collected with either a Pulsator II (PII) ( $\bar{x}$  voltage=8.11) or Pulsator III (PIII) ( $\bar{x}$  voltage = 5.46) (Lane Mfg., Denver, CO) manually adjusted machine. Collection with either machine significantly elevated cortisol, creatine phosphokinase, and glucose above pretreatment levels (P<.001). Bulls ejaculated with the lower voltage machine (PIII) had a trend for lower values; cortisol PII, 19.9 ± 1.4 (ng/ml) PIII, 17.4 ± 1.8 (ng/ml) (P=.071) (CPK, PII, 624.0 ± 120.8(IU/L), PIII, 519.9 ± 107.2 (IU/L) (n.s.) glucose, PII 82.4 ± 1.7 (mg/dl); PIII 78.7 ± 1.8 (mg/dl) (n.s.). Vocalizations in the squeeze chute were significantly higher during electroejaculation compared to restraint. The lower voltage PIII machine caused significantly fewer vocalizations compared to the higher voltage machine. The mean number of vocalizations were: restraint 0.15±0.1, PII 8.9 ± 1.1, PIII 3.9 ± 1.0 (P<.001). The higher voltage PII machine significantly increased aversion scores and balking in the crowd pen compared to the low voltage machine, (P=.019). A four point rating scale was used to assess balking and refusal to enter the leadup chute. The scores were, pretreatment 1.00 ± 0, PII 1.5 ± .2 and PIII 1.2 ± .1. These results indicate that electroejaculation is more aversive than restraint in a squeeze chute and the use of the lowest possible voltages will reduce aversiveness. There was also a trend for fewer vocalizations when a skilled veterinarian operated the machine compared to veterinary students.

**Key Words:** Aversion, Electroejaculation, Beef bulls, Welfare

**86 Effect of early sexual experience on the sexual performance of yearling rams: fenceline contact.** E. O. Price\*, M. R. Dally, R. Borgwardt, A. Orihuela, and V. Parthasarathy, *University of California, Davis.*

Previous research has demonstrated that rams given sexual (mating) experience in their first year of life were less likely than sexually-inexperienced rams to exhibit sexual impotence as yearlings. In the present study, rams were given direct exposure to estrous ewes at 7-8 mo of age (N=26), fenceline contact with ewes at 7-8 mo (N=21) or no heterosexual experience (N=27). When initially tested for sexual performance as yearling rams (18-19 mo), 8 of 21 (38%) rams given fenceline exposure to ewes as ram lambs exhibited no sexual interest in estrous females. This level of sexual inactivity was intermediate to control rams given no heterosexual contact as ram lambs (16 of 27 rams inactive - 59%) and rams given the opportunity to mate with estrous ewes as ram lambs (5 of 28 rams inactive - 18%; 4 of the 5 inactive rams had been inactive when exposed to ewes a year earlier). The proportion of impotent inexperienced and mated controls differed (P=.004) but neither of these groups differed significantly from the fenceline-exposed rams. These results confirm the importance of early sexual experience in this species.

**Key Words:** Sheep, Ram, Reproduction, Sexual behavior, Early experience

**87 Effect of stress-related compounds on porcine immune function in vitro.** G. D. Weesner<sup>1\*</sup>, J. R. Flanders<sup>2</sup>, and E. J. Wynveen<sup>2</sup>, <sup>1</sup>USDA-ARS and <sup>2</sup>Purdue University, West Lafayette, IN.

A study was conducted to determine the effects of several stress-related compounds on porcine (p) lymphocyte function. Porcine peripheral blood lymphocytes (PBL) were isolated and suspended in liquid media. Aliquots of the PBL suspension were cultured in microtiter plate wells with or without the addition of the mitogens concanavalin A or phytohemagglutinin. In addition, cells were treated with endogenous opioid peptides (EOP; beta-endorphin, met-enkephalin, and leu-enkephalin, 0-100 ng/well), cannabinoids (anandamide, 0-333 ug/well; WIN 55212-2, 0-50 ug/well; and palmitoylethanolamide, 0-80 ug/well), cortisol (0-5 ng/well) and ovine prolactin (oPRL, 0-2 ng/well). All combinations of mitogens and stress-related compounds were replicated in triplicate. PBL function was assessed by the proliferative response to the mitogens and stress hormone treatments. After 48-72 h of incubation, proliferation was terminated and cell numbers were determined by colorimetric analysis. As expected, cortisol decreased basal and mitogen-induced lymphocyte proliferation in a dose dependent manner ( $P < .01$ ). Likewise, the cannabinoids anandamide ( $P < .05$ ) and WIN 55,212-2 ( $P < .01$ ), as well as oPRL ( $P < .01$ ) inhibited lymphocyte proliferation showing dose dependence. None of the EOP compounds affected basal or mitogen-stimulated proliferation ( $P > .2$ ). This lack of effect indicates that these peptides either have no effect on cell proliferation, or that the dosage was insufficient to cause an effect. Overall, these results demonstrate that cortisol and cannabinoids, both stress-related compounds, have suppressive effects on porcine lymphocyte function.

**Key Words:** Swine, Stress, Immunology

**88 Recombinant bovine prolactin effects in prepubertal and adult rats at different ambient temperatures.** P. A. Eichen<sup>1\*</sup>, D. E. Spiers<sup>1</sup>, K. E. Westhoff<sup>1</sup>, and J. C. Byatt<sup>2</sup>, <sup>1</sup>University of Missouri, Columbia, <sup>2</sup>Monsanto Agricultural Co., St. Louis, MO.

Previous studies have shown that injection of adult rats with bovine somatotropin or placental lactogen improves growth in heat-challenge conditions. The present study was conducted to determine growth promotant activity of recombinant bovine prolactin (rBPRL) as a function of age and ambient temperature ( $T_a$ ). Female rats at 50 (n = 59) or 100 days of age (n = 60) at either thermoneutral (TN; 21°C) or heat-challenge (HC; 31°C)  $T_a$  received daily ip injection of either rBPRL (2 mg/kg BW) or sterile water. All injections were for 10 days. Body weight and food consumption were recorded daily, with measurements of resting metabolic rate and body temperatures on the last injection day. Determinations of fat free mass (FFM), total body water (TBW) and mass of selected organs relative to body mass were made one day later. In prepubertal rats, rBPRL treatment did not alter body weight gain or feed intake. FFM, TBW and liver mass were not affected by rBPRL, but were decreased in HC rats. Reproductive tract mass was not altered by  $T_a$ , but was increased in rats receiving rBPRL compared to control rats ( $P \leq .01$ ). Metabolic rate decreased ( $P \leq .002$ ) and tail-skin temperature increased ( $P \leq .0001$ ) from 21 to 31°C, but were not affected by rBPRL treatment. Adult rats treated with rBPRL increased body weight above control level only under TN condition ( $P \leq .04$ ). FFM and TBW were lower in HC rats compared to TN rats ( $P \leq .0001$ - $.0002$ ), but not affected by rBPRL treatment. In general, organ mass was not altered by rBPRL treatment, but spleen mass was greater in rBPRL rats ( $P \leq .0002$ ). Metabolic rate decreased ( $P \leq .0001$ ) and tail-skin temperature increased ( $P \leq .0001$ ) from 21 to 31°C, but was unaffected by rBPRL treatment. These results show that rBPRL has age- and  $T_a$ -dependent effects in rats, but is a less effective stimulant of growth than previously-tested promotants.

**Key Words:** Prolactin, Development, Heat stress

**89 Relationships among behavior and reproductive traits in swine.** K. M. Irvin, *The Ohio State University, Columbus.*

The objectives were to measure sow behavior and to evaluate relationships between sow behavior and objectively measured reproductive traits. Behavior traits (subjectively measured) were sow temperament with offspring (STP), temperament with workers (STW), farrowing ease (EASE), milking problems (MILK), overall mothering score (OMS) and crate adaptability score (CAS). Scores were at birth or 21 d. Scores were 1 (desirable), 2 or 3. Objectively measured traits included number born alive (NBA), birth weight (BWT), number at 21 d (N21) and 21 d weight (21WT). Sows farrowed in raised crates. Air temperatures averaged 20°C and weaning was at 28 d. Duroc and Landrace sows (270 litters) of multiple parities were in trial 1. Highly significant ( $P < .01$ ) correlations were found between OMS and NBA (-.37), N21 (-.64), BWT (-.28), 21WT (-.20), STP (.21), EASE (.23) and MILK (.31). Highly significant correlations ( $P < .01$ ) were between STP and 21WT (-.20) and STP and MILK (.71). A desirable overall mothering score was associated with more offspring at birth and 21 d, with heavier birth and 21 d weights and an ability to accept her pigs, have an easier farrowing and no milking problems. Yorkshire and Large White sows (36 litters) of multiple parities were in trial 2. Highly significant ( $P < .01$ ) correlations were found between OMS and 21WT (-.68), EASE (.46), MILK (.50) and CAS (.68). Other correlations included OMS and NBA (-.37,  $P = .03$ ) and STW (.19,  $P = .29$ ). CAS was correlated with 21WT (-.48,  $P < .01$ ) and with MILK (.64,  $P < .01$ ). The ability of sows to adapt to a crate was desirably related to heavier 21 d weights, to no milking problems and with a superior overall mothering score. Behavior in sows can be measured subjectively, is significantly associated with objectively measured reproduction traits and can be used to enhance evaluation accuracy.

**Key Words:** Behavior, Pigs, Reproduction

**90 Interleukin-6 and prostaglandin  $E_2$  responses of ovine anterior pituitary cells to bacterial endotoxin.** E. L. Knoppel, S. K. Chapes, and J. E. Minton\*, *Kansas State University, Manhattan.*

We established that bacterial endotoxin (END) stimulated interleukin-6 (IL6) secretion from cultured porcine anterior pituitary (AP) cells, and that END stimulated IL6 by a cyclooxygenase-dependent mechanism. Here, we extend those findings to sheep AP cells, and establish that folliculostellate (FS) cells of the sheep AP are major secretors of prostaglandin  $E_2$  (PGE) in response to END. Wether AP were obtained immediately after exsanguination, and subjected to enzymatic and mechanical dispersion. Cells from 3 to 4 AP were pooled in media with 10 % fetal bovine serum, plated at  $4 \times 10^5$  cells/well, and cultured at 37 C for 4 d. Wells containing cultured cells were washed with serum-free media, and treatments applied (in serum-free media) for various times, depending on the experiment. Culture media were harvested at the conclusion of the experiment, and frozen until IL6 and PGE analyses. Treatment was the sole source of variation in the statistical model. In the first experiment, cells were exposed to 0 to 10  $\mu\text{g/ml}$  END for 24 h. END stimulated PGE at 1 and 10, and IL6 at .1, 1 and 10  $\mu\text{g/ml}$  compared to untreated cells ( $P < .001$ ). In the second experiment, cells were exposed to 0 or 10  $\mu\text{g/ml}$  END for 6, 12, 18, or 24 h. END stimulated PGE accumulation in media compared to control wells at 6, 12, 18 and 24 h ( $P < .01$ ), whereas IL6 was increased by END treatment only after 12, 18 and 24 h in culture ( $P < .001$ ). In a third experiment, PG production in response to END was evaluated in AP cultures enriched in FS cells (+FS), and compared to populations depleted of FS cells (-FS) or unselected control cells. END stimulated ( $P < .05$ ) PGE in +FS cells at .01  $\mu\text{g/ml}$ , whereas 10  $\mu\text{g/ml}$  END was required to stimulate PGE ( $P < .001$ ) in -FS cultures. The data suggest that bacterial END stimulates PGE and IL6 secretion in ovine AP cells in vitro, and that AP FS cells (thought to be the source of AP IL6) secrete PGE robustly in response to END.

**Key Words:** Anterior pituitary, Interleukin-6, Prostaglandin  $E_2$