based on wheat, corn, and soybean meal and variation in CP content was achieved by substituting soybean protein isolate by corn starch and free amino acids (lysine, methionine, tryptophan, threonine, isoleucine and valine). Six blocks of two littermate barrows were used at each stage. Littermates received either the NP or the LP diet. Performance, nutrient digestibility, energy, protein and fat balance, and components of HP (indirect calorimetry) were measured for 10 d in pigs housed individually at 24C and fed four meals daily at about 90% of their ad libitum intake; feed intakes were similar within a litter. Performance was not affected (P>.05) by diet characteristics (915 g/d for ADG and 2.17 for FCR) and differed between stages. Nitrogen gain was lower (P<.05) at stage 1 (24.2 g/d) than at stages 2 and 3 (26.6 g/d) and lower for diet LP (24.5 g/d) than for diet NP (27.0 g/d). When adjusted for identical ME intake (2570 kJ/(kg BW)$^{.60}$/d) and physical activity, HP was higher (P<.01) for diet NP (1402 vs 1350 kJ/(kg BW)$^{.60}$/d for diet LP) and at stages 2 and 3 (1404 vs 1320 kJ/(kg BW)$^{.60}$/d at stage 1). The lower HP at stage 1 was due to a lower (P<.01) fasting HP (661 vs 766 kJ/(kg BW$^{.60}$/d at stages 2 and 3). The HP difference between diets was not affected by stage of growth and is equivalent to the difference in thermic effect of feed between diets (17.9 and 16.0% of ME for diets NP and LP, respectively). The activity related HP represented 8.1% of ME intake. These results confirm the interest of using a NE system as a basis for formulation of pig feeds.

Key Words: Pig, Crude protein, Heat production

Physiology: Uterus, gamete, embryo, and growth

561 Sheep oviductal secretory glycoprotein and mRNA expression in prepubertal ewe lambs, and mature ewes after natural or progestin-synchronized estrus. J. G. Berardinelli*[1] and D. Burgess[1], [1]*Montana State University, Bozeman.*

Expression of sheep oviductal secretory glycoprotein (sOSP) and mRNA in the ampulla (AMP) and isthmus (IST) were evaluated in prepubertal ewe lambs (PP; n = 5), mature ewes that exhibited natural estrus (MNE; n = 4), and mature ewes synchronized with progestin (MSE; n = 5). Salpingectomies were preformed aseptically 24 h after estrus for MNE and MSE ewes, and 18 h after feed and water removal for PP ewes. Utero-tubal, isthmic-ampullary, and ampullary-infundibular junctions of each oviduct were ligated to prevent fluid transfer among segments. Sections (4 mm) of mid-ampulla and mid-isthmus of one oviduct were frozen immediately in OCT for immunocytochemical analyses. Mucosa of the AMP and IST of the other oviduct was scraped with sterile mRNAase-free slides. Scrapings were placed into 1 mL of TRIzol® reagent and flash frozen in liquid N_2 for mRNA expression analysis. Sections (5 μm) of AMP and IST were treated with a primary rabbit antibody specific for sOSP, followed by a FITC donkey anti-rabbit second antibody, and visualized by fluorescence microscopy. Real-time RT-PCR, using forward and reverse primers for sOSP, was used to determine the presence of sOSP mRNA in each segment. Immunofluorescent staining showed that sOSP was present at the mucosa-lumen interface of the AMP and IST in 100% of PP, MNE, and MSE ewes. Relative fluorescent density (RFD; 0 = black; 3 = intense green) of AMP and IST sections did not differ (P < 0.05) among PP, MNE, or MSE ewes. RFD was greater (P < 0.05) in the AMP than in the IST. Sheep OSP mRNA was present in the AMP of every ewe (100%). There was no indication of mRNA expression for sOSP in the IST of any ewe (0%). We conclude that sOSP is present in the muscosa of the AMP and IST; however, sOSP mRNA is expressed only in cells of the AMP. Presence of sOSP in the AMP and IST, and mRNA for sOSP in the AMP was not affected by progestin synchronization or sexual development in sheep.

Key Words: Sheep oviduct secretory glycoprotein, Sexual development, Synchronization

562 Mifepristone treatment on d 2 of pregnancy decreases uterine capacity in swine. J. L. Vallet* and R. K. Christenson, *USDA, ARS, US Meat Animal Research Center.*

Progesterone treatment on d 2 and 3 of pregnancy accelerated conceptus development and uterine protein secretion and decreased uterine capacity. By contrast, treatment with mifepristone (RU486), a progesterone antagonist, on d 2 of pregnancy decreased uterine protein secretion and conceptus development. The objective of the following experiment was to determine the effect of RU486 on uterine capacity. Gilts were unilaterally ovariohysterectomized (UHO) at 160 d of age, observed for estrus starting at 200 d of age, and mated after at least one estrous cycle of normal length (17 to 23 d). Gilts then received either corn oil (CO, n = 47) or RU486 (400 mg in CO, n = 44) intramuscularly on d 2 of pregnancy. Gilts were slaughtered on d 105 and blood was collected from each fetus to measure fetal hematocrit. Each fetus, its associated placenta and each fetal heart, liver, and brain was weighed. The number of gilts remaining pregnant, mean fetal hematocrit and mean fetal heart and brain weight did not differ between treatments. Uterine capacity (litter size in UHO gilts) was significantly less (4.7 ± 0.4 and 7.3 ± 0.3, respectively; P< 0.01) in RU486-treated gilts than in CO gilts. Fetal weights (907 ± 18 and 859 ± 17, P = 0.05) and fetal liver weights (23.9 ± 0.8 and 21.5 ± 0.8, P < 0.05) were greater in fetuses of RU486-treated gilts compared to CO gilts. The number of fetuses weighing >900 g (2.5 ± 0.3 and 2.7 ± 0.3) and the number of placentas weighing >225 g (2.0 ± 0.3 and 2.2 ± 0.3, respectively) did not differ between treatments. In contrast, the number of fetuses weighing <900 g (2.2 ± 0.4 and 4.6 ± 0.4) and the number of placentas weighing <225 g (2.8 ± 0.4 and 5.0 ± 0.4, respectively) were less (P < 0.01) in RU486-treated gilts than in CO gilts. Thus, RU486 decreased uterine capacity, primarily by reducing the number of smaller conceptuses at d 105 of gestation. These results, combined with previous results, suggest that optimal uterine capacity is associated with an optimal progesterone concentration on d 2 and 3 of pregnancy.

Key Words: Progesterone, RU486, Fetus

563 Molecular cloning and endometrial expression of porcine high density lipoprotein receptor SR-BI during the estrous cycle and early pregnancy. J. G. Kim*, J. L. Vallet, and R. K. Christenson, [1]*USDA, ARS, U.S. Meat Animal Research Center, Clay Center, NE.*

Rapid development of the placenta and fetus is associated with elevated levels of circulating high density lipoprotein (HDL) in humans. HDL receptor SR-BI (CD36L1) mediates selective cholesterol uptake and it is expressed in the human placenta. Endometrial expression of HDL receptor SR-BI mRNA has not been studied. We hypothesized that HDL receptor SR-BI may be expressed in porcine endometrium to take up maternal HDL cholesterol during early pregnancy to support endometrial development. The objectives of this study were to 1) clone and sequence the full coding region for HDL receptor SR-BI and 2) characterize SR-BI gene expression in the endometrium during the estrous cycle and early pregnancy in swine. By iterative screening of a porcine expressed sequence tag library, we obtained a clone (2601 bp, GenBank AF467889) containing the full coding region of HDL receptor SR-BI. Percent identities of porcine SR-BI amino acid sequence with bovine, human, mouse and rat SR-BI were 88, 87, 80 and 79%, respectively. Endometrial expression of SR-BI mRNA in White composite gilts (n=3 to 4) was determined by Northern blotting using total RNA from d 10, 13 and 15 cyclic and from d 10, 13, 15, 20, 30 and 40 pregnant gilts, followed by densitometry. There was an interaction (status x day) in SR-BI mRNA expression (P<0.01). In cyclic gilts, endometrial expression of SR-BI mRNA did not change between days 10 and 13, and increased (P<0.01) between d 13 (84.4±10.8 arbitrary units) and 15 (151.7±9.3). In pregnant gilts, endometrial expression of SR-BI mRNA increased (P<0.01) between d 10 (100.0±9.3) and 13 (140.5±9.3), remained elevated until d 30 (157.5±10.9), and decreased (P=0.015) on d 40 (113.4±10.8). These results show that endometrial SR-BI mRNA expression is temporally regulated during early pregnancy and the estrous cycle. This pattern of gene expression suggests that HDL receptor SR-BI plays a role in endometrial function during the estrous cycle and early pregnancy in swine.

Key Words: Endometrium, Early pregnancy, Cholesterol uptake

564 Timing of dinitrophenol treatment during in vitro culture of bovine embryos. J. F. De La Torre-Sanchez* and G. E. Seidel, Jr., *Colorado State University, Fort Collins, CO USA.*

Dinitrophenol (DNP) uncouples oxidative phosphorylation (OXP) and reduces glucose oxidation in in vitro-cultured embryos. Partial inhibition of OXP by DNP is beneficial for porcine and bovine embryos around the time of compaction. In this work we evaluated effects of timing

of DNP treatment on bovine embryo development in vitro. Slaughterhouse oocytes were matured and fertilized in vitro by standard procedures. Presumptive embryos were cultured in CDM (similar to SOF) plus nonessential amino acids and 10 μM EDTA for 2 d, and 8-16 cell embryos were randomly allocated to a 3 x 3 factorial design with factors dose: 90, 30, and 10 μM DNP, and time (Early= culture in DNP for 2.5 d, no DNP for 2.5 d; Late= culture in DNP only the last 2.5 d; and All= culture in DNP the whole 5-d period). Culture was in CDM plus nonessential and essential amino acids and 2 mM glucose (CDM-2). An additional well with no DNP for 5 d was included as a control. The experiment was replicated 3 times with semen from each of 3 bulls. After culture, embryos were evaluated for % of blastocysts, stage of development, morphological quality, and degree of lightness/darkness as a measure of lipid content. Data were analyzed by ANOVA, with factors time (3), DNP (3) and bulls (3). Time and DNP also were compared separately with the control. Early culture with DNP produced more advanced ($P<0.01$) and lighter ($P<0.05$) embryos than Late culture with All culture embryos showing intermediate values; embryos cultured in 90 μM DNP were less advanced ($P<0.01$) and tended to be darker ($P=0.07$) than embryos cultured in 30 or 10 μM DNP. When time and DNP were compared with controls, embryos in the Early group and in 30 μM DNP tended to produce more blastocysts than controls (Early 48% vs control 35% ($P=0.09$), 30 μM, 48% vs control, 35% ($P=0.06$). 30 μM DNP during precompaction culture (from 8-16 cell to compact morula stages) was beneficial for postcompaction embryo development.

Key Words: Dinitrophenol, Embryo, Bovine

565 Two-step vitrification and in-straw dilution of in vitro produced bovine embryos. L. F. Campos-Chillon*[1], J. F. de la Torre-Sanchez[2], and G. E. Seidel, Jr.[2], [1]*College of Veterinary Medicine and Biomedical Sciences, Colorado State University,* [2]*Animal Reproduction and Biotechnology Laboratory, Colorado State University.*

This study was aimed at developing a simple, two-step vitrification procedure that permits in-straw dilution so that embryos can be transferred directly. The factorial design included two embryological stages (morula and blastocyst), three equilibration times (1, 2 and 3 min) and two loading temperatures (4 and 24°C). A total of 775 grade 1 morulae and blastocysts sired by three bulls were obtained in six replicates. Briefly, oocytes were aspirated from 2-8 mm follicles from slaughterhouse ovaries, matured in vitro, and fertilized and cultured with standard procedures. We preloaded 0.25-ml straws with a 1 cm column of DHCDM (0.5 M galactose in a Hepes-buffered medium similar to SOF), then 0.5 cm air, and then 7 cm of DHCDM. Embryos were transferred to 1 ml of V1-CDM (3.5 M ethylene glycol in HCDM) for 1, 2 or 3 min at 24°C. Next, embryos were moved in 1 μl into a 10 μl droplet of V2-CDM (7 M ethylene glycol, 0.5 M galactose, 18% w/v Ficoll 70 in HCDM) at 24°C or at 4°C. In less than 1 min, the droplet containing embryos was loaded, followed by 0.5 cm air and 1 cm of DHCDM. The straw was sealed and plunged slowly into liquid nitrogen. Straws were thawed in air (24°C) for 10 sec and then in water at 20°C until ice disappeared. Straws were gently shaken to mix columns; then, embryos were placed in CDM + 5% FCS for 72 h. Data were arc sin transformed, analyzed by ANOVA, and means tested with Tukey's hsd. Room temperature was superior to 4°C for equilibrating embryos for vitrification. At 24°C (Table 1), 1 min equilibration was best for morulae, but 3 min equilibration was best for blastocysts.

Table 1. Expansion and hatching rates of vitrified embryos equilibrated at 24°C

	Morulae		Blastocysts	
Equilibration time (min)	% Expansion	% Hatching	% Expansion	% Hatching
1	57^{b}	23^{a}	55^{a}	29^{a}
2	37^{a}	12^{a}	65^{a}	41^{ab}
3	40^{ab}	14^{a}	82^{b}	60^{b}
Non-vitrified control	65^{b}	25^{a}	84^{b}	45^{b}

^{a,b} Values within columns without common superscripts differ ($P<0.05$).

Key Words: Embryo, Vitrification, In vitro

566 The size of the morula and the timing of blastocyst formation influence the resistance of bovine blastocysts to pro-oxidant agents. J. M. Feugang*, I. Donnay, F. Dessy, and A.-S. Lequarre, *Veterinary Unit, Catholic University of Louvain, 1348 Louvain-la-Neuve.*

In previous studies (Feugang et al., Theriogenology 55, 1, 2001), we showed that exposure of bovine embryos from the morula stage to pro-oxidants induced the degeneration of some blastocysts while the others remained unaffected. The degeneration process was only observed at day 7.5 post-insemination (pi) with no sign before. Here, the two populations of blastocyst (degenerated or resistant) were further characterized using time-lapse cinematography. In vitro produced zygotes were cultured under 5% O_2 in SOF medium with 5% FCS. At Day 5 pi (120 hpi), morulae were collected and cultured in a cinematography chamber in the same medium containing 0.01 mM 2,2#-azo amidinopropane (AAPH), an exogenous radical generator, or 0.4 mM buthionine sulfoximide (BSO), an inhibitor of glutathione synthesis. Frames were recorded every 4 min during 72 h. For each embryos developing to the blastocyst stage, the timings of cavitation and expansion as well as the diameter of the morula (including the zona pellucida) were recorded. The proportion of morulae reaching the blastocyst stage and of degenerated blastocysts on Day 8 pi (192 hpi) were similar with both pro-oxidants (84% and 50% for AAPH - 91% and 54% for BSO; Chi square $P\geq0.05$). Cinematographic analysis showed that, for both pro-oxidants, the population of resisting blastocysts derived from morulae with a larger mean diameter (Table 1). These resisting blastocysts also had started earlier their cavitation process and had a tendency to expanse more rapidly than degenerated ones ($P\geq0.05$). These results suggest that the capacity of a blastocyst to resist to oxidative stress depends on the morula size and the kinetics of blastocyst formation. Because the diameter of an embryo remains quite unchanged from the oocyte up to the morula stage, it is likely that blastocyst resistance can be correlated with the diameter of the oocyte from which it was derived. Further studies are needed to confirm this hypothesis and evaluate if a selection can be performed prospectively on those parameters.

Table1. Effects of pro-oxidants on the kinetic of bovine morula/blastocyst transition.

	AAPH-exposed embryos		BSO-exposed embryos	
	Survived	Degenerated	Survived	Degenerated
External diameter of morulae (μm)	161 ± 1^{a}	156 ± 1^{b}	161 ± 2^{a}	152 ± 1^{b}
Timing of cavitation (hpi)	134 ± 1^{a}	141 ± 2^{b}	136 ± 2^{a}	143 ± 2^{b}
Timing of expansion (hpi)	145 ± 2^{a}	152 ± 4^{a}	144 ± 2^{a}	149 ± 2^{a}

Data were analyzed by ANOVA 1 and expressed as meansem. ^{a,b} Values significantly different within the same pro-oxidant ($P\leq0.05$). Total of 3 replicates (45 emryos for each pro-oxidant).

Key Words: Bovine embryo, In vitro production, Oxidative stress

567 Physiology of pregnancy and calving characteristics of Holstein cows bred to Holstein or Gir (*Bos indicus*) sires. S. J. Schmidt*[1], B. S. Gandy[1], F. Hoholm[1], K. Graves[1], J. White[1], and S. T. Willard[1], [1]*Mississippi State University, Mississippi State, MS.*

The crossbreeding of Holstein dairy cows with Gir, which has a higher milk production potential than many other *Bos indicus* breeds, has not been evaluated extensively in the U. S., nor have the physiological characteristics of such crossbreeding efforts been documented completely. The objective of this study was to evaluate the physiology of pregnancy and calving characteristics of Holstein cows (n = 36) bred (AI) to Holstein (H) or Gir (G) sires. Blood serum samples were collected at 14-d intervals from 60 days of gestation to calving for evaluation of the effects of breed of sire on serum concentrations of progesterone (P4; quantified by RIA). Placentome measurements were also recorded at 14-d intervals during gestation using transrectal ultrasonography between 45 and 180 days of pregnancy. Following calving, placentas were collected (H: n = 5; G: n = 5) for analysis of cotyledon size, weight and number, and total placental weight. A calving difficulty score (1 = no difficulty, 5

= caesarian) and calf vigor score (1 = alert, 5 = dead) was assigned at calving, and calf birth weight and sex recorded. Overall (from week -32 to calving), serum concentrations of P4 were higher ($P < 0.05$) in Holstein cows bred to H sires (5.5 ± 0.16 ng/ml) than Holstein cows bred to G sires (4.8 ± 0.20 ng/ml), and did not differ ($P > 0.10$) relative to sex of calf. Placentome surface area increased ($P < 0.01$) during gestation ($r = 0.62$), but did not differ ($P > 0.10$) between H- and G-sired cows. Calf birth weights did not differ ($P > 0.10$) by sire breed (H vs. G), however G bull calves were heavier (48.1 ± 3.0 kg) than G heifer calves (37.3 ± 1.7 kg); H bulls and heifers did not differ ($P > 0.10$) in birth weight (46.0 ± 2.3 and 41.0 ± 2.3 kg, respectively). Gestation length (281.3 ± 1.4 vs. 284.0 ± 2.3 d), placental weight (4.5 ± 0.38 vs. 5.0 ± 0.51 kg), cotyledon surface area (91.8 ± 10.7 vs. 94.6 ± 7.9 cm^2) and weight (24.8 ± 1.8 vs. 24.6 ± 1.5 g), calf vigor score (1.6 ± 0.30 vs. 1.6 ± 0.24) and calving difficulty score (1.3 ± 0.14 vs. 1.4 ± 0.15) did not differ ($P > 0.10$) between H- and G- sired cows, respectively. In summary, while serum concentrations of P4 were slightly higher for H- than G- sired Holstein cows, all other gestational and calving parameters quantified were not affected by breed of sire.

Key Words: Holstein, Bos indicus, Pregnancy

568 Marked physical changes occur in yearling beef bulls during natural breeding. R. W. Ellis*[1], G. P. Rupp[1], P. J. Chenoweth[2], L. V. Cundiff[3], and D. D. Lunstra[3], [1]*Great Plains Veterinary Educational Center, University of Nebraska, Clay Center, NE,* [2]*Kansas State University, Manhattan, KS,* [3]*USDA, ARS, US Meat Animal Research Center, Clay Center, NE.*

To assess changes in body condition score (BCS), body weight (BW), scrotal circumference (SC), mating activity, and semen quality during natural breeding, 74 yearling (15 to 16 mo) beef bulls were evaluated biweekly before, during, and after a 63-d pasture breeding period (mid-June to August). Bulls used for breeding (UFB; n = 60) were compared to control bulls not used for breeding (NFB; n = 14). For multiple sire breeding, subgroups of 9 to 10 UFB bulls were exposed to cows at a bull/cow ratio of 1:20 in 80- to 160-acre pastures. At the start of observations, all bulls averaged 6.1 ± 0.1 BCS, 554 ± 5 kg BW, 36.3 ± 0.2 cm SC. In UFB bulls during the 63-d breeding period, BW decreased 73 ± 3 kg ($P < 0.001$; range = -25 to -103 kg), BCS declined 1.5 ± 0.1 units ($P < 0.01$; range = -1.0 to -2.5 units), and SC decreased 1.4 ± 0.2 cm ($P < 0.01$; range = -0.5 to - 4.0 cm), compared to values observed in NFB bulls. Percentage of normal spermatozoa decreased in both UFB and NFB bulls through the observation period. In general, mating proficiency increased and abortive mounting activity decreased as UFB bulls gained mating experience. In UFB bulls, 75% (n = 45) incurred musculoskeletal (n = 38) or reproductive (n = 7) injuries and 42% (n = 19) of the injuries were classified as major (> 4-d duration). Pregnancy palpation of cows from each breeding pasture at 65- to 87-d post-breeding indicated 91 to 95% pregnancy rates (paternal parentage will be determined after calves are born). We conclude that yearling beef bulls used for multiple-sire natural mating exhibit surprisingly high injury rates and large losses in body weight and testis size with declining semen quality during the breeding season. Additional emphasis on increased management and supplemental nutrition is needed in beef bulls used for multiple-sire breeding, and the impacts of injury rate and losses in BW and SC upon individual bull fertility remain to be elucidated.

Key Words: Beef bulls, Natural mating, Testes

569 Semen and libido characteristics in boars given repeated injections of Lutalyse. M. J. Estienne* and A. F. Harper, *Virginia Polytechnic Institute and State University, Blacksburg, VA.*

The objective was to determine the effects of repeated injections of Lutalyse (Pharmacia and Upjohn, Kalamazoo, MI) on semen and libido characteristics in terminal-line boars (1.5 yr of age). Semen was collected once weekly from wk 0 to 21. Gel-free semen volume and gel weight were determined gravimetrically, and sperm concentration, the percentage of motile sperm cells, and sperm velocity were determined using an integrated visual optical system (Hamilton Thorn Research, Beverly, MA). From wk 5 to 21, boars received an i.m. injection of 10 mg Lutalyse (n = 11) or 2 mL vehicle (n = 11) immediately prior to entering the collection room. Gel weight (36.5 ± 0.8 g), sperm concentration (0.33 ± 0.01 billion/mL), total sperm cells (66.2 ± 1.2 billion), motile sperm cells (69.5 ± 1.0 %), and sperm velocity (129.7 ± 1.2 um/sec), were affected by time ($P < 0.01$), but not by treatment or treatment x time ($P > 0.1$). The percentage of morphologically normal sperm cells, assessed at wk 21, was similar ($P > 0.1$) between groups (80.8 ± 1.0). Gel-free semen volume was similar ($P > 0.1$) between groups from wk 0 to 5 (191.3 ± 5.4 mL), but tended to be lower (by up to 23 %) in Lutalyse-treated boars from wk 5 to wk 21 (treatment x time, $P = 0.08$). Libido was evaluated from wk 5 to 21. There was an effect of treatment ($P = 0.04$), but no effect of time or treatment x time ($P > 0.1$) on the period from injection to the first attempt to mount the artificial sow (182.8 ± 30.9 s and 89.3 ± 30.9 s, for Lutalyse- and control boars, respectively). Duration of ejaculation was affected by treatment ($P < 0.01$; 472.0 ± 43.1 s and 280.4 ± 43.1 s, for Lutalyse- and control boars, respectively) and time ($P < 0.01$), but not by treatment x time. The period from injection to the start of ejaculation (225.6 ± 9.1 s) and false mounts (0.8 ± 0.1) were not affected by treatment, time or treatment x time ($P > 0.1$). Overall, there were no dramatic positive or negative effects of long-term treatment with Lutalyse on semen quality and libido in boars.

Key Words: Lutalyse, Semen, Boars

570 Breed effects on immune and endocrine profiles in growing pigs. M. A. Sutherland*, M. Ellis, and J. L. Salak-Johnson, *University of Illinois, Urbana-Champaign, IL.*

The objective of this study was to determine effects of breed and age on baseline immune and endocrine measures, Meishan (n=54), Landrace (n=36), Yorkshire (n=36), Berkshire (n=36) and Duroc (n=18) piglets were weaned at 17 to 21 d and kept in a common facility. Littermates were adjusted to the new environment ≥ 7 d prior to initial blood sample. Samples were obtained via venipuncture at 4, 8 and 12 wk of age to determine plasma cortisol (CORT), chemotaxis (CHTX), phagocytosis, natural killer cytotoxicity (NK), lymphocyte proliferation (LPA), total white blood cell (WBC) and leukocyte differentials. At 4, 8 and 12 wk baseline plasma CORT level was greater ($P < 0.0001$) in Meishan than Yorkshire, Landrace or Berkshire pigs. Durocs had higher ($P < 0.0001$) basal CORT level at 4 and 12 wk compared to Yorkshire, Landrace or Berkshire pigs. Berkshires had a higher ($P < 0.0001$) neutrophil count at 4 wk than any other breed, but there were no other breed or age effects on total WBC or lymphocyte cell counts. At 8 wk of age, Yorkshires had greater ($P < 0.05$) neutrophil phagocytosis than Landrace, Duroc or Meishan pigs. Neutrophil CHTX in response to human C5a was lower ($P < 0.05$) in Berkshires at 4 wk than in Duroc, Landrace or Meishan pigs. At an E:T ratio of 50:1, NK activity was higher ($P < 0.05$) in Yorkshires than in Landrace or Duroc pigs. There were breed and age effects ($P < 0.0001$) for leukocyte differentials. In addition, Meishans gained less ($P < 0.05$) weight after 8 and 12 wk than Duroc, Landrace or Yorkshire pigs. These results indicate that breed and age significantly affect both baseline immune and endocrine traits.

Key Words: Immune, Swine, Breeds

571 Assessments of velvet antler growth rates using digital infrared thermography in red deer stags. S. Bowers*[1], S. Gandy[1], D. Neuendorff[2], T. Dickerson[1], S. Mozisek[2], R. Randel[2], and S. Willard[1], [1]*Mississippi State University, Mississippi State, MS,* [2]*Texas A&M University - TAES, Overton, TX.*

Velvet antler (VA), a by-product of the deer farming industry, is usually harvested based on morphology, conformation and size. However, the use of Digital Infrared Thermal Imaging (DITI) to assess thermal gradients of the antler may permit the harvesting of VA at its peak in the growth phase. The objective of this study was to evaluate whether DITI would pattern VA growth. Antler growth rates, DITI measurements (main beam VA base, mid and tip temperatures), BW and scrotal circumference (SC) were obtained from red deer stags (n=31) every 14-d following eruption (d 0) through d 126. For analysis, antler growth patterns were split into three time points: early, mid and late, or were tested relative to day of eruption. Velvet antler growth rates increased ($P<0.001$) from 0.45 ± 0.03 cm/d in the early period to 0.52 ± 0.04 cm/d in the mid growth period, and decreased ($P<0.001$) to 0.16 ± 0.03 cm/d in the late growth period. Velvet antler DITI changed ($P<0.001$) over time for all stags and differed ($P<0.001$) between base, mid and tip. Base, mid and tip DITI were positively correlated ($R \geq 0.80$) with one another ($P<0.001$),and base, mid and tip DITI were positively correlated to VA growth (R=0.52, R=0.54, R=0.68 respectively, $P<0.001$). During the early growth period, VA temperatures increased ($P<0.05$) from 38.9 ± 0.2 °C at the base to 39.3 ± 0.2 °C at the tip of the antler. In addition, there was a tendency ($P<0.10$) during the

mid growth phase for the tip (38.4 ± 0.3 °C) to have a higher DITI than the base (37.9 ± 0.2 °C) of the antler. In contrast, during the late growth period, DITI was higher (P<0.001) at the base (36.8 ± 0.3 °C) than at the tip (35.7 ± 0.3 °C) of the antler. During the time of VA growth, SC was positively correlated with BW (R=0.70, P<0.001), and increased (P<0.001) from 15.9 ± 0.5 cm on d 0 to 20.5 ± 0.7 cm on d 112. In addition, BW increased (P<0.001) from 113.0 ± 5.4 kg on d 0 to 137.2 ± 6.9 kg on d 112. In conclusion, VA thermogenesis patterned VA growth with higher VA temperatures occurring during the early and mid growth periods, and lower VA temperatures occurring during the late growth period when VA growth began to cease. This suggests that DITI measurements may have value in determining the period of peak VA growth.

Key Words: Red Deer, Velvet antler, Digital infrared thermography

572 Relationship between placental characteristics, delivery parameters and placental retention. A. L. Riddle*[1], H. D. Tyler[1], and J. D. Quigley[2], [1]*Iowa State University, Ames, IA,* [2]*APC Company, Inc., Ames, IA.*

Retained placenta and dystocia are increasing problems within the dairy industry. Optimal delivery conditions can improve overall health status of the calf and dam, along with reducing the incidence of retained placenta. The objectives of this experiment were to determine placental factors that may be associated with dystocia and retained placenta. Calves (n=70) and placentae (n=44) were obtained from Holstein cattle following parturition. Delivery parameters include calving ease scores, duration of parturition, calf weight and parity. Placental characteristics evaluated after expulsion included color index (1-light to 5-dark) of cotyledons located at center and tips of placenta, cotyledon number, placental weight and length of umbilical stump. After delivery, calves were weighed, blood samples were collected to evaluate hematocrit, and the length and diameter of umbilical cords were measured. Multiple regression was used to identify explanatory variables associated with each response variable. Response variables included placental expulsion time, duration of calving, calf weight and calving ease scores (CES). The only factor that significantly affected placental expulsion time was umbilical cord break point (p<0.05). Factors that affected duration of calving included parity (p<0.01), diameter of umbilical stump (p<0.01), calf weight (p<0.0001), total length of umbilical cord (p<0.05) and calf umbilical cord efficiency (calf weight/diameter of umbilical stump) (p<0.0001). Factors affecting CES included color index in center of placenta (p<0.01), color index in tips of placenta (p<0.01), diameter of the umbilical stump (p<0.01), cotyledon number (p<0.05), and umbilical cord break point (p<0.01). Finally, the only factor that affected calf weight was weight of the placenta (p<0.05). The data strongly reflects the relationship between placental factors and delivery parameters.

Key Words: Retained placenta, Calf, Parturition

573 The effect of using of Ovsynch with supplemental GnRH on pregnancy rates of Holstein heifers in the tropics. R. W. Godfrey, R. E. Dodson*, A. J. Weis, and O. T. Isles, *University of the Virgin Islands, Agricultural Experiment Station, St. Croix.*

This study was conducted to evaluate the effect of GnRH given after artificial insemination (AI; day 0) on pregnancy rate (PR) of synchronized Holstein heifers at two times of the year. Heifers were synchronized using Ovsynch in April-May (Spring; n = 30; 16.4 ± 0.2 mo of age) or September-October (Fall; n = 20; 20.2 ± 0.3 mo of age) of 2002. Control heifers (n = 10 per season) received Ovsynch only. In the Spring 10 heifers received GnRH (750 iu, i.m.) on d 5. In the Fall and Spring 10 heifers received GnRH on d 5 and 11. Pregnancy was determined on d 45 by palpation. Rectal temperature (RT) of all heifers was measured for 10 d before and 30 d after AI. Ambient temperature, relative humidity (RH) and temperature humidity index (THI) were measured during this time using data loggers. Percentage of black hair coat (BHC) was determined using image analysis software (Sigma Scan 5.0). Heifers were categorized as dark (> 50% BHC) or light (< 50% BHC). Data were analyzed using GLM procedures of SAS. Ambient temperature and THI were lower (P < 0.05) in the Spring than in the Fall (26.9 ± 0.1 °C and 76.8 ± 0.1 vs 29.1 ± 0.1 °C and 80.1 0.1, respectively) but RH was not different (P > 0.10; 71.9 ± 0.4 vs 72.7 ± 0.4 %, respectively). There was no effect of GnRH treatment or season (P > 0.10) on PR. Heifers had higher RT (P < 0.0001) in the Fall than in the Spring (40.0 ± 0.05 vs 39.5 ± 0.05 °C, respectively). Dark heifers had a lower PR (P < 0.03) than light heifers (42.5 vs 80.0 %, respectively). In the Fall pregnant heifers had lower BHC (P < 0.02) than open heifers (58.8 ± 5.4 vs 77.6 ± 5.7 %, respectively) but there was no difference in the Spring. These results indicate that there is no beneficial effect of supplemental GnRH given post-AI on pregnancy rates of heifers synchronized using Ovsynch. Coat color of heifers had an effect on pregnancy with light colored heifers having a higher PR. Selecting of light colored dairy cattle may be a way of enhancing pregnancy rates under tropical conditions.

Key Words: Heifer, Coat color, Pregnancy

574 The effect of hair coat color on rectal and surface temperatures of Holstein heifers in the tropics. R. W. Godfrey, O. T. Isles*, A. J. Weis, and R. E. Dodson, *University of the Virgin Islands, Agricultural Experiment Station, St. Croix.*

This study was conducted to evaluate the impact of the environment and coat color on rectal and surface temperatures of Holstein heifers. Heifers were evaluated for 40 d during April-May (Spring; n = 30; 16.4 ± 0.2 mo of age) and September-October (Fall; n = 20; 20.2 ± 0.3 mo of age). Ambient temperature, relative humidity (RH) and temperature humidity index (THI) were measured at 10-min intervals using data loggers. Rectal temperature (RT) of heifers was measured every other day. Coat surface temperature (CST) of white and black coat of heifers was measured every other day only during the Fall using an infrared thermometer. Percentage of black hair coat (BHC) was determined using image analysis software (Sigma Scan 5.0). Heifers were categorized as dark (> 50% BHC) or light (< 50% BHC). Data were analyzed using GLM and correlation procedures of SAS. Ambient temperature and THI were lower (P < 0.05) in the Spring than in the Fall (26.9 ± 0.1 °C and 76.8 ± 0.1 vs 29.1 ± 0.1 °C and 80.1 ± 0.1, respectively) but RH was not different (P > 0.10) between Spring and Fall (71.9 ± 0.4 vs 72.7 ± 0.4 %, respectively). Mean and median BHC were 67.6 and 73.3 %, respectively. Heifers had higher (P < 0.0001) RT in the Fall than in the Spring (39.8 ± 0.06 vs 39.2 ± 0.03 °C, respectively). Dark heifers had higher RT (P < 0.0004) than light heifers (39.6 ± 0.03 vs 39.4 ± 0.06 °C, respectively). The CST of black coat was 4.1 ± 0.2 °C higher (P < 0.0001) than CST of white coat. The CST of black coat of dark heifers was higher (P = 0.05) than that of light heifers (43.5 ± 0.2 vs 42.4 ± 0.5 °C, respectively), but CST of white coat was not different (P = 0.08) between dark and light heifers (39.3 ± 0.2 vs 38.6 ± 0.3 °C, respectively). There was a low correlation (P < 0.01; r = 0.175) between RT and CST of white coat but not with CST of black coat (P > 0.10; r = 0.069). The higher RT of dark heifers suggests that selection for white coat color may be useful in mitigating effects of heat stress in dairy cattle in hot climates.

Key Words: Heifer, Coat color, Environment

Ruminant Nutrition: Fats and fatty acids

575 Conjugated linoleic acid (CLA) and milk production. M. A. McGuire*[1] and J. M. Griinari[2], [1]*University of Idaho, Moscow,* [2]*University of Helsinki, Finland.*

Dairy products are an important source of nutrients in the human diet. However, many scientists view dairy fat unfavorably due to the risk of coronary heart disease. A substantial body of literature now demonstrates that fatty acids in dairy fat possess important benefits to human health. Conjugated linoleic acid (CLA) and its precursor, trans-11 C18:1 or vaccenic acid, have been shown to be potent anticarcinogens in various cancer models, and dietary intake and plasma concentrations of these fatty acids are related to a reduced risk of breast cancer. Enhancing the concentrations of CLA in bovine milk would improve the healthful nature of milk fat as well as the perception by the consumer. Conjugated linoleic acid refers to a family of 18 carbon fatty acids with 2 double bonds separated by a single bond. Many isomers exist that arise from biohydrogenation of polyunsaturated fatty acids in the rumen. Desaturation of vaccenic acid within mammary tissue is the main source of cis-9, trans-11 CLA, the principal CLA in milk fat, shown to have anticarcinogenic effects. Another isomer is trans-10, cis-12 CLA produced