THI values of 60 and 90. Respiration rates increased by 2.0 breaths per minute per increase in THI unit ($P < 0.001$; $r2 = 0.4343$). Milk yield losses became significant when minimum THI on any given day was 65 or greater. Milk yield losses per day were 2.2 kg between a minimum THI of 65 and 73. Furthermore, milk yield losses became significant after 17 hours of exposure to an average THI of 68 and equated to a 2.2 kg per day loss in milk yield. This suggests that cooling of dairy cows producing more than 35 kg milk/d should be initiated at a minimum THI threshold of 65 or above or when average THI is 68 for more than 17 hours. We did not detect any advantage of BGHI index over THI in predicting milk yield losses or physiological responses. This project was supported by National Research Initiative Competitive Grant no. 2006-01724 from the USDA Cooperative State Research, Education, and Extension Service.

Key Words: heat stress, dairy cattle, index

387 Evaluation of the stress response of heifers during transportation. S. M. Behrends*[1], T. B. Schmidt[1], D. H. Keisler[3], J. W. Daily[2], J. O. Buntyn[1], D. J. Sykes[1], L. E. Hulbert[2], K. M. Cooley[1], D. T. Dawson[1], and J. A. Carroll[2], [1]*Mississippi State University, Mississippi State*, [2]*Livestock Issues Research Unit, USDA-ARS, Lubbock*, [3]*University of Missouri, Columbia*.

To evaluate the stress associated with transportation; 22 heifers (326 ± 47 kg) were randomly assigned to a control (Con) or transport (Tran) group. On d 0, 12 h prior to the transportation, heifers were weighed and fitted with an indwelling rectal temperature (RT) probe, jugular catheters and heart rate (HR) monitors. On d 1, all heifers were haltered and tied for 2 h prior to transportation. At the end of the 2 h period all heifers were weighed, controls were returned to their tie stall and transported heifers were loaded on the trailer for transport. The first transport period (FTP) began when Tran heifers were loaded on a trailer with 12 individual stanchions and Con heifers were returned to tie stalls. Blood samples were obtained throughout the 4 h transport period (Con and Tran heifers) at 30-min intervals. After transport, Tran heifers were taken to a new location unloaded and weighed; blood samples were obtained for 2 h post-transport. Simultaneously, Con heifers were weighed and blood samples obtained. Heifers were allowed a rest period for 14 h. After the rest period on d 2, heifers were subjected to a second transport period (STP; same protocol as in FTP). Serum was analyzed for cortisol (CS), insulin-like growth factor-1 (IGF-1), and growth hormone (GH). The FTP resulted in a 6% loss in BW for the Tran heifers as compared to a 2.5% loss for the Con heifers ($P<0.001$). Overall, BW loss was 2% greater ($P>0.02$; FTP and STP combine) for Tran heifers compared to Con heifers. During FTP ($P < 0.001$) and STP ($P < 0.002$) Tran heifers had an elevated RT compared to Con heifers. Prior to- and post-transport (both FTP and STP), CS concentrations did not differ between the treatment group's. Differences ($P < 0.05$) in CS were observed starting 1 h into the FTP and 30 min into the STP. After three h in transit, no difference ($P\geq0.05$) was observed in CS for both the FTP and STP. Results of this study indicate that transportation can be an acutely stressful event, as seen with increased CS concentrations, increased RT and increased BW losses. However, after 3 h, it appears that heifers are able to acclimate to initial stress induced by transportation.

Key Words: cortisol, stress, transportation

388 Use of an automated sampler to assess bovine adrenal hormone response to transportation. N. C. Burdick*[1,2], J. A. Carroll[2], R. D. Randel[3], S. T. Willard[4], R. C. Vann[5], C. C. Chase, Jr.[6], D. A. Neuendorff[3], A. W. Lewis[3], J. W. Dailey[2], L. E. Hulbert[2], L. C. Caldwell[1,3], J. G. Lyons[1], and T. H. Welsh, Jr.[1], [1]*Texas AgriLife Research, Texas A&M System, College Station*, [2]*USDA ARS Livestock Issues Research Unit, Lubbock, TX*, [3]*Texas AgriLife Research, Texas A&M System, Overton*, [4]*Mississippi State University, Mississippi State*, [5]*MAFES, Mississippi State University, Raymond*, [6]*USDA ARS Subtropical Agricultural Research Station, Brooksville, FL*.

Automated blood sampling would aid characterization of acute endocrine responses to transportation procedures. In this study, the IceSampler™ device was programmed to collect blood samples via jugular catheter from the herd's 7 calmest (C; temperament score=0.84±0.03) and 8 most temperamental (T; temperament score=3.37±0.18) 10-month-old Brahman bull calves at 15- and 30-min time intervals relative to transportation. Bulls were fitted with indwelling jugular catheters, rectal thermometer probes, and heart rate monitors and were then transported. Bulls were loaded onto a trailer that contained individual stalls. The trailer remained stationary for 120 min to allow for acclimation. After initiation of transportation at time 0, bulls were transported (390 Km roundtrip) for 480 min at an average speed of 91 Km/h. Plasma concentrations of cortisol, epinephrine (EPI) and norepinephrine (NE) were determined by RIA and by EIA, respectively. Data were analyzed using ANOVA specific for repeated measures. Rectal temperature increased over time (38.3±0.2 and 39.3±0.2°C pre- and post-transport, respectively; $P<0.01$) but was not affected by temperament ($P>0.10$). Heart rate remained steady in C bulls (μ=100.8±26.2 bpm) but varied over time in T bulls (time*temperament $P<0.01$). Cortisol concentration increased ($P<0.01$) in C bulls (18.6±5.5 at time 0 to 44.6±5.7 ng/mL at 15 min) but not T bulls (μ=36.8±3.2 ng/mL) in response to the initiation of transportation at time 0. Concentrations of EPI remained unchanged in C bulls (μ=43.7±15.4 pg/mL) throughout the sampling period but decreased in T bulls (235.7±32.1 and 78.6±54.2 pre- and post-transport, respectively $P<0.05$) whereas NE concentrations were not affected ($P>0.10$) by transportation or temperament (μ=267.19±48.2 and 261.3±49.8 for C and T bulls, respectively). These data suggest that temperament affects the stress response to transportation. The use of remote samplers allows us to detect specific indices of transportation stress, and to discern that although some changes were attributable to handling stress and temperament, the transportation process was not equally stressful within temperament groups.

Key Words: bovine, stress, transportation

Animal Health: Animal Well Being: Tackling the Issue of Cow Longevity

389 New frontiers in mastitis research. S. C. Nickerson*, *University of Georgia, Athens*.

Mastitis or bacterial infection of the mammary gland is the most costly disease of dairy cattle, with estimated economic losses approaching $2 billion each year in the US. Approximately 40 years ago, the 5-point plan for mastitis control was developed, and although modifications have been added to this plan, it has remained the cornerstone for controlling this disease in dairy cows over the past 4 decades. However, as consumers and milk processors demand higher quality products free of adulterants, dairy farmers continue to strive to lower the prevalence

of intramammary infection and the associated milk somatic cell and bacteria counts, in attempts to improve milk quality and meet higher quality standards. As a result, newer products and enhanced mastitis management practices have been developed to further lower the new infection rate and eliminate existing cases of mastitis. For example, novel antimicrobial formulations for pre- and postmilking teat antisepsis focus on rapid and complete killing of mastitis-causing pathogens, while improving teat skin condition to reduce microbial colonization. Intramammary infusion products being developed are based on natural antimicrobials that minimize withdrawal times and enhance cure rates. More attention is now focused on managing the coagulase-negative staphylococci, which cause minimal increase in somatic cell counts, but are the most prevalent mastitis-causing bacteria on all dairies. And finally, newer attempts to enhance the bovine immune system against mastitis-causing bacteria through dietary supplementation, immunization, and controlling immunosuppression continue to show promise for the control of this disease.

Key Words: dietary supplementation, immunosuppression, vaccination

390 Tackling the issue of cow longevity: Battling lameness. J. K. Shearer*, *University of Florida*, *Gainesville*.

According to a 1996 NAHMS report, 15% of cows are culled from US dairy herds as a direct effect of lameness. Indirect effects of lameness on milk production and reproduction are estimated to account for an additional 49.1% of culling in US herds. These figures suggest that lameness is a significant cause of reduced cow longevity. Research on lameness in cattle has been directed toward improvement in understanding of the pathogenesis of laminitis (subclinical laminitis). Laminitis associated with rumen acidosis results in low rumen pH predisposing to the release of potent vasoactive substances that disrupt blood flow to the corium. Inflammation, intravascular coagulation, ischemia and the activation of metalloproteinase enzymes (MMP) follow with weakening of the suspensory apparatus of the third phalanx (P3). Weakening of the suspensory system leads to rotation and sinking of P3 and is accompanied by compression of the supportive tissue and digital cushion that lie beneath P3. Alternative mechanisms responsible for weakening or laxity of the suspensory apparatus of P3 have been proposed by UK researchers. These include activation of MMP by a gelatinolytic enzyme observed in prepartum heifers termed hoofase and by hormonal changes associated with calving. Researchers observed fewer claw lesions in heifers housed in straw yards during the transition period compared with heifers housed in free stalls indicating that soft flooring surfaces during the peripartum period are important to foot health. This suggests that heifers may be less resistant to compressive loading forces that may cause injury to the digital cushion and adjacent supportive tissues. Downward displacement of P3 results in damage to the digital cushion with subsequent reduction in fat content and replacement with collagenous tissue. This reduces shock absorbing function of the digital cushion and predisposes to sole uclers. Recent work suggests that fat content of the digital cushion may also be affected by body condition (BC). If these observations are correct, lameness may be the result of, rather than the cause of, poor BC as most believe.

Key Words: lameness, laminitis, subclinical laminitis

391 Increasing longevity by increasing reproductive efficiency in dairy cattle. M. C. Wiltbank*, *University of Wisconsin*, *Madison*.

Some of the decrease in longevity of dairy cattle is attributed to decreasing reproductive efficiency. Poor reproduction in dairy cattle is multifactorial with physiology, genetics, management, health, and nutrition underlying the problems and the solutions to poor reproduction. Many dairy managers are using hormonal programs to manage reproduction with increased reproductive efficiency primarily due to increasing service rate with little improvement in pregnancies per AI (fertility). Newer programs have been developed that result in improved fertility, compared to breeding after estrus. These programs involve increasing numbers of targeted hormonal treatments to optimize gamete viability and hormonal environment for pregnancy. Genetic selection for reproduction has also now become a part of the selection indices in many countries potentially leading to dairy cattle genetics with improved reproductive potential. In addition, reproduction is a primary target of other genetic selection strategies including genomics and cross-breeding within the dairy industry. In spite of the focus on reproductive protocols and genetic selection for improved reproduction, it is clear that management and health underlie some of the variability between herds in reproductive efficiency. However, randomized studies showing improvements in reproduction after manipulation of these variables are still scarce. Dairy cattle nutrition has been found to alter dairy cattle reproduction in both positive and negative ways; however, the experimental designs utilized in these studies are frequently not optimal for making firm conclusions about reproduction. In general, the relative contribution of these varied factors to reproductive efficiency or inefficiency in dairy cattle has been surprisingly difficult to define. This has led to inaccuracy and inefficiency in diagnosing reproductive problems on specific dairy herds and in determining the most efficient directions for future reproductive research.

Key Words: fertility, productivity, service rate

392 Improving longevity with new genetic models and marker assisted selection. K. A. Weigel*, *University of Wisconsin*, *Madison*.

Historically, programs for genetic improvement of dairy cattle have been completely dependent on national milk recording systems or breed association type programs for data collection. Due to increases in average herd size, a large percentage of records now come from on-farm herd management software programs. These allow timely measurement of traits such as conception rate, calving ease, and stillbirth rate, because events are recorded when they occur, rather than at monthly intervals. More importantly, they provide data for traits that are ignored in national milk recording systems, such as flow rate, milking duration, and the incidence of infectious diseases and metabolic disorders such as mastitis, ketosis, lameness, metritis, and displaced abomasums. In the future, radio-frequency identification systems may allow routine measurement of new traits, such as activity, body temperature, and hormones associated with female fertility or animal health. Therefore, performance testing may become concentrated in large herds with on-farm software and electronic data capture systems. One breeding company has implemented intensive data recording in 175 large commercial herds, as compared with 1600 to 3800 progeny test herds for its competitors. Consolidation may also occur in sire acquisitions, with breeding companies relying on a few large, extensively phenotyped supplier herds. In the era of whole-genome selection, phenotypes for novel traits from contracted data farms, which may include commercial dairy herds, custom heifer growers, or wet calf ranches, can be combined with dense single nucleotide polymorphism genotypes to develop genomic predictions that can be used in the population at large.

Key Words: health, longevity, genetics