246 Metabolic disorders and immune response in farm animals. N. Lacetera*, U. Bernabucci, B. Ronchi, and A. Nardone, *Dipartimento di Produzioni Animali*, *Viterbo, Italy*.

Metabolic regulation and immune response are highly integrated systems and the proper function of each is dependent on the other. It is widely recognized that the immune system requires energy and substrates to maintain its function, and mounting an immune response likely requires using resources that could otherwise be allocated to other biological functions. Reproduction, lactation, growth, thermoregulation represent some of the energetically-demanding functions that in farm animals are likely to compete with immune system for resources. Studies carried out in different animal species revealed that activation of the immune response may cause perturbation of metabolic status, and suggested that understanding the cost of immune function in terms of energy or single nutrients is essential for more accurate characterization of nutrient budgets of animals and better understanding of the role of immunity in the evolution of life strategies. On the other hand, several papers described an association between disorders of energy, lipid, vitamins or minerals metabolism and perturbation of immune response. In particular, recent studies carried out in domestic ruminants revealed an association between energy deficit and related loss of body condition and increase of plasma non esterified fatty acids, impairment of immunoresponsiveness and increased susceptibility to infections. From a biochemical point of view, metabolic disorders and related deficiency or excess of nutrients or metabolites may regulate immunity by causing perturbation of both innate and adaptive immune pathways. From an ecological perspective, the immune system may be considered as an energetically costly system that may or may not have priority over other uses of energy available. The hypothesis of a trade-off between immune and other biological functions in farm animals would deserve to be investigated with particular emphasis for those physiological circumstances, as it is the case of the periparturient period, characterized by high demands, low feed intake, frequent occurrence of metabolic disorders and immunosuppression.

Key Words: Metabolism, Immunity, Farm Animals

247 Administration of a *Staphylococcus aureus* bacterin to dairy heifers reduces new infection rate and somatic cell counts at time of calving. S. C. Nickerson*[1], E. Hovingh[2], C. Peterson[3], S. Brannock[3], E. Schaffer[3], and P. W. Widel[4], [1]*University of Georgia*, *Athens*, [2]*Pennsylvania State University*, *College Park*, [3]*James River Correctional Facility*, *Goochland, VA*, [4]*Boehringer Ingelheim Vetmedica, Inc.*, *St. Joseph, MO*.

Use of a *Staphylococcus aureus* bacterin as a means of preventing intramammary infections (IMI) in dairy heifers was evaluated. At approximately 6 to 18 months of age, Holstein heifers from the James River Correctional Center Dairy in Goochland, VA were processed for vaccination and to collect mammary secretions for microbiological analysis. Fifty-three heifers were immunized with a commercial bacterin (Lysigin, Boehringer Ingelheim Vetmedica, Inc.) using a 5-ml dose intramuscularly in the semimembranosus muscle of the rear leg; 53 heifers served as unimmunized controls. The vaccine was a lysed culture of polyvalent *S. aureus* somatic antigens of 5 phage types in an aluminum hydroxide base. Fourteen days after initial processing and at 6-month intervals until calving, vaccinates were processed for boosting. At 2-month intervals after trial initiation and through calving, mammary secretion samples were collected for bacteriological culture and somatic cell counts (SCC). Microbiological examination of mammary samples collected from bred heifers over gestation demonstrated that 19.8% of heifers (9.4% of quarters) were infected with *S. aureus*, 68.9% (34.3% of quarters) were infected with coagulase-negative staphylococci (CNS), 6.6% (2.3% of quarters) were infected with environmental streptococci, and 1% (0.3% of quarters) were infected with coliforms. Vaccine efficacy data showed that the percentage of heifers with *S. aureus* IMI at calving was lower in vaccinates (13.3%) compared with controls (34.0%). Likewise, IMI with CNS were lower in vaccinates (64.2%) compared with controls (69.8%). The SCC in samples collected during first week of lactation from uninfected heifers for vaccinates and controls were 66,095 and 132,754/ml; a 50.2% reduction; and for infected heifers, SCC were 441,764 and 892,176/ml; a 50.5% reduction. Results demonstrated that administration of a commercial bacterin to breeding age and pregnant Holstein heifers reduced the prevalence of *S. aureus* mastitis as well as the SCC at time of calving.

Key Words: *Staphylococcus aureus*, Mastitis, Vaccination

248 Serum non-esterified fatty acid and beta-hydroxybutyrate in the transition period and their associations with disease in dairy cows. M. E. Carson*[1], S. J. LeBlanc[1], S. M. Godden[2], M. B. Capel[3], M. W. Overton[4], J. Santos[5], K. E. Leslie[1], and T. F. Duffield[1], [1]*University of Guelph*, *Ontario, Canada*, [2]*University of Minnesota*, *St. Paul*, [3]*Perry Veterinary Clinic*, *Perry, NY*, [4]*University of Georgia*, *Athens*, [5]*University of California Davis*, *Tulare*.

The objective of this study was to characterize the relationship of serum NEFA and BHB concentrations in the transition period with clinical disease in dairy cows across different regions of North America. A field study was conducted with 2316 Holstein cows in 56 dairy herds in 4 regions of Canada and the United States. Once weekly, after the morning feeding, blood was collected from cows in the week before their expected calving date, and again from the same cows in weeks 1, 2, and 3 postpartum. Serum was stored at -20°C within 8 hours of collection. NEFA, BHB and Ca were measured using a Hitachi 911 auto-analyzer. Considered alone and assuming equal weight on sensitivity and specificity, the optimal cut-points for prediction of displaced abomasum (DA) and retained placenta (RP) were calculated. The 23% of cows with NEFA ≥0.5 in week -1 were 2.8 times more likely to subsequently have DA than cows below this cut-point. Multivariable logistic regression models of the probability of DA were made using information available before and after calving. Accounting for the random herd effect and region, pre-calving NEFA ≥0.5 mmol/L (odds ratio (OR) =1.8, P=0.02), week 1 postpartum NEFA≥1.0 (OR=3.0, P<0.001) and week 1 Ca ≤2.2 mmol/L (OR=2.5, P=0.0003) predicted risk of DA for serum data obtained at or prior to week 1 postpartum. BHB did not remain in the week 1 model when pre- and postpartum NEFA were included. Cows that did not have elevated NEFA pre- or postpartum or sub clinical ketosis (SCK) had the lowest risk of DA (0.8%). For serum obtained during the week prior to calving, multivariable logistic regression models accounting for the random herd effect found pre-calving NEFA ≥0.3 mmol/L (OR =1.7, P=0.0032), twins (OR =5.9, P<0.0001) and dystocia (OR=2.3,

P=0.0002) to be important predictors of the risk of RP. These data confirm the associations of NEFA with health and support their use as tools for monitoring or investigation of transition dairy cows.

Key Words: Metabolic, NEFA, Transition

249 Intramammary pathogens from 3755 dairy goats and sheep and farm characteristics from New York State. D. J. Wilson*[1], R. N. Gonzalez[2], P. M. Sears[3], L. H. Southwick[4], H. F. Schulte[2], and G. J. Bennett[2], [1]*Utah State University*, *Logan*, [2]*Cornell University*, *Ithaca, NY*, [3]*Michigan State University*, *East Lansing*, [4]*Lee H. Southwick Consulting*, *Virgil, NY*.

Prevalence of mastitis pathogens of dairy sheep and dairy goats and mean SCC in bulk milk are not the same as in bovines. Mastitis control practices used on small ruminant farms have limited documentation.
Milk samples were aseptically collected for milk culture from 3164 dairy goats (36 herds) and 591 dairy sheep (6 flocks) from 1993-2004 in New York State. Lactating doe numbers averaged 88 (median 30.5); milking ewes averaged 99 (median 83.5). Most common goat breeds when specified were French Alpines and Saanens. Mean number of dry animals was 23 does and 258 ewes.
Mean bulk tank SCC was 425,000/ml for sheep, 835,258/ml for goats. Mean estimated milk production per 305 d was 1102 lb (500 kg) for sheep and 1856 lb (843 kg) for does. Pathogens were isolated from milk of 64 ewes (10.8%) and 864 does (27.3%). The most common pathogens were coagulase-negative staphylococci (CNS), from 6.8% of ewes and 23.0% of does, non-agalactiae streptococci (Strep spp.), from 3.2% and 0.8%, and S. aureus from 1.2% and 1.5%, respectively.
33 of the 36 goat farms (92%) used udder preparation; 50% predipped, most with 0.5% titratable iodine dip, 31% used udder wash, 11% dry wiped, and 69% stripped for abnormal milk. 89% broke vacuum and 83% postdipped, most with 0.5% iodine or 0.5% chlorhexidine. Teat end vacuum averaged 13.7 inches Hg. 78% infused antibiotics during lactation, 78% dry treated all does and 6% selectively dry treated.
2 of the 6 sheep farms did no udder preparation, the rest used various methods that usually included dry wipe. All broke vacuum before unit removal and used postdip. Mean teat end vacuum was 12.5 inches Hg. Milking system features and performance test results will be discussed further. The most common mammary pathogen isolated from both sheep and goats was CNS, accounting for 63% and 84% of isolates, respectively. The prevalence of mammary pathogens in goats was low compared with that for dairy cows, despite the fact that goats have markedly higher mean bulk milk SCC than cows. Adoption of mastitis control practices was similar to that for cow farms, except that sheep owners did minimal udder preparation before milking.
Key Words: Ovine, Caprine, Mastitis

250 Ability of an immunomodulatory feed additive to reduce infection of the murine mammary gland with *Streptococcus uberis*, *Escherichia coli* and *Staphylococcus aureus*. A. Rowson*[1], Y. Q. Wang[1], E. Aalseth[2], N. E. Forsberg[1], and S. B. Puntenney[1], [1]*OmniGen Research*, *Corvallis, OR*, [2]*Aalseth Consulting*, *Lake Stevens, WA*.

Four experiments were completed to assess ability of OmniGen-AF to reduce the infection of the murine mammary gland with 3 bovine isolates: *S. uberis*, *E. coli* and *S. aureus*. Pregnant mice were received from Charles River and housed in pairs. Animals were assigned to either a powdered control diet (Teklad 8604) or to the same diet supplemented with OmniGen-AF (Prince-Agri Products; 0.5% w/w). Animals consumed diets during gestation (from approximately Day 15) and into lactation (to approximately Day 10). On the day of the experiments, pups were removed and euthanized. Lactating mice were anesthetized with ketamine and xylazine and the abdomen sterilized. The terminal 0.5 mm of the L4 and R4 teats were removed via sterile technique after which pathogens in 50 ul of PBS were infused into the teat canals via 33 gauge needles. Control mice received infusion of PBS only. Experiment 1 consisted of infusing mice with 50 CFU of a bovine isolate of *S. uberis* and an infection period of 48 hr. Experiments 2 and 3 consisted of infection of glands with 100 and 25 CFU of a bovine isolate of *E. coli* and infection periods of 48 and 24 hrs, respectively. Experiment 4 consisted of infusion of glands with 50 CFU of a bovine isolate of S. aureus and an infection of 36 hrs. After progression of the infection, lactating mice were anesthetized, blood taken via cardiac puncture and euthanized. L4 and R4 mammary tissues were taken. DNA was extracted from mammary and blood (Qiagen) and concentrations of pathogen DNA determined using quantitative PCR. Genomic DNA from each pathogen was used to generate a standard curve for each pathogen. OmniGen-AF caused significant ($P<0.05$) reductions (>95%) in *S. uberis* and *S. aureus* DNA in mammary tissues. Further, OmniGen-AF reduced ($P<0.05$) *S. uberis* DNA concentration in blood by >95%. Feeding OmniGen-AF caused a numerical reduction in ($P>0.05$) in *E. coli* detection (60% reduction) in mammary tissue. *E. coli* and *S. aureus* DNA were not detectable in blood. In summary, feeding OmniGen-AF reduced infection of the murine mammary gland by bovine mastitic pathogens.

Key Words: Mastitis, OmniGen-AF, Murine Model

251 Evaluation of selective, chromogenic media in an on-farm culture kit. D. W. Remsburg*, B. I. Smith, and M. A. Kristula, *University of Pennsylvania*, *Kennett Square*.

Identification of mastitis causing organisms through microbiological culture has been suggested as a first step in successful mastitis treatment. This process is particularly important in mastitis caused by Staphylococcus aureus (SA), where rapid identification and segregation of infected animals is critical to an effective control program. The goal of this study was to evaluate the sensitivity and specificity of a commercially available culture media compared to culture performed in a diagnostic microbiology lab. HyLabs AP059 (marketed as IdentMast) is a commercially available mastitis culture paddle with two sides of selective chromogenic media. Chromogenic media differentiates between bacterial species by changing the color of the bacterial colony and surrounding media. In this project composite milk cultures were aseptically collected from 163 lactating Holstein dairy cows at University of Pennsylvania Veterinary School's dairy farm. The AP059 paddles were immersed into the milk sample and then incubated for 24 hours. The remaining milk was submitted to the University of Pennsylvania Veterinary Microbiological Laboratory (PVML) for routine aerobic bacterial culture. Results from the HyLabs AP059 paddle were compared to results from the microbiology lab to determine the sensitivity, specificity and accuracy. The sensitivity, specificity and accuracy of the Hylabs AP059 compared to the PVML results were 100%, 94% and 95%, respectively. The positive predictive value and negative predictive values of the HyLabs AP059 were 74% and 100%, respectively. These results are based on an interpretation of any pink colonies being described as SA. All false positive samples were cultured by the PVML as a coagulase negative Staph sp.(CNS). Additional CNS colonies were observed on the SA

selective media as clear and green colonies. The results demonstrate that the HyLabs AP059 mastitis culture paddle can be an effective screening tool for mastitis caused by SA but positive cultures should be confirmed through traditional laboratory culture.

Key Words: Mastitis, Culture, Dairy Cow

252 Evaluation of a novel chlorine dioxide teat dip on teat end and teat skin health. L. L. Timms*, *Iowa State University*, *Ames*.

The purpose of this study was to evaluate the teat end health and skin conditioning performance of an experimental chlorine dioxide teat dip vs. commercial dips and best management practices at the ISU Dairy. A teat dip trial was conducted from late August through early November 2007. An experimental teat dip utilizing a no mix chlorine dioxide germicidal mode and containing 15% emollients was evaluated (Boumatic, Madison, WI). Herd standard post-milking teat dip used was a 0.5% iodine, 10% emollient product (Quadraplex ,IBA), while the pre milking teat dip was a 0.25% iodine, 2% skin conditioning product (BacStop, IBA).The trial used a split udder design. Left teats of 56 cows were pre and post dipped with current herd dips (control) while right side teats were dipped with the chlorine dioxide dip (treatment). Teat skin and teat end scoring were performed using a variation of the Goldberg and Timms methods, respectively, by trained graders. Scoring was performed twice per week. Results were compiled and analyzed using SAS. Teat end and skin scores were analyzed using a 2 sample t-test while proportion of rough/cracked teat ends were analyzed using a 2 sample test of equality of proportions. There were no significant differences in teat skin score between treated and control teats, and skin condition was excellent (mean near score 1). Within 3 days of dipping, average teat end score started to trend higher with significantly higher ($p < .01$) average teat end scores in treated vs. control quarters by 6 days post dipping through end of the trial. Average teat end scores and % rough teats were significantly higher in chlorine dioxide dipped teats, with this reaction occurring more on teats that had higher hyperkeratosis at the start. Marked changes in teat end scores were measured over time and periods as short as days in all groups signifying other factors besides teat dips also influence teat health.

Key Words: Chlorine Dioxide Teat Dips, Teat Skin, Teat End

253 Sodium chlorite lactic acid teat dip contaminated with *Serratia liquifaciens*. D. J Wilson*, J. D. Trujillo, R. T. Skirpstunas, and K. B. Cavender, *Utah State University*, *Logan*.

This report describes bacterial contamination of sodium chlorite lactic acid (SCLA) teat dip, which has not been reported previously.
A commercial dairy farm had two apparently healthy cows that died within 48 h following intramammary (IMM) infusion of dry cow treatment at the end of lactation. Teat dip containing SCLA had been stored for 2 years on the farm, and was used only to dip teats following IMM infusion with dry cow treatment.
The original container storing the SCLA teat dip was visibly soiled externally. The dip was found culture-positive for *Serratia liquifaciens*. A plan for follow up milk cultures was recommended, but no samples were received. All remaining teat dip was discarded. Further herd history was lost to follow up.
Only when BHI rinse of the original teat dip container was incubated and then streaked for culture was *Serratia liquifaciens* isolated from the film on the inside of the container. In addition to previous reports of contamination of other types of teat dips, the risk of contamination with potential mastitis pathogens, especially *Serratia* spp. applies to SCLA teat dip. Soiled containers of teat dip should be cultured to monitor for contamination with bacteria, or preferably discarded.

Key Words: Teat Dip, Contamination, *Serratia marcescens*

254 Teat end and skin conditioning evaluation of two experimental heptanoic acid teat dips during winter. L. L. Timms*[1] and J. Morelli[2], [1]*Iowa State University*, *Ames*, [2]*Ecolab, Inc.*, *St. Paul, MN*.

The purpose of this study was to evaluate the teat end health and skin conditioning performance of two experimental heptanoic acid based teat dips vs the commercial product Remain Gold® using a split udder design during the winter season under best management winter milking practices. Two separate teat dip trials were conducted simultaneously at the Iowa State Dairy Farm from late October 2006 through March 2007. Experimental teat dips KX-6185 and KX-6186 were provided by Ecolab (St Paul MN). Both products contained 1% heptanoic acid and 10% skin conditioners. All trials used a split udder design. In trial 1 (Pen 1 Free Stalls), left teats of 56 cows were pre-dipped with 0.25% iodine teat dip (IBA) and post dipped with Remain Gold®. Right side teats were pre and post dipped with KX-6185. In trial 2 (Pen 2 Free Stalls) 56 cows had teats pre-dipped with a 0.25% iodine dip. Left teats were post-dipped with Remain Gold® and right teats were post-dipped with experimental teat dip KX-6186. Teat skin and teat end scoring were performed using a variation of the Goldberg and Timms methods, respectively, by trained graders. Scoring was performed twice per week. Results were compiled and analyzed using SAS. Teat end and skin scores were analyzed using a 2 sample t-test while proportion of rough/cracked teat ends were analyzed using a 2 sample test of equality of proportions. There were no significant differences in teat end and teat skin condition between udder halves for all products in all trials However, there was significant teat changes within udder halves across time, signifying other factors beside teat dips contributing to teat condition issues. Marked changes in teat end scores were measured over time and periods as short as days. Product treatment comparisons frequently showed parallel trends in score averages. This illustrates the importance of a split udder design to evaluate skin conditioning performance.

Key Words: Teat Dipping, Teat Skin, Teat End