170 Effect of glutamine supplementation on immune responsiveness and milk production in dairy cattle. L. Doepel*[1], N. Gagnon[1], M. Lessard[1], G. E. Lobley[2], J. F. Bernier[3], and H. Lapierre[1], [1]*AAC Dairy and Swine R & D Center, Lennoxville, QC, Canada,* [2]*Rowett Research Institute, Aberdeen, UK,* [3]*Université Laval, QC, Canada.*

Sixteen multiparous Holstein cows were used to determine the effect of glutamine (Gln) on immune responsiveness and milk production during the immediate postpartum period, when there are competing demands from the gut, mammary gland, and immune system. Cows received abomasal infusions of either 300 g/d Gln delivered in 10 L of water (8 cows) or water alone (8 cows) for 21 d following calving. During d14-21, treatments did not affect milk yield (39.3 vs. 40.5 kg, P = 0.66), protein content (2.99 vs. 2.98%, P = 0.87) or fat content (3.92 vs. 3.73%, P = 0.46), for water and Gln, respectively. Peripheral blood mononuclear cells (PBMC) were isolated from blood collected by jugular venipuncture on d -25, 4, 11, and 18 relative to calving. Interferon-γ concentrations, the lymphocyte proliferative response to concanavalin A (0.5 μg/ml), and cell subpopulations were determined on the PBMC. Leukocyte counts and differential analysis were also performed on these days plus on d -12, -3 and 1 relative to calving. Interferon-γ concentration did not change over time (P=0.35). Lymphocyte proliferation was not affected by treatment (0.84 vs. 0.71 for water and Gln, respectively; P = 0.38), or by time (P = 0.44). There was a tendency (P=0.09) for a treat*time interaction for the CD4 population, due to a reduction at d4 for the water treatment compared to d 11 and 18, while there was no change for Gln treatment. Leukocyte and neutrophil counts changed over time (P < 0.001), with the counts being higher on d1 than during the treatment period. The data from this study suggest that Gln supplementation does not improve the immune status of postpartum dairy cows.

	Pretreat[1]				Treat[2]			
	Precalf	SEM	Day 1	SEM	Water	Gln	SEM	P[3]
IFN-γ, pg/ml	1353.0	303.7	—-	—-	1042.4	1164.94	179.9	0.65
Cell count/μl								
Leukocytes	6642.3	368.9	9749.6	549.7	7203.2	7229.8	498.4	0.90
Eosinophils	458.8	—-	227.0	—-	251.0	195.8	—-	0.59
Lymphocytes	2434.0	174.4	2536.0	243.5	2958.7	2717.6	220.7	0.58
Monocytes	686.7	58.9	1018.9	116.8	888.7	809.6	105.0	0.07
Neutrophils	2932.1	176.4	5830.7	520.5	3059.5	3276.8	528.1	0.75
Cytometry, %								
B cells	14.2	5.0	—-	—-	16.2	13.8	2.1	0.43
CD2	57.1	3.9	—-	—-	63.5	66.7	2.6	0.43
CD4	28.0	3.1	—-	—-	33.7	38.1	1.5	0.06
CD8	15.2	2.1	—-	—-	16.0	17.5	1.1	0.38
Gamma-delta	9.7	1.3	—-	—-	12.2	7.9	1.4	0.06

[1]Pretreat=mean of d -25, -12, and -3, and both treatments;
[2]Treat=mean of d 4, 11, and 18; [3]P=P-value for treatment effect

Key Words: Glutamine, Immune Response, Dairy

Breeding and Genetics: Genetics of Efficient Feed Utilization

171 Mechanisms regulating feed intake: role of appetite-regulating peptides. M. G. Thomas* and K. L. Shirley, *New Mexico State University, Las Cruces.*

Feed intake, or appetite, is a multifaceted physiological event. Regulation of feed intake can be attributed to, or modulated by, energy expenditure, the interaction of diet with the digestive system, and (or) central mechanisms influenced by flux of neurotransmitters and neuropeptides. The latter directs discussion towards the basal hypothalamus as a focal point by which the brain receives input of the body's metabolic state and interprets this information for appetite and modulation of other systems such as growth, reproduction, or lactation. Discovery and research of gut and appetite-regulating peptides has been increasing for almost a century. In the last decade, considerable emphasis has been placed on hormones derived from adipose tissue, such as leptin and adiponectin. Leptin is a physiologic antagonist to a potent orexigenic brain peptide, neuropeptide Y (NPY). The leptin receptor is co-localized with NPY on neurons within the ventro-medial hypothalamus of the ruminant. Intracerebroventricular (ICV) infusion of NPY stimulates appetite and infusion of leptin suppresses appetite. Suppression of appetite has also been observed with central infusion of insulin. These types of studies were effective for evaluating neuro-regulation of appetite; however, they may only explain gross effects of these neuropeptides on appetite, as concomitant to ICV infusion studies, increases in serum concentrations of leptin parallel increases in daily feed intake level and body weight in growing animals. Thus, fine control of appetite may be more related to gene regulation or receptor binding affinity for factors such as NPY and leptin. For example, as ruminants age and fatten, leptin receptor expression levels appear dynamic within the hypothalamus and pituitary. Development of marker assisted selection programs are challenging, especially for polygenic traits such as level of feed intake or residual feed intake. Further understanding of the influences of environmental and intrinsic factors are needed to narrow this search for candidate genes. Physiologic knowledge of signals of adiposity, neuropeptides, and their receptors could aid this process.

Key Words: Appetite, Neuropeptide Y, Leptin

172 Genetic variation in feed utilization: selection responses in mice. M. K. Nielsen*, *University of Nebraska, Lincoln.*

Selection for high (MH) or low (ML) heat loss per unit size (kcal/kg$^{.75}$/d), measured in direct calorimeters, and no selection (MC), have been practiced in mouse lines as a proxy measure for feed energy requirement for maintenance. Selection was only in males. All selection lines were present in 3 independent replications making a total of 9 lines. Selection ceased after 16 generations. All 9 lines were maintained without intentional selection for 26 generations. Selection recently resumed and is practiced again for the same criterion (high or low or no selection) in each of the lines. During the original selection, realized heritability of heat loss was 0.28. After initial selection, feed intake was 9% greater in MH and 11% less in ML, both as compared to MC. After re-initiating selection, feed intake is 7% greater in MH and 15% less in ML, both as compared to MC. Differences in heat loss and feed intake persist through very mature ages. No difference in longevity has been detected. Genetic correlations with heat loss, and probably maintenance energy requirement, are: positive with ovulation rate and locomotor activity, negative with body fatness. Locomotor activity of MH mice was twice that of ML, and MC mice were intermediate. Locomotor activity differences explained 36% of the differences in maintenance feed intake between lines. When reared in hot or cold environments, there was no line x environment interaction for feed intake, body weight or fatness. MH mice had reduced litter size in the cold, but performance of ML mice relative to MC did not interact with environment. ML mice are adaptable to chronic stressors, but MH mice are not, as measured by serum corticosterone level. Estimates of energy costs per unit of gain (total, or fat and non-fat) do not appear to be different between the lines. Thus, genetic variation in feed intake, after accounting for possible differences in rate and composition of gain, appear to be mostly if not totally explained by differences in maintenance energy costs per unit size. Selection to reduce energy for maintenance was successful; non-desirable responses were a reduction in ovulation rate and an increase in body fatness.

Key Words: Selection, Feed Intake, Mice

173 Genetic evaluation of efficient feed utilization in beef cattle. D. H. Crews, Jr.*, *Agriculture and Agri-Food Canada Research Centre, Lethbridge, Alberta, Canada.*

The wide range of traits for which most beef breed associations predict EPD focus on increasing the outputs of the production system, thereby increasing the genetic potential of cattle for reproductive rates, weights, growth rates, and end product yield. Feed costs represent a large proportion of the variable cost of beef production and genetic improvement programs for reducing input costs will likely include traits related to feed utilization. Feed conversion ratio, defined as feed inputs per unit output, is a traditional measure of efficiency that has significant phenotypic and genetic correlation with feed intake, growth rate, and mature size. One limitation is that favorable decreases in feed to gain as correlated response to increased growth rate does not necessarily relate to specific improvement in efficiency. Residual feed intake is defined as the difference between actual feed intake and that predicted on the basis of requirements for maintenance of body weight and production. Phenotypic

independence of residual feed intake with growth rate, body weight, and other energy depots can be forced, however, genetic associations may remain when phenotypic regression is used. Heritability estimates for phenotypic residual feed intake have been moderate, ranging from 0.26 to 0.43. Genetic correlations of phenotypic residual feed intake with feed intake have been highly positive, suggesting that improvement would produce the correlated response of decreasing feed intake. Residual feed intake estimated by genetic regression results in zero genetic correlation with its predictors thus alleviating concerns over long term antagonistic response in increased mature size and maintenance requirements. The genetic regression approach requires knowledge of genetic covariances of feed intake with growth rate and weight. Cost of individual feed intake measurement on potential replacements will be a consideration for implementation of national cattle evaluations for efficiency of feed utilization. These costs must be compared to expected and, if possible, realized rates of genetic progress and associated reductions in feed input requirements.

Key Words: Genetic Evaluation, Beef Cattle, Feed Efficiency

174 Realities of measuring feed intake on individual pigs to genetically improve feed efficiency. D. S. Casey*[1] and P. W. Knap[2], [1]*Pig Improvement Company, Franklin, KY,* [2]*Pig Improvement Company, Germany.*

Feed efficiency is an important economic trait to the swine industry. Most improvement has been made indirectly by selecting on lean growth rate, but can also be improved by selecting for growth when feed intake is restricted. Neither of these methods involves measuring feed intake on the pig, but if done would result in a direct measurement of feed efficiency. The objective of this review was to discuss issues involved in measuring feed intake on individual pigs. Feed intake can be obtained by penning pigs individually, but pigs in this situation tend to eat more, grow faster, and are fatter than pigs housed in groups. To avoid this genotype x housing system interaction, electronic feeders were developed to measure individual feed intake on group-housed pigs. These feeders are single-spaced and offer some protection from competition, whereas conventional feeders offer no protection. These feeder differences did not affect performance of boars, but gilts on electronic feeders ate less, grew slower, and deposited less backfat and loin muscle area. Data from electronic feeders have also been found to contain substantial amounts of errors that require editing. Different editing methods have been shown to affect the accuracy of feed intake estimates, which in turn affect heritability estimates. Operating these feeders takes time and requires highly trained personnel. They are also costly, which usually limits the number of pigs that can be evaluated. Testing strategies can be adapted to increase the number of pigs measured during a test period with minimal impact on accurately estimating feed intake. This will depend on the testing strategy used and the model used to replace missing records. Because electronic feeders measure each visit to the feeder, feeding behavior traits and feed intake curves can be obtained and used to improve feed efficiency. Measuring feed intake on individual pigs is not trivial but there are benefits that can be exploited to maximize genetic improvement of feed efficiency.

Key Words: Swine, Feed Efficiency, Feed Intake

175 Methods of editing errors in data from electronic swine feeders impact heritability estimates of average daily feed intake. D. S. Casey* and L. Wang, *Pig Improvement Company, Franklin, KY.*

Methods of editing errors in data from electronic swine feeders affect accuracy of estimating average daily feed intake (**ADFI**), which will impact genetic improvement of feed efficiency. The objective of this study was to measure the effect of two editing methods on heritability estimates of ADFI. FIRE® electronic feeders were used to measure feed intake for 7,106 boars from approximately 73 to 163 d of age. Feed intake data were edited using two methods (**EM1, EM2**). For EM1, errors were identified in daily feed intake (**DFI**), occupation time per day, and mean DFI for a pen. Corresponding DFI records were replaced with a missing value. Data for a pig were discarded if the percentage of missing DFI was >75. DFI records were regressed on test day for each pig using a 4^{th} order polynomial. Estimates of DFI from this model were used to calculate ADFI. Unreasonable values for ADFI from individuals and off-test groups were discarded. For EM2, 16 criteria were used to identify errors in visits. A linear model was used to adjust error-free DFI for the effect of errors. Unreasonable values of DFI were replaced with a missing value. Data for a pig were discarded if the percentage of missing DFI was >85. Adjusted DFI were regressed on test day for pigs in an off-test group using a random regression model that included a 3^{rd} order polynomial for the fixed curve for each line (n=10) and a 1^{st} order polynomial for the random curve for each pig. Missing values of DFI were replaced with estimates from this model. A sire model was fit to ADFI from the two editing methods. The model included on-test weight x line, herd-line-year-season, and herd-off-test group. After editing there were 6,197 (87.2%) and 6,861 (96.6%) pigs with an estimate of ADFI from EM1 and EM2. Mean ADFI for EM2 was 51 g/d larger and the standard deviation was 29 g/d smaller. Heritability estimates were .18 and .27 for EM1 and EM2 and the phenotypic correlation was .88. Methods of editing errors in data from electronic swine feeders impact estimates of heritability thus affecting genetic improvement of feed efficiency.

Key Words: Feed Intake, Editing Methods, Heritability

Combined Animal, Dairy, and Poultry Extension Workshop

176 Development of model biosecurity programs. J. Shutske*, *University of Minnesota, St. Paul.*

Bio- and agricultural security programs designed to protect animal health and minimize risk often contain components such as facility access control, personal hygiene, sanitation, and animal quarantine/isolation protocols. Biosecurity protocols are often implemented using checklists that guide the user in the process of evaluating current practices and environmental/equipment conditions. These checklists provide a basis for continuous improvement. We have learned in other areas of risk control that the most effective measures to reduce risk/loss involve efforts to eliminate potential hazards through equipment and system-level design rather than heavy reliance on human action and behaviors which can be highly variable and subject to competing motivations. This becomes increasingly important as animal agriculture becomes more reliant on a labor force that may include individuals with limited knowledge of animal production, animal health, or even a basic understanding of personal health behaviors and practices. Workers themselves may, in fact, be the most crucial link within a successful production security program. Being on the front lines of an operation, workers are in the best position to monitor environmental conditions, observe changes in animal health, suggest improvements, and provide an ongoing evaluation of an operation's biosecurity program. Other industries have recognized and embraced the role of the workforce in implementing quality control and improvement. Workers are also the ones who will have the first exposure to hazardous biological and chemical agents that could impact an operation. Thus, an effective biosecurity program should also have some means of monitoring and protecting worker health. Based on the few events in the U.S. where there have been intentional breaches of security within the food system, it is also clear that those in the labor force could also be involved in facilitating (or preventing) an event whether intentionally or otherwise. So, biosecurity programs, educational materials, and checklists created in the future should encourage producers to engineer out potential hazards and should holistically consider the role of workers in implementing and providing continuous evaluation of biosecurity programs.

Key Words: Biosecurity, Engineering, Labor

177 Catastrophic Composting: Is it safe and effective? J. M. DeRouchey*, J. P. Harner, and J. P. Murphy, *Kansas State University, Manhattan.*

Composting of animal mortalities has increased in popularity in recent years due to decreased availability and increased costs associated with the traditional animal rendering industry. However, with increasing foreign animal disease and transmission concerns, composting has received considerable more attention as a potential method for mass mortality disposal. Limited research has shown composting can reduce pathogens