**264 Relative importance among sow productivity traits in the selection criterion for purebred dam lines, based on a modified profit function with causal relationships between traits.** V. M. Quinton*[1], J. W. Wilton[1], J. A. B. Robinson[1], and P. K. Mathur[2], [1]*University of Guelph, Guelph, Canada,* [2]*Canadian Centre for Swine Improvement, Ottawa, Canada.*

Economic weights for sow productivity traits in pure-line pig populations were derived from a single profit equation in order to provide flexibility to alternative market requirements or production systems. The profit function method was modified to account for differences in piglet perinatal survival environment imposed by litter size at birth. Both the 100kg finished pig and the feeder pig market were considered. As an example, the economic weights were calculated from average trait values in Ontario purebred Yorkshire herds and provincial average prices and costs. Based on the unmodified profit function, when the mean litter size was increased from 6 to 16 pigs, and all other traits remained constant, the economic weight for total litter size was constant, and those for survival traits increased from $0.16/% to $0.43/% for the finished pig market. When the profit function was modified, the weight for litter size decreased as mean litter size increased, from $2.51/pig for 6 pigs/litter to $1.76/pig for 16 pigs/litter. Economic weights for all other traits were the same as before the modification. The effect was similar for the feeder pig market. Short-term profit in the finished pig market from index selection with economic weights for a mean litter size of 8 pigs was 97% of that based on the correct weights when the mean litter size was 12 pigs, and 87% when the mean litter size was 16 pigs. Profit from selection for litter size alone was 85% of the maximum attainable from selection on the correct index in the finished pig market, and 51% of the maximum in the feeder pig market for an average litter size of 12 pigs. Relative predicted gains from selection on either reduced or incorrect indices decreased with the length of the selection program, and in some cases the decrease became substantial in the long-term.

**Key Words:** Sow productivity, Profit function, Economic weight

**265 Comparison of two models to estimate breeding values for intramuscular fat percentage in Duroc pigs.** D. W. Newcom* and T. J. Baas, *Iowa State University, Ames, IA.*

Data from a selection experiment designed to increase intramuscular fat percentage in Duroc swine were used to compare how animals rank based on breeding values estimated from either a one- or two-trait animal model. Predicted intramuscular fat percentage (PIMF) was estimated using linear regression analysis of five image parameters averaged across four longitudinal ultrasound images and 10th rib off-midline backfat from a cross-sectional image. Carcass intramuscular fat percentage (CIMF) was determined by chemical analysis of a slice from the 10th rib of the loin. All pigs in the selection experiment (boars, barrows, and gilts) were scanned, and one to three barrows and selected gilts from each litter were harvested. Breeding values were estimated using MATVEC and fitting a one- or two-trait animal model. The one-trait model estimated breeding values for PIMF (P1) from only PIMF for all pigs (n=1630) with gender and scan group as fixed effects, animal (genetic) and litter as random effects, and scan weight as a covariate. The two-trait model estimated breeding values for PIMF (P2) and CIMF (C2) from PIMF for all pigs and CIMF from those pigs (n=392) harvested. In addition to the effects in the one-trait model, harvest group and harvest weight were added as a fixed effect and covariate, respectively, in the two-trait model. Spearman rank correlation coefficients were calculated between P2 and C2, P2 and P1, and C2 and P1. Correlations were calculated for all pigs with scan data, within year for all pigs scanned (n=379, 637, and 614, for Gen 0, 1, and 2, respectively), and by gender within year. The rank correlations between P2 and C2, P2 and P1, and C2 and P1 for all pigs with scan data were 0.95, 0.95, and 0.84, respectively. Rank correlations by year for all three EBV combinations increased over the three generations of the project. After sorting by sex, rank correlations in Generation 2 between C2 and P1 for boars and gilts were 0.91 and 0.91, respectively, showing similar animals would be selected when ranking was based on C2 or P1.

**Key Words:** Swine, Breeding values, Intramuscular fat

**266 Evaluation of Dorset, Finnsheep, Romanov, Texel, and Montadale breeds of sheep: Productivity of $F_1$ ewes in fall breeding seasons.** E. Casas*, B. A. Freking, and K. A. Leymaster, *USDA-ARS, U.S. Meat Animal Research Center.*

Objectives were to estimate effects of sire breed (Dorset, Finnsheep, Romanov, Texel, and Montadale), dam breed (Composite III and northwestern whiteface), mating season (August, October, and December), ewe age (1, 2, and 3 yr), and their interactions on productivity of $F_1$ ewes. A total of 1,799 $F_1$ ewes produced 3,849 litters from 4,804 exposures to Suffolk rams during 35-d mating seasons. Conception rate and ewe longevity were determined. Litter size and weight at birth were recorded and litter size and weight at weaning and 20 wk of age were analyzed separately for dam- and nursery-reared litter mates. Total productivity through 3 yr of age for each ewe entering the breeding flock was calculated as the sum of 20-wk weights for dam- or nursery-reared lambs. Interactions of sire breed x mating season, sire breed x ewe age, and mating season x ewe age were generally significant. Interactions of sire breed x mating season were often due to changes in rank as well as magnitude, indicating the importance of matching sire breeds to specific mating seasons. Litter size at birth of Dorset-, Texel-, and Montadale-sired ewes was not affected by dam breed; however, Finnsheep-sired ewes out of northwestern whiteface dams were more prolific than Finnsheep-sired ewes out of Composite III dams and the opposite situation existed for Romanov-sired ewes. Least-squares means of sire breeds ($P < 0.001$) for total productivity of dam-reared lambs were 98.5, 103.5, 106.9, 124.6, and 154.9 kg for Texel, Dorset, Montadale, Finnsheep, and Romanov, respectively. Superior productivity of Romanov-sired ewes was due to greater conception rates and litter sizes for each mating season and ewe age, as well as greater ewe longevity. Total productivity of $F_1$ ewes by Composite III dams (125.6 kg) was greater ($P < 0.001$) than ewes born to northwestern whiteface dams (109.7 kg). Experimental results provide comprehensive information about the appropriate use of these breeds in crossbreeding systems.

**Key Words:** Reproductive traits, Sheep, Breeds

**267 Pedigree analysis of a closed population of crossbred sheep.** K. M. MacKinnon*, L. A. Kuehn, and D. R. Notter, *Virginia Polytechnic Institute and State University, Blacksburg, Virginia.*

Inbreeding and genetic diversity were compared in selected and control lines of 50% Dorset, 25% Rambouillet and 25% Finnsheep breeding established in 1983 and maintained as closed populations for 13 yr. Fall-lambing selection (S) and spring-lambing genetic control (G) lines were created in spring, 1987. Selection for fall lambing began in spring, 1988. Flock S consisted of 125 ewes and 10 rams; G was composed of 45 ewes and 5 rams. Fourteen sire lines were identified in G in 1987; a ram from each line was retained whenever possible. Founder numbers were 126 in S and 96 in G. Inbreeding was evaluated for three sets of animals from each line: all lambs (L), all rams and ewes present (P) and an offspring from each mating (M, including hypothetical offspring for open ewes). Inbreeding rates were similar for L, P and M in S (1.41 ± 0.04, 1.46 ± 0.06 and 1.56 ± 0.04 %/yr), but variable in G due to small population size and sampling of five rams per year (1.91 ± 0.98, 1.42 ± 0.15 and 1.82 ± 0.13 %/yr). Average inbreeding rates yielded effective population sizes for L, P and M of 35.5, 34.3 and 32.1 in S and 26.2, 35.2 and 27.3 in G. Effective founder numbers for L, P and M were similar in S (32.0, 31.5 and 31.6), but varied in G (25.2, 30.8 and 28.8), possibly due to inbreeding effects, small population size and sampling of rams. Numbers of founder genome equivalents (the number of equally represented founders needed to produce the observed heterozygosity) reveal impacts of small population size, bottlenecks, inbreeding and overlapping generations, which were more evident for L, P and M in G (5.2, 10.0 and 3.7) than in S (6.6, 6.7 and 5.3). Effects of inbreeding on lamb BW, fall fertility of ewes and ewe litter size were calculated using REML and found to be -0.027 ± 0.023 kg/%, -0.70 ± 0.25 %/% and -0.0018 ± 0.0053 %/%. Results suggest that genetic variation in a flock is best determined by analysis of animals available to be bred. G animals were similar in heterozygosity to S, as is desired in a genetic control line.

**Key Words:** Pedigree, Inbreeding depression, Sheep

**268 Competing risks analysis of lamb mortality.** B. R. Southey*[1], S. L. Rodriguez-Zas[1], and K. A. Leymaster[2], [1]*University of Illinois Champaign-Urbana, Urbana, IL,* [2]*USDA, ARS, USMARC, Clay Center, NE.*

Survival is often represented as the time elapsed between two events (e.g. birth to mortality) or until the end of period considered. The typical survival models assume one type of terminal event thereby ignoring that there could be multiple causes of mortality. A competing risks model that accounts for different causes of mortality was evaluated. Discrete survival methods using a complementary log-log link function were applied to lamb mortality records from a composite population at the US Meat Animal Research Center. Causes of mortality were grouped into disease, maternal (e.g. dystocia), pneumonia and other causes. A total 8301 lamb survival records from birth to weaning were analyzed using sire, animal and maternal effect mixed models including sex, contemporary group, type of birth and age of dam as fixed effects. The results showed substantial differences on the effect of lamb sex among mortality categories. The influence of birth type and age of dam on survival showed little variation with mortality category. Estimates of variance components from the sire and animal models compared to the maternal model indicated maternal components were present. Estimates of heritability from a maternal effects model ranged between 10 and 20% and varied with the mortality category. Results from the maternal category were consistent with literature studies on parturition, lamb behavior and selection for rearing ability. These results indicate that failure to account for the cause of the terminal event on mortality and longevity studies may hide important genetic differences. Therefore, breeding programs are likely to be ineffective when the multiple causes involved in time to event traits such as mortality and longevity are ignored.

**Key Words:** Analysis, Sheep, Survival

**269 Genetic correlations for litter weight weaned with reproduction and wool characteristics in Rambouillet, Columbia, Targhee and Polypay sheep. .** K. J. Hanford*[1], L. D. Van Vleck[1], and G. D. Snowder[1,2], [1,2]*USDA, ARS, U.S. Meat Animal Research Center,* [1]*Lincoln, NE,* [2]*Clay Center, NE.*

Genetic correlations between litter weight weaned (LW) and litter size born (NB), litter size weaned (NW), fleece weight (FW), fleece grade (FG), and staple length (SL) were estimated from Rambouillet (RAM), Columbia (COL), Targhee (TAR), and Polypay (POL) data collected from 1950 to 1998 at the U.S. Sheep Experiment Station, Dubois, ID. Numbers of breed records ranged from 8,313 to 39,816 for LW; 9,081 to 44,211 for NB and NW; 8,872 to 39,820 for FW and FG; and 1805 to 3574 for SL. Estimates of direct heritability with single-trait animal models using REML ranged from 0.07 to 0.09 for LW, 0.08 to 0.10 for NB, 0.03 to 0.07 for NW, 0.50 to 0.66 for FW, 0.16 to 0.41 for FG, and 0.56 to 0.76 for SL. Estimates of the genetic correlation between LW and NB were similar for RAM, COL and TAR breeds (0.59, 0.68, and 0.62, respectively), but was close to zero for POL (0.05). The low correlation for POL may be due to generally restricting ewes to rearing only 2-3 lambs, which would impact a highly prolific breed such as POL more than less prolific breeds. The estimate of genetic correlation between LW and NW was close to one for all breeds, as expected, because NW is a component of LW. Estimates of the genetic correlations between LW and both FW and FG were near zero for all breeds, except RAM (0.12 for FW and -0.19 for FG). Estimates of the genetic correlations between LW and SL varied among the breeds (0.07, -0.19, 0.10, and -0.17 for RAM, COL, TAR, and POL, respectively). Litter weight weaned is often used as an overall measure of range ewe productivity. These results suggest that selection for LW would result in neutral or favorable correlated responses except for a decrease in FG for RAM and decreases in SL for COL and POL. Decreases in FG and SL would have a minimal economic impact because of the small genetic correlations and because increased LW should offset decreases in FG and SL under today's market prices.

**Key Words:** Fiber, Genetic Correlation, Prolificacy

**270 Influence of birth weight and birth rank on lamb survivability.** C. S. Welsh*[1], B. L. Golden[1], R. M. Enns[1], D. J. Garrick[1], and G. B. Nicoll[2], [1]*Colorado State University, Fort Collins, CO, USA,* [2]*Landcorp Farming Ltd, Rotorua, New Zealand.*

The objective of the sheep breeder is to increase the number of lambs weaned, either by increasing prolificacy or increasing lamb survival. Increasing prolificacy reduces lamb survival because, relative to singles, multiple lambs have competition for milk and reduced birth weight (BW). Breeding values (BV) for prolificacy are readily available. The heritability of number born is 0.10 to 0.15, implying birth rank (BR; single, twin, triplet, or quadruplet) has a genetic component. Lamb survivability BV have yet to be implemented. The objective of this study was to determine if BR should be fit as a fixed effect in the evaluation of lamb survivability (LS). If birth rank (BR) is fit, the BV predicts LS adjusted for BR. By omitting BR as a fixed effect, the BV predicts LS including the effect BR has on LS. Possible genetic influences on LS include BW and BR. Data were from two Romney flocks (n=31,127) with lambs born 1997-2000 at Landcorp, New Zealand. LS was scored 0 for death prior to weaning and 1 for survival. Pearson (partial) correlation matrices were derived. The phenotypic correlation between LS and BR was -0.17, indicating lamb survival decreases as number of lambs born increases. Adjusted for BW, this correlation decreased to -0.14, suggesting birth weight does not fully account for the decline in lamb survival observed as BR increases. The phenotypic correlation between BW and LS was 0.2, suggesting higher birth weight is associated with higher survival. Once this correlation was adjusted for BR, it decreased to 0.13, indicating some of the effect birth weight has on lamb survival is independent of number of lambs born. These results show phenotypic variation in lamb survival cannot be explained entirely by birth weight differences nor by birth rank differences. Further research to compare the relative accuracy of lamb survivability BV for alternative models is planned.

**Key Words:** Sheep, Survival, Genetic analysis

**271 Caprine genetic resource conservation program.** J. M. Dzakuma*[1], S. A. Ericsson[2], B. L. Sayre[3], T. A. Gipson[4], and H. D. Blackburn[5], [1]*Prairie View A&M University, Prairie View, TX,* [2]*Sul Ross State University, Alpine, TX,* [3]*Virginia State University, Petersburg, VA,* [4]*Langston University, Langston, OK,* [5]*USDA-ARS-National Animal Gerplasm Program, Fort Collins, CO.*

A genetic resource conservation center for goats has been established at Prairie View A&M University (PVAMU). The objectives of the project are based upon: 1). Genetic resources are the building blocks for all production systems. 2). Conservation, maintenance, enhancement and access to these genetic resources will enable small goat producers to increase their profitability. 3). Angora doe numbers have declined two-thirds from about 750,000 in 1995 to 260,000 in 2000. Spanish and Tennessee Stiff-legged doe numbers have also declined because they have been crossed to the dominant meat type breeds. Sixty four F and 8 M per breed of Tennessee Stiff-legged, Spanish and Boer goats, were bred in fall 2002 in order to establish live populations (*in situ*) conservation program at PVAMU. The *in situ* population was divided into 2 lines/breed: Line 1, would be selected for growth and Line 2, selected for resistance to common gastro-intestinal parasites. *Inter se* matings will be made in subsequent years within each line, within breed. Simultaneously, collection of semen that would be preserved cryogenically (*ex situ*) as part of the National Animal Germplasm Program (NAGP), has commenced in West TX with Sul Ross State University and in East TX with PVAMU. Genotyping efforts at Virginia State University have linked the myotonic phenotype to a single nucleotide polymorphism (SNP) in the chloride channel-1 (C1C-1) gene expressed in skeletal muscle. Continued efforts are underway to characterize the genotype in relationship to carcass traits in the Tennessee Stiff-legged breed. Phenotypic and genetic characterization of goat breeds will be carried out at all the institutions. Although this project has been initiated in TX the preservation effort will be extended nationally. This *in situ* project will enable the breeds to be properly characterized and evaluated in East TX environment and allow us to perform comparative trials, undertake crossing experiments and conduct research into other areas. Presently, 12.9 and 22.9 % of the germplasm needs for Spanish and Angora breed regeneration and security have been acquired.

**Key Words:** Goats, *ex situ*, Genetic resources

**272 Population genetic structure of a colony of German Shepherd and Labrador Retriever dog guides.** J. B. Cole*[1], D. E. Franke[1], and E. A. Leighton[2], [1]*Louisiana State University, Baton Rouge, LA,* [2]*The Seeing Eye, Inc., Morristown, NJ.*

Pedigree analysis was used to describe changes in genetic diversity in a colony of dog guides. German Shepherds (GS) and Labrador Retrievers (LR) were evaluated. Parameters estimated included average coefficients of relationship to the breed, average coefficients of inbreeding, effective founder number, effective ancestor number, founder genome equivalents, and effective population size. There were rapid increases in average pairwise relationship in both breeds, although the average was approximately one-third higher in the GS population than in the LR population. A similar trend was observed for average inbreeding. Both measures showed a steady increase for several generations and levelled off thereafter. In the current generation, relationship and inbreeding for all animals averaged 25.3% and 26.2% in GS and 15.5% and 22.0% in LR, respectively. Effective founder number initially decreased in GS until generation 3, and then increased steadily. There was a constant increase in effective founder number in LR after founding. Final values were 35.5 and 20.2 in GS and LR, respectively. A similar pattern, with current values of 23.6 and 16.9, was seen for effective ancestor number as well. This is probably due to the fact that this is a small population which received new genetic material by migration distinctly different populations. Founder genome equivalents were initially higher in the GS but decreased over time in both breeds to 5.6 and 5.3 in GS and LR, respectively. Changes have been effected in the genetic management of the breeding colony to slow, and eventually reverse, the trends towards increased relationships and inbreeding. Effective population sizes are not expected to change significantly in the near- to medium-term. Use of a more diverse portfolio of sires and dams, as well as the introduction of germplasm from outside of the current breeding colony, will help insure the continued health of this population.

**Key Words:** Population structure, Dog guides, Genetic diversity

## Companion Animals

**273 Human-animal-relationship as a risk factor for overweight pets.** E. Kienzle*[1] and R. Bergler[2], [1]*Chair of Animal Nutrition, Ludwig-Maximilians-University, Munich, Germany,* [2]*Psychological Institute, University of Bonn, Bonn, Germany.*

Hundred and twenty cat owners and 120 dog owners (60 with overweight and 60 with normal pets, respectively) were interviewed by standardized questionnaires. Questions to dog and cat owners were made similar where applicable. Overweight dogs more often slept in their owner's bed. Their owners talked more and on a greater variety of subjects to their dogs and they were less afraid of taking diseases from their dogs. Exercise, work or protection by the dog were rated as less important. These characteristics of the human-animal-relationship were interpreted as signs of over-humanisation of overweight dogs. In overweight cats the human-animal-relationship also showed indicators of over-humanization, such as talking to the cat on topics which are not related to the cat. Owners of overweight cats and dogs watched their pets more often when they were eating. Several items indicate that feeding the pet was an important stimulant for communication with the overweight pet. The human-animal-relationship of owners of overweight cats was characterized by a higher intensity of the bond between owner and cat. By contrast there were hardly any indications that the bond between overweight dogs and their owners was stronger than the bond between normal dogs and their owners. Owners of overweight dogs appeared to be more aware of the overweight problem than owners of overweight cats. In overweight dogs the number of meals and snacks was significantly increased compared to normal dogs. In normal and overweight cats there was no difference in the frequency of meals and snacks, however, overweight cats often had free choice of food intake. Overweight cats and dogs were given kitchen scraps more often on top of their usual diet. Preventive health care for the pet (such as health checks, observation of feces quality, vaccinations) was more important to the owners of normal pets than to those of overweight pets. Owners of overweight dogs had less interest in preventive health care for themselves than owners of normal dogs, whereas in owners of overweight cats there was a tendency to the contrary.

**Key Words:** Human-animal-relationship, Overweight, Pets

**274 Effect of temperament on stress response of stray adult dogs in a shelter environment.** C. L. Coppola*, T. Grandin, and R. M. Enns, *Colorado State University, Fort Collins, CO USA.*

Due to a dog's inherent social nature and a keen sense of its surroundings they are vulnerable to changes in the environment. The main stressors a domestic dog encounters in a shelter are isolation, exposure to constant noise and novel, irritating stimuli. The objective of this study was to examine the relationship between seven temperament traits of stray adult dogs and their stress response to the shelter environment as measured by salivary cortisol after 9 days in the shelter. Dogs (n = 26) included in the study were healthy, non-pregnant, potential adoption candidates not claimed by their owner. Animals that were deemed dangerous and/or not suitable for adoption were excluded from the study. The primary temperament traits evaluated were: sociability (interaction with people and other dogs) and reactivity (response to sudden novel stimuli). The secondary temperament traits evaluated were: independence, confidence, calmness, playfulness and lack of fear. All traits were ascertained through the results and interpretation of an adoptability assessment conducted on the 2nd day of housing in the shelter. A Mixed Model was used to evaluate the effect of temperament on cortisol level on day 9. The model included the fixed effects of each temperament level and type (as classified by AKC breed types), as well as the random effect of individual. Sociability, reactivity, confidence, calmness and lack of fear affected cortisol levels on day 9 ($P < 0.05$). As sociability and reactivity levels increased in an individual animal, cortisol level increased by $0.2342 \pm 0.083$ and $0.2313 \pm 0.075 \mu g/dl$, respectively. Isolation or lack of socialization and reaction to the shelter environment are important key factors in predicting the stress response of an animal while housed in a shelter environment. Identification of animals that may have an elevated stress response may prove to be beneficial from both a welfare and financial standpoint by decreasing overall stress response and ultimately improving the physical and mental health of the animal.

**Key Words:** Dog, Temperament, Stress Response

**275 Use of expert system software in teaching problem solving in a companion animal nutrition class.** J. P. McNamara*, *Washington State University.*

The objective was to demonstrate effectiveness of teaching nutrition and problem solving skills using problem solving techniques and expert system software in an advanced class. The course is AS 406, Nonruminant Nutrition. The only prerequisite is one basic Animal Feeds and Feeding class, for which students have had one year of college chemistry, biology, one semester of organic chemistry. The objective is to teach advanced nutritional principles and practical feeding of nonruminants, primarily companion animals. Students first demonstrate that they can balance a ration using the algebraic method, then move on to problem scenarios. Students do not answer questions, rather they design a list of questions they need to have answered to solve the problem. After that, students begin designing an expert system to help someone else (a client, for example) to solve a different problem or to learn some aspect of nutrition. They develop an objective, a flowchart of questions and potential answers, and then write an expert system using commercially available software containing an inference engine for backward or forward chaining. This process forces students to define a problem or a learning objective and devise the question set which will provide answers leading to a specific recommendation or finding. They must also provide the potential answers to the questions they ask, and then make their findings. The process helps the students to learn nutritional facts and concepts, and to use specific logic, as the system will not run otherwise. Students (with teacher guidance and input at each step) decide which pieces of information are critical to the situation then explain the reasoning for the solution to the user. The software is easy to learn, based on normal English, and logical IF, AND, OR, THEN, and ELSE, statements. No previous computer programming experience is necessary. Potential effectiveness may be demonstrated by the fact that all students (8 years, more than 180 students) have been able to design a working system, with