

272 Population genetic structure of a colony of German Shepherd and Labrador Retriever dog guides. J. B. Cole*¹, D. E. Franke¹, and E. A. Leighton², 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. Bergler², 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 ± 0.083 and $0.2313 \pm 0.075 \mu\text{g}/\text{dl}$, 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

the majority including sufficient depth of knowledge expected at senior level. Student evaluations provide high rankings (9 of 10 or better) on fostering independent thinking ability, problem-solving skills, ability to apply knowledge.

Key Words: Critical thinking, Nutrition, Companion animals

276 Investigations on the energy requirements of adult cats . G. Edtstadler-Pietsch¹, R. Rudnick², and E. Kienzle*¹, ¹Chair for Animal Nutrition, Ludwig-Maximilians-University, Munich, Germany, ²Nestle Purina PetCare Research.

Energy requirements of 138 adult colony cats were determined by recording the energy intake during periods of weight constancy (> 4 weeks). Females had a mean body weight of 3.88 kg, while the body weight of male cats averaged 5.09 kg. Neutered females were significantly heavier than intact queens (mean body weight of 4.09 kg and 3.64 kg, respectively, $p < 0.05$). Middle-aged cats had higher body weights than young (< 5 yrs) and very old cats (> 10 yrs.). The mean energy requirement of adult cats was 251 kJ ME/kg BW. Maintenance energy requirements per body mass unit decreased with increasing body weight. Mean energy requirements of cats with a body weight of up to 3 kg were 319 kJ ME/kg BW, while heavy cats with a body weight of over 5 kg needed only 209 kJ ME/kg BW for weight maintenance. This suggests that most of the heavier cats were not larger cats, but rather more overweight cats with a reduced percentage of fat-free body mass. Energy requirements of a cat population with a considerable percentage of overweight individuals can therefore be best described using a function with an exponent for metabolic body mass, which is considerably lower than 0.75 (maintenance energy requirements = $544 \text{ kJ ME/kg BW}^{0.40}$). Neutered cats had significantly lower energy requirements than intact cats (286 kJ ME/kg BW vs. 231 kJ ME/kg BW; $p < 0.05$). When the cats were grouped according to body weight there were no significant differences between intact and neutered cats of the same weight group. The young adult cats had higher energy requirements per body mass unit than middle-aged animals. While cats of 1 to 5 years of age needed an average of 313 kJ ME/kg BW, mean maintenance energy requirements of cats between 6 and 10 years of age only came up to 231 kJ ME/kg BW. Very old cats had slightly higher energy requirements than middle aged cats. Age effect interacted with the effect of overweight. When only data of lean cats were evaluated there was a gradual decrease of energy requirements with age.

Key Words: Maintenance energy requirements, Cats

277 Prediction of energy digestibility based on total dietary fiber (AOAC-method) in complete dry food for dogs and cats. E. Kienzle*¹, V. Biourge², and A. Schönmeier¹, ¹Chair of Animal Nutrition, Ludwig-Maximilians-University, Munich, Germany, ²Royal Canin, Research Center, Aimargues, France.

It has been repeatedly demonstrated that there is a negative relationship between fiber in dry matter and energy digestibility in pet foods. This is true for any method of fiber determination that measures the major percentage of cellulose. So far, however, there are only few observations on total dietary fiber (TDF; by AOAC-method) and energy digestibility. In the present study therefore 610 digestion trials with dog foods and 261 digestion trials with cat foods were evaluated. Digestion trials were carried out according to AAFCO-protocols, and energy in food and feces was determined by bomb calorimetry. In addition to TDF the crude fiber (CF) content was determined in 495 dog foods. The following regression equation between energy digestibility (%) and TDF in % dry matter (DM) was obtained for dog food: energy digestibility = $96.6 - 0.96 \times \text{TDF} (\% \text{ DM})$; $r = 0.94^{**}$. A similar equation was obtained for cat food: energy digestibility = $95.6 - 0.89 \times \text{TDF} (\% \text{ DM})$; $r = 0.88^{**}$. For crude fiber in dog foods the regression equation was: energy digestibility = $92.9 - 1.6 \times \text{CF} (\% \text{ DM})$; $r = 0.87^{**}$. This confirms earlier results. The correlation was even closer for TDF than for CF, and for TDF there were no outliers. Prediction of energy digestibility in dry food by TDF as a basis for prediction of ME may be even more accurate than prediction of energy digestibility by CF.

Key Words: Total dietary fiber, Energy digestibility, Cats and dogs

278 Comparison of in vitro nutrient disappearance to in vivo nutrient digestibility and fermentability using the ileal-cannulated dog model. E. A. Flickinger*, A. M. Gajda, C. M. Grieshop, L. L. Bauer, N. R. Merchen, and G. C. Fahey, Jr., University of Illinois Department of Animal Sciences.

A model for estimating in vitro nutrient digestibility previously has been developed and validated using ileal-cannulated pigs. Our objective was to determine the accuracy of this model at predicting dry matter (DM), organic matter (OM), and crude protein (CP) digestibility in ileal-cannulated dogs. Two diets were used: a moderate diet (25% protein, 11% fat) and a super-premium diet (28% protein, 23% fat). Diets were fed to 8 ileal-cannulated dogs in a crossover design with chromic oxide used as a digestibility marker. The same diets were used as substrates in an in vitro system. Briefly, samples were ground and incubated with pepsin-HCl followed by pancreatin enzyme to simulate hydrolytic digestion before incubating with anaerobic media and canine fecal inoculum to simulate colonic fermentation. The in vitro model accurately ranked DM, OM, and CP hydrolytic digestibility of these diets, but predicted differences ($P < 0.05$) due to diet in digestibility of all three nutrients, while the in vivo model resulted in differences ($P < 0.05$) for CP alone. For digestive values including fermentation, the in vitro model correctly ranked and predicted differences ($P < 0.01$) in disappearance of DM and CP as compared to the in vivo model. However, the in vitro model predicted no difference between the OM total tract digestibility of the two diets, while the in vivo model resulted in greater ($P < 0.01$) OM digestibility of the super-premium diet. Generally, the in vitro model predicted digestibility coefficients that were lower than in vivo results, with the most variability occurring in CP digestibility values and the least variability occurring in DM digestibility values. These results indicate that although this in vitro model may aid in predicting relative diet digestibility, it is not a substitute for in vivo research on canine nutrient digestibility.

Key Words: Dog, In vitro, Nutrient digestibility

279 Influence of diet on fecal *Lactobacillus* population. C. J. Fu*¹, J. N. Carter², J. H. Porter¹, and M. S. Kerley¹, ¹University of Missouri-Columbia, ²Nestle Purina PetCare Company.

Forty Labrador Retriever puppies were used in a completely randomized block design to compare the effect of two meat-based (treatments 1 and 2) and two grain-based (treatments 3 and 4) extruded dry commercial diets on the *Lactobacillus* population in the feces. The crude protein content of treatments 1 - 4 were 28.0, 28.0, 25.5, and 27.0 % on DM basis, respectively. The fecal samples were collected individually from each dog on day 0, 3, and 14. Total anaerobe (TOTA) and *Lactobacillus* (LACT) bacteria were enumerated by an agar plating method. The media for TOTA enumeration was anaerobe basal agar (Oxoid, CM972, Basingstoke, Hampshire, England) with 10 % sterile defibrinated horse blood. The media for LACT was MRS broth (Difco, #288130, Sparks, MD, USA) and agar (20 g/L) with 20 mg/L vancomycin supplement. Incubation time was 48 h in an anaerobic chamber at 37 °C. *Lactobacillus* as a percentage of TOTA was greater ($P < 0.05$) for treatment compared to the others (24 vs 16, 7, and 14 %). There was no main effect ($P > 0.05$) due to day of sampling (11, 15, and 20 % LACT for day 0, 3, and 14, respectively). However, the ratio increased ($P < 0.05$) from day 0 to day 14 (11 and 38 % LACT, respectively) for the puppies fed the diet that resulted in the greater percentage LACT population. Diet can influence gut bacterial population in the puppy. Differences appear to exist in the ability of commercial diets to elicit bacterial population responses. There were no obvious correlations between type of diet and fecal LACT.

Key Words: Diet, *Lactobacillus*, Puppy