Companion Animal Symposium: Comparative nutrition—Protein and energy across species

772 Thinking comparatively allows flexibility: The legacy of Duane Ullrey. Mark S. Edwards*, *California Polytechnic State University, San Luis Obispo, CA.*

A Michigan native, Duane Ullrey completed a BS degree in animal husbandry (1950) and an MS degree in animal pathology (1951) from Michigan State College. Duane earned a PhD in animal nutrition with minors in physiology and biochemistry (University of Illinois, 1954). Upon graduation, he taught at Oklahoma A&M University. In 1956, Duane was hired as an assistant professor, becoming a full professor in 1968, of animal nutrition with a joint appointment in Departments of Animal Science and Fisheries and Wildlife at Michigan State University. He taught and conducted research in swine and white tailed deer nutrition, as well as taught Animal Nutrition in the College of Veterinary Medicine, ultimately developing a Comparative Animal Nutrition program. Duane influenced many (34 graduate students, 140 graduate committees) in formal and informal learning environments. Duane established new care standards in the field of zoo animal nutrition. His comparative approach facilitated service on prominent committees, including the National Academy of Sciences, Committee on Animal Nutrition (1981; Chair, 1985), Lab Animal Nutrition (1978), Mineral Toxicity (1980), Horse Nutrition (1989), and Primate Nutrition (Chair, 2003). Duane was recognized by his colleagues with honors, including the MSU Distinguished Faculty Award (1983), ASAS Morrison Award (1988), ASAS Fellow (1990), the first Comparative Nutrition Society honorary life member (1996), and the first award recipient of the Duane E. Ullrey Achievement Award by the American Association of Zoo Veterinarians (1999). Duane was a mentor, friend and colleague. He cultivated sound scientific principles in species husbandry, emphasized a strong foundation in nutrition, and guided our comparative discovery of relevant similarities and differences among novel species with known models. A consummate life-long learner, Duane embodied integrity, thoughtfulness, humor, honesty, and perseverance in his personal and professional life. Through his students, he continues to make remarkable contributions in academia, industry, and regulatory agencies in areas of animal agriculture, wildlife and natural resource management, veterinary medicine, and human nutrition and health.

Key Words: comparative animal nutrition

773 Protein and energy metabolism in the development and management of obesity and chronic diseases in humans. David J. Baer*, *USDA, ARS, Beltsville, MD.*

Obesity and several obesity-related diseases, such as cardiovascular disease and diabetes, are epidemic not only in the United States but around the globe. In addition to their impact on premature death and loss of quality of life, the combined economic burden of obesity and diabetes is nearing one-half trillion dollars in the United States. Furthermore, in many countries, including the United States, there is significant growth in the proportion of the older population, and optimal dietary protein is necessary for healthy aging to minimize age-associated loss of muscle (sarcopenia). Protein is an energy yielding macronutrient, and consumption of protein or any energy yielding macronutrient in excess of need will contribute to unhealthy weight gain. However, some studies have demonstrated that consumption of protein in excess of the Recommended Dietary Allowance for adults (0.8 g/kg body weight/day) is associated with improved health outcomes, including improved body composition and improved insulin sensitivity without detrimental effects on bone or renal function. The effect of higher protein diets on reducing food intake is one mechanism by which protein may influence body composition. In addition to the amount of dietary protein, the quality of that protein can affect health outcomes. Increased consumption of dairy protein, and whey protein in particular, has been associated with decreased body fat without a loss of lean mass. The relatively high branch-chain amino acid concentrations of whey protein may contribute to its physiological effects. Leucine, and perhaps other branched chain amino acids, might mediate changes in body composition through modulation of the mTOR or other key regulatory pathways. With the global public health challenges of obesity and its comorbidities, dietary recommendations to improve health continue to be evaluated. Higher protein diets and high quality proteins can play an important role in improving body composition and supporting healthy aging.

Key Words: obesity, protein, humans

774 Brain and cognitive development: Assessing the impact of nutrition in a neonatal piglet model. Rodney W. Johnson*, *University of Illinois, Urbana, IL.*

Prenatal and early postnatal insults increase the likelihood for neurobehavioral problems later in life. One hypothesis suggests that the pre- and postnatal periods represent sensitive periods during which exposure to adversity programs biological systems in a manner that persists and accentuates vulnerability to behavioral problems later in life. This hypothesis is predicated on pre- and/or postnatal stress influencing structural and functional plasticity of the brain and subsequent stress resilience. The piglet is an excellent model for perinatal developmental studies because it is a gyrencephalic species with brain growth and morphology similar to humans. Its gastrointestinal anatomy and physiology are comparable and in a recent study that examined the similarity of immune-related genes in humans, pigs, and rodents, the overall mean similarity to human immune-related proteins was significantly higher for pigs compared with mouse. In the piglet model we have reported profound effects of perinatal infection, postnatal nutrition, and being born small for gestational age on brain development and behavior. The later issue is particularly relevant to this symposium because protein-energy malnutrition during pregnancy is a leading cause of intrauterine growth restriction and small for gestational age births.

Key Words: low birth weight, learning and memory, stress resilience

775 Comparative gastrointestinal utilization of nitrogen, lysine, and glucose in equids and suids. Nathalie Trottier*, *Michigan State University, East Lansing, MI.*

Equids are obligate hindgut fermenters and thus are equipped with a large cecum and voluminous proximal colon for microbial fermentation of plant cell wall fiber components. Suids are also hindgut fermenters; however, because they have evolved consuming highly diverse diets, they are also classified as omnivores. Suids share similar gastrointestinal anatomical features with equids, and therefore may be a useful model of gastrointestinal nitrogen and carbohydrate metabolism. Important differences exist in the kinetics of glucose transport between equine and porcine small and large intestinal tissues, and these differences

shed light on the divergent ability of these 2 species to absorb dietary carbohydrates. In contrast, the 2 species share distinct similarities in intestinal Lys transport kinetics. In both species, the large colon apical membrane is capable of Lys transport via a high capacity and lower affinity transport process that is higher than that of the small intestine. Lys transport across the pig and the pony jejunum is 1.14 and 1.16 pmol/mg tissue (V_{max}), respectively, and uptake by the pig and pony colon is 0.84 and 0.91 pmol/mg tissue (V_{max}), respectively. In both species, the large colon has a lower affinity for Lys compared with the small intestine (i.e., 0.89 and 1.05 K_M, pig and pony, respectively). The broader capacity of Lys transport in the large colon is indicative of the potential role it plays in the uptake of Lys. It is proposed that the porcine model may be useful to predict amino acid requirements for maintenance and digestibility in equids.

Key Words: suid, equid, nutrient

776 Carnivores, omnivores, and herbivores—Concepts of ideal protein formulation for ornamental and commercial aquaculture feeds. Delbert M. Gatlin III* and Sergio Castillo, *Texas A&M University System, College Station, TX.*

Aquacultural production of various fish and crustacean species is continuing to grow throughout the world at over 6% per year, and projected to continue expanding as the demand for seafood increases and harvests from wild stocks remain at or beyond maximum sustainable levels. The efficiency of producing various aquatic species is generally considered to be greater than that of terrestrial livestock, primarily due to efficient feed utilization and protein accretion per unit of energy consumed. There is considerable variation in dietary protein requirements of various fish and crustacean species as well as their ability to use protein and lipid for energy. This variation appears to be primarily related to natural feeding habits in which aquatic species are generally categorized as being herbivorous, omnivorous of carnivorous. This presentation will provide an overview of the protein and amino acid requirements of prominent freshwater omnivorous and carnivorous fish species such as the channel catfish (*Ictalurus punctatus*) and rainbow trout (*Oncorhynchus mykiss*). Those requirements will be compared and contrasted with that of the red drum (*Sciaenops ocellatus*), a marine carnivore, and the omnivorous common carp (*Cyprinus carpio*) of which colored varieties are produced for ornamental purposes. Specific emphasis will be placed on application of the ideal protein concept in formulating diets for these various species.

Key Words: aquatic animals, amino acid requirement, comparative nutrition