640 Development of a web-based course in animal welfare. C. Wickens*, J. Siegford, and A. Zanella, *Michigan State University*, *East Lansing*.

Animal welfare is a complex issue of growing national and international importance, thus it is imperative to train personnel in scientific welfare assessment. Animal welfare instruction requires a multidisciplinary approach, which is not easily achieved in programs at single institutions. A university-wide collaboration of faculty at Michigan State University is developing a web-based animal welfare assessment course, using interactive media and software, to teach graduate and veterinary students scientific principles needed to assess animal welfare. Students will learn animal welfare concepts through a series of modules including: welfare ethics and law; economics of welfare; physiological indicators of welfare; welfare and suffering, including pain; and welfare standards among other relevant topics. To enhance quality and offer global diversity of content, modules will be created by international animal welfare experts. Web-based interaction between students and instructors from multiple institutions will provide opportunities for dialogue and collaboration. Real and science-based information has been compiled to form hypothetical scenarios, depicting various production or other animal-related situations. Students will use information on behavioral biology, physiology, husbandry, nutrition, veterinary care, housing, indicators of stress, and stockmanship to assess animal welfare by reviewing the information and rating each area, as well as the overall scenario. The scenarios contain links which allow students to access pertinent articles and animal welfare resources for additional information before making an assessment. A standardized answer key for each scenario allows students to compare their assessment to that of a panel of animal welfare scientists. The course will be evaluated to assess information acquisition, impact on knowledge of and attitudes toward welfare, and main criteria used to assess welfare. Future directions might include packaging course materials into CD-ROM format for professional use and licensing the course to other universities.

Key Words: Education, Welfare Assessment, Web-Based Instruction

Alpharma Symposium: Animal Health—Acidosis in Dairy Cattle

641 Ruminal acidosis: beyond the rumen. M. B. Hall*, *U. S. Dairy Forage Research Center, USDA-ARS*, *Madison, WI*.

Although the main focus in ruminal acidosis has been on the rumen, it might be more accurate to consider this nutritional disorder as a syndrome that can affect systems beyond the rumen and outside of the gastrointestinal tract. Notwithstanding that ruminal acidosis is by definition related to low ruminal pH and damage to that compartment of the gut, damage and impairment of function associated with ruminal acidosis has been reported for diverse systems. Among the signs associated with ruminal acidosis, mucin casts shed in feces are indicative of destruction of epithelium in the large intestine. Apparently similar to damage caused by grain overload in equines, it may offer a link between the species for routes by which laminitis may be induced. It also suggests that excessive fermentation in other portions of the gastrointestinal tract may be involved in the syndrome of ruminal acidosis. The damage and changes reported with induced acute ruminal acidosis offer indication of the array of systems that may be compromised: reduced oxidative metabolism of neutrophils, pneumonia, liver abscesses, laminitis, damage to various organ systems, gastroenteritis, fungal invasion of damaged tissues, and reduced saliva secretion. The study of ruminal acidosis has focused largely on the rumen. A broader view of tissues and functions affected might offer a better sense of the impact of this disorder on the animal and of appropriate treatments.

Key Words: Ruminants, Health, Nutrition

642 Regulation of ruminal pH: interaction of dietary and animal factors. M. S. Allen*, *Michigan State University*, *East Lansing*.

Ruminal pH is determined by the balance between the production of fermentation acids by microbes in the rumen and the absorption, passage, neutralization, and buffering of those acids. The production rate of fermentation acids is highly variable across diets. Identification of intrinsic characteristics of individual feeds have been identified that affect relative rates of digestion in vitro. However, absolute rates of digestion and passage of feed fractions in vivo are required to predict fermentation acid production. Absolute rates can be determined using the pool and flux method with ruminally and duodenally cannulated cows. Recent experiments using this method show great variation in fractional rates of passage of starch by source and indicate that rate of starch digestion in the rumen is a second order process and highly affected by concentration/activity of enzymes. Lack of information for absolute rates of digestion and passage of feed fractions from the rumen as well as microbial efficiency, which affects the yield of fermentation acid produced per unit of organic matter fermented, limit our ability to accurately predict fermentation acid production. Fermentation acid absorption is the primary route of hydrogen ion removal from the rumen and the concentration gradient across the ruminal epithelium is likely the major factor affecting their rate of absorption. Concentration gradient is likely affected by milk yield, which has been shown to be positively related to rate of fermentation acid absorption, as well as the strength and frequency of ruminal contractions, which affect mixing and blood flow. Coarse forage fiber retains digesta in the rumen, providing buffering capacity inherent in feedstuffs, increases salivary buffer flow through stimulation of rumination, and increases the concentration gradient through stimulation of ruminal motility. The importance of coarse forage fiber to maintain ruminal pH likely increases with the fermentability of diets.

Key Words: Ruminal pH, Concentration gradient, Rumen motility

643 Applied aspects of ruminal acidosis induction and prevention. G. R. Oetzel*, *University of Wisconsin*, *Madison*.

Recent information is improving our understanding of subacute ruminal acidosis (SARA) in dairy cows. Herds with SARA can be identified by measuring pH of ruminal fluid collected by rumenocentesis from a subsample of cows in the herd. Approximately 23% of herds evaluated as part of the clinical service provided by the Food Animal Production Medicine Section at the School of Veterinary Medicine, University of Wisconsin-Madison, were classified as having SARA problems. In herds feeding TMR, risk for low ruminal pH was higher in cows between 80 and 150 days in milk compared to cows less than 80 days in milk. Apparent risk factors for SARA, based on clinical and experimental data, include high dry matter intake, low dietary fiber content, inadequate dietary buffering, lack of long fiber particles, offering concentrate feeds separate from forage, sorting of feed ingredients within a TMR, intake of large meals at irregular intervals, and feed ingredients with unexpectedly high carbohydrate fermentability. Experimentally-induced SARA in lactating cows causes dry matter intake depression, decreased milk yield, increased ruminal concentrations of volatile fatty acids, transient spikes in ruminal lactate, the appearance of unusual fermentation products in ruminal fluid, and increased blood haptoglobin concentrations. SARA does not reliably cause milk fat depression, and short-term SARA challenges have no effect on milk fat content. SARA is more difficult to prevent in high-yielding cows with high dry matter intakes. Future prevention of SARA will likely require extremely consistent delivery of diets with minimal variation in composition; allowing cows adequate access to feed so that meals are small and regular; carefully formulating diets to optimize total intake of fermentable carbohydrate, fiber effectiveness, and buffering capacity; including (as needed) feed additives that help prevent low ruminal pH; and early detection of low ruminal pH - before long-term problems in cow health appear.

Key Words: Dairy cows, Subacute ruminal acidosis induction, Subacute ruminal acidosis prevention