heating time needed to reduce trypsin inhibitor (TI) content of soybean resulted in improved ileal true digestibility (TD) of protein. Petroleum spirit-extracted dehulled soybean (TI 58.4 mg/g DM) was adjusted to 780 g/kg DM and heated alone or with either sodium metabisulphite (11.8 g/kg DM) or cysteine (15 g/kg DM) for 25, 35, 55 or 75 minutes at 95C. Reactive SH, determined by reaction with 4-vinyl pyridine and HPLC separation, was increased by C and S and decreased with heating time. Heating decreased TI 3.9 times faster in the presence of S but not of C. Each of these 12 preparations was included as the sole source of protein in diets formulated for chicks to provide 150, 200 or 250 g CP/kg diet. A diet with enzyme hydrolysed casein plus amino acids (E) as the sole source of protein at 200 g CP/kg diet was used to measure endogenous loss. Chromic oxide was the marker. The diets were offered to 3 cages of 3 chicks (E to 9 cages) ad libitum for 3 days (8 to 10 d of age). Food was removed overnight on day 10 and each cage was fed at timed intervals ad libitum on day 11 for 4 hours before euthanasia with pentobarbitone sodium given intra peritoneum. TD was calculated as 1-slope of the regression of ileal N per g diet on diet N per g diet using diet E as a zero test dietary N level together with the 3 levels of each test material. TD (mean SEM) soybean alone 0.670.029, 0.780.037, 0.790.026, 0.870.009; +C 0.720.028, 0.860.023, 0.870.014, 0.860.018; +S 0.880.021, 0.890.014, 0.890.013, 0.880.010 at 25, 35, 55, 75 minutes respectively. TD of soybean alone increased with heating time to 75 minutes. The same maximum TD was achieved in 35 minutes with added C and in 25 minutes with added S. The TD achieved with added S was slightly but not significantly greater than the maximum achieved on heating soybean alone (difference 0.0250.0160, t 1.56).

Key Words: Ileal digestibility, Sulfite, Heat

AMSA Updates Session

846 Korean Pork 101. D.E. Burson*[1], D.B. Griffin[2], and W.N. Osburn[3], [1]*University of Nebraska,* [2]*Texas A&M University,* [3]*Michigan State University.*

The changing economy and society in Korea combined with market liberalization is changing the Korean meat industry. Western style retailing is being adapted in Korea and has created a need for training. Therefore, the U.S. Meat Export Federation has established the Meat Education and Research Center (MERC) in Seoul, Korea to train butchers and meat retailers in the latest meat merchandising techniques. The National Pork Producers Council, the US Meat Export Federation, Korea, and meat scientists from the University of Nebraska, Texas A&M University and Michigan State University developed a train the trainer program, Korean Pork 101, for MERC instructors. Korean Pork 101 was designed to provide up to date information on pork quality, consistency and value. The course included topics of teaching and workshop methods, an overview of pork production in the U.S., pork quality, meat distribution and shelf life, fabrication value and merchandising, pork specifications, carcass fabrication and pork safety. The three day workshop was conducted with a series of lectures and discussion during an afternoon session and a laboratory demonstration in the evening. Approximately thirty instructors were trained and evaluations indicated that the program was valuable.

Key Words: pork, training, Korea

847 Advanced HACCP course update. N.G. Marriott*[1], [1]*Virginia Polytechnic Institute & State University.*

Since January 25, 2000 all inspected meat and poultry plants are required to have a food safety preventive program known as Hazard Analysis and Critical Control Points (HACCP). The American Meat Science Association (AMSA) and various professional members have been instrumental in the development of educational material, especially short courses, that has assisted the meat and poultry industry with the implementation of this food safety program.Regulatory requirements of HACCP plan assessment with an emphasis on verification and validation has been attributable to the International HACCP Alliance interest in the accreditation of an advanced HACCP course that will emphasize instruction about verification and HACCP plan validation. During 2000, the AMSA Continuing Education Committee accepted the challenge of the development of an advanced HACCP course to be accredited by the International HACCP Alliance. It was agreed that the content of this course would be developed by AMSA members. The AMSA Continuing Education Committee agreed upon a course content outline and one or more scientists for the development of this 2-day short course. It was decided that the course would be developed as PowerPoint presentations with appropriate handouts and supplementary materials that would be peer reviewed before the AMSA Continuing Education Committee would obtain accreditation from the International HACCP Alliance. The course content will become the property of the American Meat Science Association but available for members' use to present as a short course to the industry. More information about the course content will be discussed. Furthermore, a progress update of material development, peer review, accreditation by the International HACCP Alliance, and material availability to the American Meat Science Association membership will be provided.

Key Words: HACCP, AMSA, Course

Symposium on Concentrated Animal Feeding Operations Regarding Animal Behavior, Care, and Well Being

848 Physiological indicators of stress in domestic livestock. Donald C. Lay Jr.*, *Livestock Behavior Research Unit, Agricultural Research Service-USDA, West Lafayette, IN.*

As with most mammals, domestic livestock will experience varying degrees of both psychological and physiological stress at some time during their life. The objective quantification of these stressful states and application of appropriate measures to limit excessive exposures to stressors is imperative. Proper management of an animal's exposure to stressors will maximize animal well-being and can have beneficial effects on animal production. Although scientists have recognized the deleterious effects of stress for more than 70 years, debates and questions on physiologically assessing its presence in humans and other animals continues to challenge researchers today. Because stress can be defined simply as any physiological change from homeostasis, traditional physiological measurements have relied on quantifying these alterations to homeostasis, such as deviations in heart rate, respiration rate, body temperature, and hormone concentrations. These measurements are still highly relied upon today. It is also well recognized that when these common alterations in baseline homeostatic mechanisms are dramatically altered, an organism's life strategies such as growth, disease resistance, and reproduction can be affected. Therefore, a great deal of research has concentrated on quantifying physiological alterations in these systems, such as changes in growth and reproductive hormones, changes in populations of lymphocytes, and(or) outward signs of failure of these systems, such as low growth rates, infertility, and an increased number of diseased animals. An area of importance that has been relatively inaccessible are those changes that occur in the central nervous system. Because stress is commonly composed of both a physiological and psychological component, how the animal perceives the stress is critical to assessing its well-being. Physiological measures used thus far to assess the mental response to stress include neuronal activity and measurement of neurotransmitters. Scientists have done a good job of measuring all of these physiological alterations, unfortunately the underlying challenge that continues to confront scientists is how to define the degree of physiological change that translates into distress for the animal.

Key Words: Stress, Livestock, Well-being

849 Influence of stress on composition and quality of meat, poultry, and meat products. E. P. Berg*, *University of Missouri.*

Stress experienced by meat-producing animals prior to slaughter not only influences lean and fat deposition, but also the physicochemical components involved in conversion of muscle to meat. Stressors that

trigger a physiological response can be short term (loud noise, unfamiliar environment, fighting, electric prod goading) or long term (sickness, dehydration, malnourishment, hot/cold stress). Postmortem metabolism in porcine and certain poultry muscles is more rapid than beef or lamb. Metabolism of intramuscular glycogen plays a primary role in the expression of unfavorable meat quality attributes such as dark cutting beef or pale, soft, and exudative (PSE) pork. The level and extent of postmortem pH decline is glycogen dependent because anaerobic conversion of glycogen to glucose to lactic acid results in an acceptable (or unacceptable) ultimate meat pH. Activation of the sympathetic nervous system in response to a stressor results in mobilization of energy (glucose) from storage (glycogen). Prolonged activation may leave a lesser concentration of glucose available for conversion to lactic acid. The resulting meat will have a high pH (closer to physiological pH), a dark, dry appearance, reduced consumer appeal, a shorter shelf life, and (depending on duration) reduced levels of marbling. Activation of the sympathetic nervous system immediately prior to slaughter is particularly detrimental to swine and poultry. The fight or flight response initiates glycogenolysis and elevates heart rate, blood pressure, and muscle temperature. In this state, stunning and exsanguination will trap heat and lactic acid in the muscle as the system converts to anaerobic metabolism. The accumulation of lactic acid results in a rapid pH decline while the carcass temperature is high. This leads to denaturation and shrinkage of myofibrillar proteins that bind water, and to the development of PSE meat that has little consumer appeal and limited functional value in further processing. The entire meat production system must strive to produce a high-quality product that consumers will purchase repeatedly. Management techniques that reduce preslaughter stress are more easily controlled than postmortem chemical reactions.

Key Words: Stress, Meat quality, Meat production

850 The Free Farmed Program in the US and the Freedom Food Program in the U.K. Adele Douglass*, *Farm Animal Services, 236 Mass Ave., NE, #203, Washington, D.C. 20002.*

A presentation on the Freedom Food Program in the United Kingdom and a history of how the Free Farmed Program came about in the United States. A discussion of the Program description, what are the standards and the costs involved, what are the certification requirements, the assessments and the audits.

Key Words: Farm, Animal Welfare, Animal Behavior

851 Impact of public perception on current and future livestock and poultry production. G. J. Coleman*[1] and P. H. H. Hemsworth[2], [1]*Monash University,* [2]*University of Melbourne.*

It is well documented that there is a complex set of economic, political, social and personal factors which impact poultry and livestock production and marketing. It has, however, proven difficult to systematize current knowledge in this area. The aim in this paper is to identify the facets of public perception which impact livestock and poultry production practices and to suggest future impacts on the one hand and possible moderating strategies on the other.
Public perception comprises general attitudes and personal attitudes. General attitudes are those opinions which are collected by surveys and reflect peoples' opinions but, because they are not specifically directed to a particular behaviour, may not be expressed in a specific behaviour. It is useful to distinguish these public opinions from personal attitudes that an individual holds, which are derived from experience and which direct behaviour. Understanding this distinction and the differential impact of the two is important in predicting their effects on future poultry and livestock production and the relevance of education and regulation. Private attitudes are direct predictors of behaviour and are relevant to, for example, meat buying behaviour. General attitudes, on the other hand, influence politicians and regulatory bodies and lead to changes in trade policy and other regulations.
Sustainable poultry and livestock production requires economic viability, ecological viability and social acceptability. Social acceptability impacts on issues such as animal welfare, food safety, genetically modified foods and quality of life for the farmer/stockperson. These issues are likely to affect future production practices through consumer buying behaviour, product standards set by processors and retailers, international trade policy and welfare regulations. Many of these influences are outside the control of the poultry and livestock industries and are driven by special interest groups. Research needs to focus more on assessing the attitudes and knowledge of the poultry and livestock industries in these areas, developing education programs which inform the public on these issues and developing industry strategies to proactively influence the direction of community opinion and government regulation.

Key Words: attitude, welfare, production

852 The effect of management practices on the stress response in livestock. J.L. Morrow-Tesch*[1], [1]*USDA-ARS Livestock Issues Research Unit, Lubbock, TX.*

Stress is a function of life for farm animals. When the biological cost of responding to a stressor becomes to great to overcome, the animal is in a state of distress. The biological response to stress in not a general one as originally proposed but is dependent on the individual's perception of the stressor. Many factors such as age and genetics influence the perception of a stressor. Because animals respond to a stress by changes in their behavior and physiology, we can measure the components of these changes and increase our understanding of how to manage stress in the animal's environment. Many animal management practices are stressful to livestock including handling animals; mixing, moving and regrouping; weaning; and castrating, dehorning, tail-docking and other painful procedures. Several research groups are focusing on ways to reduce the stress associated with these management practices which is important for enhancing animal well-being. Several examples of ways to manage stress in production systems include reducing social stress through hides (areas where pigs can place their heads to reduce aggressive contacts with pen mates) or olfactory cues, providing environmental enrichment and creating alternative production systems.

Key Words: stress, behavior, management

853 The FASS initiative to develop training materials on farm animal care. John McGlone*, *Texas Tech University.*

The public requires accountability in expenditure of public dollars in teaching and research. The USA Animal Welfare Act, the Public Health Service, the USDA and the Federation of Animal Science Societies (FASS) Guide for the Care and Use of Agricultural Animals in Agricultural Teaching and Research (Ag Guide, 1999) require that people who use animals be properly trained. While training materials have been available for users of laboratory animals for some time, training materials for those who use farm animals in teaching and research have not been available. The FASS board authorized a project to begin development of peer-reviewed educational materials late in 2000 and the first product of this effort was released in March, 2001. The materials in the first package – meant to cover introductory farm animal care topics – include a two-tape digital video, a CD with the Ag Guide and some sample questions to be used in the trainee evaluation. The tape's script was written by three authors (J. McGlone, J. Morrow-Tesch and C. Stull), produced by the FASS office and a local video production company and was reviewed by the FASS Animal Care, Use and Standards committee. More tapes are planned to cover each common farm-animal species. Development of a multi-media and web-based training program will be facilitated by capture of the video in digital format. Collaboration between FASS and The American Registry of Professional Animal Scientists (ARPAS) is underway to develop a certification program for farm animal workers.

Key Words: Animal care, Training, Multimedia