collections. In regard to the latter, a recognition letter has been designed to alert university-based administrators of the value of poultry genetic resources. The committees' present administrative goals include development of priority guidelines for repository deposits of semen at the Ft. Collins NAGP facility, development of poultry-specific parameters for the GRIN database, establishment and distribution of useful guidelines/advice for handling and cryopreservation of semen by non-experts.

Key Words: Poultry, Conservation, Genetic resources

53 Dairy cattle contributions to the National Animal Germplasm Program. L. B. Hansen*, *University of Minnesota, St. Paul.*

Genetic diversity within the six recognized breeds of dairy cattle in the US was viewed as the key area of concern for the dairy cattle committee of the National Animal Germplasm Program. The ten-member dairy cattle committee has a membership roster as follows: two from the land-grant universities (L. Hansen, U. of MN, Chair, and M. Schutz, Purdue U.), two from USDA/ARS (M. Ashwell and C. Van Tassell), two from AI companies (D. Funk, ABS Global, and C. Sattler, Select Sires), one from NAAB (to be named), one from a breed association (C. Wolfe, American Jersey Association), the USDA/ARS Executive Secretary for NAGP (H. Blackburn), and an ex officio member from USDA/CSREES (R. Frahm). Committee members will have terms with fixed years of service, and the terms will have staggered years for final year of service. The key goal of the dairy committee is for each A.I. organization in the US to submit 30 units of frozen semen from progeny test sires to the repository for the germplasm program at Ft. Collins, CO. Frozen semen is requested from each 10th Holstein sire entering progeny testing as well as every bull entering progeny test for the other five breeds. The dairy cattle committee will be charged with the responsibility of reviewing requests for use of dairy cattle germplasm in the repository.

Key Words: Germplasm preservation, Dairy cattle, Genetics

Energy Nutrition of Ruminants

54 Energy nutrition of ruminants: keeping books. C.L. Ferrell*, *USDA, ARS, Roman L. Hruska U.S. Meat Animal Research Center, Clay Center, NE.*

Goals of energy metabolism research with ruminants have historically been to 1) develop an accurate means for evaluating feedstuffs and stating animal requirements, and 2) establish the tissue and biochemical origin of heat production or energy expenditures. Techniques employed in nutritional energetics of ruminants have classically been concerned with the partitioning of dietary energy into fecal, urinary, methane, heat, and recovered or product energy. Attributes of feeds that influence the partition of dietary energy has received limited attention recently. Indirect respiration calorimetry and comparative slaughter techniques continue to be important energetics research tools. Carbon dioxide entry rate techniques have found application in goat, sheep, and cattle studies. The use of heart rate as an index of energy expenditure may have application to the free ranging animal. Techniques utilizing blood flow, thermal dilution and gas analyses to quantify and separate heat generated from the GI tract into aerobic and anaerobic origins has been successfully applied to ruminants. Assessment of tissue energy metabolism from blood flow and substrate flux across the PDV, liver, gravid uterus, fetus, mammary gland, and hind limb have contributed substantially to our understanding of tissue energy expenditures and sources of their variation. Studies at the organ, tissue, cellular, and subcellular levels, including substrate turnover and channeling, ion transport, proton leakage, and uncoupling proteins have increased our understanding of the biochemical processes involved. Regulation of those processes through hormonal and other means is beginning to be understood. A major challenge of the future lies in not only establishing the biological and biochemical bases for energy expenditures, but also in determining the genetic and biological bases for differences among animals. It is equally critical that we be able to translate fundamental knowledge gained through these endeavors to functional understanding that can be applied to the whole animal.

Key Words: Cattle, Heat, Energy metabolism

55 Economics of visceral nutrient metabolism in ruminants - toll keeping or internal revenue service? C. K. Reynolds*, *The University of Reading, UK.*

Measurements across a range of productive states show that the portal-drained viscera (PDV) and liver, or the total splanchnic tissues, account for 40 to 50 % of body oxygen consumption or heat. This high rate of metabolism is in part attributable to high rates of protein turnover and thus amino acid utilization, as well as other 'service' functions supporting nutrient assimilation and 'waste management'. This metabolic intensity and the anatomic position of absorptive and liver tissues has led to the assumption that the tissues that assimilate and process incoming nutrients from the diet exact a toll in payment for their entry. This 'toll' is believed to reduce the extent to which absorbed nutrients gain admission to the arterial blood pool and reach 'productive' organs such as the mammary gland or skeletal muscle. Measurements of net nutrient flux generally support this concept of splanchnic metabolism 'restricting entry' and thus dictating supply, as on a net basis the appearance of the major carbon-based nutrients absorbed into the portal vein is typically low compared to their rate of disappearance from the gut lumen. An alternative interpretation is that this low net recovery of absorbed nutrients across splanchnic tissues is attributable to extensive metabolism of nutrients from the arterial pool, which masks true rates of absorption. In this scenario any tax to support community services is paid using internal funds. Measurements of nutrient kinetics based on isotopic labelling support the latter scenario. In the case of the liver, catabolism of amino acids is driven in part by supply and demand, with over-population dealt with by deportation, restructuring or the metabolic equivalent of cremation. Similarly, relative rates of amino acid metabolism by the gut and mammary gland vary with requirement. Organ metabolism of many energy-yielding nutrients varies with supply, demand and the need for waste management and other community services.

Key Words: Organ metabolism, Energy, Amino acids

56 Endocrine and gene expression profiles in relation to energy metabolism. G. Murdoch[1], W.D. Dixon[1], V.E. Baracos[1], E.K. Okine[1], D. Balcezak[1], J.A. Moibi[1], B.T Li[1], R.J. Christopherson*[1], and R.J. Christopherson[1], [1]*University of Alberta, Edmonton, Canada, T6G 2P5* .

In order to test hypotheses regarding regulation of energy metabolism, heat production (HP) was examined in response to adrenergic agonists and/or blocking agents in ruminants. Low doses of adrenaline, acting via β adrenoceptors, increases HP ($P< .05$) in cattle (40%) and in sheep (30-45%). Increases in HP of sheep in response to adrenaline averaged 32% ($P< .05$) while increases in the portal drained viscera and hindquarter metabolic rates were 50 % ($P< .05$) and 61 % ($P< .05$) respectively and were abolished by beta adrenergic blockade. Increases in whole body and hindquarter HP during acute cold exposure were reduced by 20-50 % by β blockers. Alpha-2 selective agonists suppress heat production in ruminants by 20-23 % ($P< .05$), suggesting a role in energy conservation. HP was positively related to β receptor density in the heart muscle, but a negative relationship was observed in non-cardiac tissues. Lipogenic enzymes (ACC and FAS), in subcutaneous and mesenteric adipose were positively correlated ($P< .05$) to HP. Expression of other target genes have recently been determined in skeletal muscle, adipose depots, rumen, abomasum and duodenum in cattle, using PCR. The expression of leptin receptor and NPY receptor type II genes were correlated ($P< .05$) in peripheral tissues, such as Biceps femoris ($r=0.91$) and subcutaneous adipose ($r=0.70$). These were not as well correlated in mesenteric adipose and perirenal adipose. Receptor gene expression was not detected in GI tissues. The expression levels of UCP1, UCP2, and UCP3 in tissues that we have screened using RT-PCR, ranged from undetectable to 100 densitometric units. We observed variable expression of leptin mRNA in adipose depots which may pertain to various functions of this peptide. Positive correlations between HP and urinary excretion of 3-MH ($P< .39$) and hydroxyproline ($P< .51$) paralleled changes in expression of genes for proteolytic enzymes. Compilation of information relating to the expression of specific genes

linked to energy expenditure will help elucidate the physiological basis for variations in energetic efficiency.

Key Words: Endocrines/Genes, Energy Metabolism, Ruminants

57 Cellular energy expenditure and the importance of uncoupling. M-E. Harper*[1], A. Antoniou[1], V. Bezaire[1], and S. Monemdjou[1], [1]*University of Ottawa*.

Just as total body energy expenditure in animals can be classified into that which supports resting energy metabolism, work, growth, etc., cellular energy expenditure can similarly be classified. Our overall objective is to examine the metabolic origins of cellular energy expenditure, differentiating between metabolic states where cells are at relative rest, and where cellular energy expenditure is high. In most situations when energy expenditure is high, mitochondrial ATP production (oxidative phosphorylation) is coupled and efficient. Uncoupling refers to the dissociation of the oxidation of energy substrates, such as fatty acids, from the synthesis of ATP by mitochondria. Uncoupling can occur during states of high energy expenditure or during states of metabolic rest. In brown adipocytes, uncoupling protein 1 (UCP1) activity can cause very high rates of energy expenditure for the purpose of thermogenesis (heat production). UCP1 is found exclusively in brown adipocytes. While uncoupling also occurs in other cells of the body, it is of greatest importance during periods of relative metabolic rest. The latter form of uncoupling is referred to as mitochondrial proton leak, and accounts for roughly one quarter of the resting metabolic rate of the rat. The mechanisms of mitochondrial proton leak are not well understood. The recently identified uncoupling proteins may play some role, but may also have some other physiological functions. Our recent findings from transgenic mice with altered expression of UCPs will be reviewed. Proton leak activity scales roughly in proportion with metabolic rate in mammals of different body size, and is related to thyroid hormone status. Proposed functions for mitochondrial uncoupling include thermogenesis, control of oxidative phosphorylation efficiency and protection from reactive oxygen species. Support: NSERC of Canada.

Key Words: thermogenesis, proton leak, uncoupling

Meat Science in an International Marketplace

58 Global meat research initiatives. R.B. Sleeth*[1], [1]*Consultant*.

The International Congress of Meat Science and Technology (ICoMST) is a very extraordinary and dynamic organization. A brief review will highlight the history, structure, and function to enable participants to better understand and appreciate its uniqueness as a scientific entity.
It is imperative that we foster worldwide cooperation in meat science and technology research to be better informed and to minimize duplication. Within the USA, scientists access the Current Research Information System (CRIS) to determine the status of ongoing research. One purpose of the ICoMST is to provide a global forum for discussing research concepts and accomplishments but proceedings are not available for the majority of the scientific community. The presentation will briefly highlight related meat research programs from several countries which hopefully will provide the impetus to develop an implementation plan to foster greater worldwide exchange of meat science and technology.

59 U.S. Pork Products in the International Marketplace. J.W. Cravens*, *National Pork Producers Council, Des Moines, Iowa*.

In 2000, the United States exported 1.25 billion pounds of pork and pork variety meats, worth 1.316 billion dollars, an increase of 213 percent by volume and 224 percent in value since 1991. Exports now represent 6.8 percent of domestic production. According to the USDA Foreign Agriculture Service, pork represented 41 percent of global meat protein consumption in 1999. Global prok trade is projected to continue increasing as global populations and per capita incomes increase and trade barriers fall.
Although the United States is one of the world's lowest cost producers of pork, to maintain rapid growth in exports, the United States industry must continue to supply safe,high quality pork that meets the needs of varied customers around the globe. The demands of the export market can very significantly from those of the U.S. market. The United States exported pork or pork variety meats to 85 different countries in 2000. Frequently the demand for various pork cuts or byproducts are unique to these individual markets. And just as frequently, unique requirements or standards exist in areas such as processing, carcass fabrication, labeling, food safety, sanitation and hygiene. This presentation will look at the demands of the export market for U.S. Pork and explore a number of these issues. It will contrast the specifications and customer requirements in the domestic market with those of the export market in an attempt to present both the opportunities that exist for increasing exports and the barriers that must be overcome. It will also explore some of the advantages our competitors have over the U.S. industry.

Key Words: Pork, Exports, Trade, Variety meats, Offals

60 Poultry products and processing in the international marketplace. S.F. Bilgili*[1], [1]*Auburn University*.

Globally, consumption of poultry meat products has increased dramatically during the last decade. As a result, production of young meat chickens (broilers), turkeys and other poultry (spent layers, ducks, geese, guinea-fowl, pheasants, ratites, etc.) continues to grow and expand in many parts of the world. Nutritional profile, taste, versatility, convenience, availability and relative value are the major reasons why consumers prefer poultry meat products. Adoption of new production and processing systems and technologies, and development of new and novel products have enabled the poultry industry to continually innovate and respond to market demands. Although poultry products vary greatly in many countries, ranging from live poultry markets to consumer packaged, ready-to-eat entrees, there has been a clear trend of diversification in the marketplace. The most obvious change has been the steady shift in product forms, from a primarily "homogenous, generic commodity" to a "well differentiated, name-branded, value-added" products. Value-adding by cut-up and further-processing not only meets the changing needs of the consumers, but also improves the net returns and profitability. Given this trend, the future challenge in product development will be preservation and/or incorporation of unique cuisine and preferences of diverse cultures.

ASAS/ADSA Animal Behavior and Well Being

61 Effect of genetic selection for loin-eye area on belly-nosing and plasma cortisol in weanling Landrace pigs. S. Torrey*[1], E. Pajor[1], S. Weaver[2], D. Kuhlers[3], and T. Stewart[1], [1]*Purdue University,* [2]*USDA-ARS Livestock Behavior Research Unit,* [3]*Auburn University*.

Two genetic lines of Landrace gilts, selected for differences in loin-eye area, were studied for behavioral and physiological differences during Segregated Early Weaning (SEW). The select line, selected for increased loin-eye area (n = 30), differed from the contemporary random control line (n = 32) by 10.6 cm^2. The gilts were weaned at an average age of 15 d and transported from Auburn University to Purdue University. Litters were blocked by farrowing date to minimize age differences and transported on two dates, 2 wk apart. Litters were videotaped continuously while in nursery to record frequency of belly-nosing. Individual blood samples were collected in late afternoon 9, 20 and 30 d after arrival into the SEW facility to measure plasma cortisol levels. Frequency of belly-nosing was examined on d 2, 3 and 4 post-weaning using scan sampling. Significant differences in frequency of belly-nosing were seen only on d 4 between the two lines (select 2.43 0.44% of time; control 0.61 0.43% of time; $p < .02$). This is in agreement with previous literature that found differences in belly-nosing occurring several days after weaning. Blood samples were assayed for cortisol levels using GammaCoat RIA. Cortisol concentrations in the select pigs (29.34 3.12 ng/ml) were significantly higher ($p < .02$) than in the control pigs (23.11 3.00 ng/mL). Previous results showed that the select pigs spent more time active and