∼17%. In vitro studies indicated that both bST and IGF-I reduced frequency of unfertilized oocytes and stimulated embryonic development to the blastocyst stage. Lactating dairy cows received +/- bST (500 mg, Posilac) at 16 h after the 2nd GnRH of Ovsynch and were sacrificed at either d 3 or d 7 post-ovulation to examine oviductal and uterine genes of the IGF system. In bST-treated cows, levels of IGF-II mRNA were higher (+ 250%) in oviducts but lower in uteri (- 60%; $P<0.05$) than control cows. Regardless of site or stage, IGFBP-3 mRNA levels were higher (+ 125%) in bST-treated cows. At D7 of the estrous cycle, GHR mRNA was decreased (- 30%) in bST-treated cows. Oviductal IGF-I luminal contents did not change; whereas, uterine IGF-I luminal contents increased ($P < 0.01$) between d 3 and 7, and were higher in bST-treated cows. In multiparous non-lactating dairy cows, bST treatment reduced pregnancy rates (19% < 60%) at d 17 based on presence of a conceptus. BST fertility responses are likely to involve both direct as well as complex and tissue specific regulation of IGFs and IGFBPs within both the embryo and reproductive tract and may be sensitive to lactational status.

Key Words: bovine somatotropin, timed insemination, embryo

44 Use of CIDR-B for regulating reproduction. Reuben J. Mapletoft*[1] and John P. Kastelic[2], [1]*University of Saskatchewan, Saskatoon, SK Canada,* [2]*AAFC, Research Centre, Lethbridge, AB Canada.*

Our knowledge of the physiology of the bovine estrous cycle has expanded greatly in recent years, primarily because of the use of ultrasonography to observe ovarian changes and follicular wave dynamics. With this new knowledge has come new methods of manipulating and controlling ovarian function. The use of CIDR-B devices for the synchronization of estrus in cattle is now well accepted throughout the world; in fact, Canada and the USA are two of the last countries to have CIDR-B devices available for use in bovine practice. The use of CIDR-B devices along with other hormone products, such as GnRH and pLH, has permitted fixed-time AI with high pregnancy rates in the beef herd. Recent research, such as that with the use of estradiol along with CIDR-B devices, offers new and exciting ways that we may be able to manipulate the bovine estrous cycle. Experiments described in this report demonstrate several different methods of eliminating estrus detection permitting fixed-time AI in heifers and lactating beef cows with highly acceptable pregnancy rates. Recent data suggest that steroid hormones readily available on the veterinary pharmaceutical market such as estradiol cypionate (ECP) and injectable progesterone can be successfully used to synchronize follicular wave emergence and ovulation in a CIDR-B-based fixed-time AI program. Various other approaches will be discussed including the synchronization of recipients used in embryo transfer and the resynchronization of animals not conceiving to the fixed-time insemination.

Key Words: Bovine, Reproduction, CIDR-B

45 A review of methods to synchronize estrus in postpartum beef cows and replacement beef heifers. D.J. Patterson*, F.N. Kojima, and M.F. Smith, *University of Missouri.*

This review will consider methods currently available to control estrous cycles of postpartum beef cows and replacement beef heifers. Development of methods to control the estrous cycle of the cow has occurred in five distinct phases. The physiological basis for estrus synchronization followed the discovery that progesterone inhibited preovulatory follicular maturation and ovulation. Regulation of estrous cycles was believed to be associated with control of the corpus luteum, whose life span and secretory activity are regulated by trophic and lytic mechanisms. Phase I included efforts to prolong the luteal phase of the estrous cycle or to establish an artificial luteal phase by administering exogenous progesterone. Later, progestational agents were combined with estrogens or gonadotropins in Phase II; whereas Phase III involved prostaglandin $F_{2\alpha}$ (PG) and its analogs as luteolytic agents. Treatments that combined progestational agents with PG characterized Phase IV. Precise monitoring of ovarian follicles and corpora lutea over time by transrectal ultrasonography expanded our understanding of the bovine estrous cycle and particularly the change that occurs during a follicular wave. We now know (Phase V) that precise control of estrous cycles requires the manipulation of both follicular waves and luteal lifespan. This review will include specific discussion of progestins, PG, and gonadotropin-releasing hormone (GnRH) and the various combinations of these hormones or their analogs being used to more precisely control the interval and timing of estrus following treatment. The review will also address the potential benefits of these treatments in eliciting response among peripubertal heifers and anestrous cows, and point to the flexibility in matching specific protocols with the particular beef management system involved. The review will conclude with a discussion of recent advances in the development of economical methods of artificially inseminating beef cows and heifers at a fixed time with high fertility, which would potentially result in a dramatic increase in the adoption of AI in beef herds.

Key Words: Estrus Synchronization, Beef Cattle, Artificial Insemination

Swine Species
Value-Added Pork Products for 21st Century Consumers

46 Economic analysis of production factors important in developing value-added pork products. R. L. Plain*[1], [1]*University of Missouri - Columbia.*

Value-added agriculture has become a topic of great interest among farmers. Many hog producers are excited about the potential to add value to their hogs through non-traditional marketing arrangements. There are three general approaches to value-added pork: through niche markets, through commodity markets and through vertical integration. Adding value to pork by marketing through a niche is based on selling the product to consumers at a premium over what is charged for commodity pork. Consumers are willing to pay this premium if they perceive there is greater value in the niche market product. The source of this enhanced value is frequently associated with one of three areas - environmental (the pork is better for the environment or the animal, e.g. pasture produced pork), health (the pork is better for the consumer, e.g. organic pork), or social (the pork is better for the community, e.g. family or locally produced pork). Adding value to pork when marketing through a commodity market is based on producing an animal that has greater value to the packer. This added value may arise from some trait of the hog (e.g. leaner, less PSE) or of the transaction (e.g. volume sales or scheduled delivery) between the producer and the packer. The third approach to value added pork involves forward integration of the hog producer in the pork chain. Many hog producers are investigating the potential to slaughter, process and distribute the pork from their hogs. This interest arises from the belief that they can market their pork at a higher price through a niche or that they can capture some of the profits being earned by the firms in the middle of the pork chain. Whether marketing value-added pork through a niche, a commodity market or more directly to consumers, the added value must be greater than the additional cost in order to be profitable.

Key Words: Pork production, Value-added, Economic analysis

47 Breeding and genetics in the evolving swine industry. J.A.B. Emsley*, *PIC, Franklin KY, USA.*

Over the last forty years, the 20th century consumer has benefited directly in lowered cost of pork because of improved productivity and efficiency of the swine production industry. Technology developments, including powerful statistical methods and faster computers, have permitted an increasingly comprehensive approach to genetic improvement at the macroscopic level. Results include 33% less feed to the same weight and 33% more lean. Tools that probe the sub-microscopic level of the swine genome now offer the added precision and fine-tuning needed to navigate customized genetic pathways that yield, at lower cost, food of the kind and quality that consumers will demand and pay for in the next forty years, into the 21st century. Knowledge of gene action and gene-gene interaction offers promise of direct means of improvement in disease resistance, animal well-being, meat quality and human health. Food marketers will ensure that, from these technical gains, a variety of pork products will result. Industry demands for tailored

genetic decision-making deeper into the pork chain will call for extraordinary skill and experience. GMO will continue to be examined as an option while society debates the risks and benefits. Driving the revolution in healthy genetic improvement efforts are the following factors: consumers are likely to want from their food more health-enhancing qualities, safety, convenience and value; industry integration of linked sectors will call for genetic decision-makers to optimize weightings on many measures throughout the pork chain, from reproduction to food processing; confidence in the food supply will necessitate traceability at low cost; selection decisions will increasingly need to factor in any interactions between genotype and environments, intrinsic and extrinsic; technology will continue to refine functions in all sectors of the pork chain and offer more control; DNA testing costs per data point will decrease substantially; accrued knowledge about genes and their effects will increase geometrically; capabilities in information processing will continue to increase dramatically; breeding decisions will require close integration of input from several disciplines.

Key Words: Swine Industry, Healthy Genetic Improvement, Technology

48 Evaluating the functional quality of pork. Eric Berg*, *University of Missouri-Columbia*.

Pork quality can be characterized by level of freshness, wholesomeness, grade, color (appearance), eating satisfaction or processing attributes (functionality). Many factors influence pork quality characteristics: 1) genetics; 2) nutrition; 3) growth promotants 4) pre-slaughter handling and transportation; 5) immobilization (stunning procedure); 6) dehairing; 7) post-slaughter handling; and 8) packaging and storage. Early postmortem measurement of pH and temperature are common measurements taken to identify potential meat quality problems, yet these easily obtained measures do not quantify the specific factors that affect pork functionality (use in further processed or value-added products) and (or) consumer acceptance (retail marketability). The CIE L*, a*, b* scale was designed to represent the human perception of color and has been used to evaluate fresh pork color and incorporated into computerized vision analysis systems that identify and sort acceptable and unacceptable colored lean. Early fiber-optic probe (FOP) instruments developed to predict the functional component of pork (water holding capacity; WHC) were totally dependent on the marginal relationship between fresh pork color and WHC. More recently, FOP probes operating in the near infrared (NIR) region of the color spectra have been developed to quantify glycolytic potential or collagen content of fresh pork. Due to the large number of factors that can influence pork quality and the marginal predictive ability of the more commonly used predictors (pH and color), development or identification of electronic equipment used to measure pork quality must account for, or attempt to quantify, functional meat quality from basic meat biochemical, physiological, molecular, and (or) structural factors that ultimately influence the appeal of pork.

Key Words: pork, quality, electronic equipment

Graduate Paper Competition
CSAS Graduate Student Competition

49 Variation in phytate content in Ontario soybean samples. S.D. Leech* and C.F.M. de Lange, *University of Guelph, Guelph, Ontario*.

Characterization of phosphorus (P) content and phosphorus availability in feed ingredients is critical for addressing feeding costs and impacts of animal production on the environment. In feedstuffs for monogastric animals, phosphorus availability is inversely related to the proportion of phosphorus present in the phytate form (% phytate P). The objectives of this study were to identify variation in total P and phytate content among Ontario soybean samples cultivated under typical management conditions, and to explore rapid indicators of phytate content. A total of 108 samples were analyzed: 58 samples representing 13 varieties and 13 growing locations in 1999; 50 samples representing 12 varieties and 12 growing locations in 2000. Nine subsets of samples from varieties grown at various locations allowed an assessment of the effects of location, variety and year on total P and phytate content. Analysis for P and phytate contents were conducted according to AOAC procedures and checked for repeatability and accuracy using potassium phosphate and sodium phytate standards. Total P content (%) averaged 0.55 (SD 0.08) in 1999 and 0.61 (SD 0.09) in 2000; phytate content (%) averaged 1.07 (SD 0.20) in 1999 and 1.27 (SD 0.26) in 2000; % phytate P (%) averaged 54.7 (SD 4.6) in 1999 and 57.9 (SD 5.1) in 2000. Location and year effects were observed in the majority of sample subsets for total P and phytate content ($P<0.05$), but not for % phytate P. Variety effects on these three measures were absent ($P>0.05$) in most sample subsets. Location and variety effects explained a large proportion of the variation in total P ($R^2 > 0.75$), phytate content ($R^2 > 0.72$) and % phytate P ($R^2 > 0.44$). A strong correlation existed between total P and phytate content ($R^2 = 0.87$; SEE = 0.09). Considerable variation in total P and phytate content was observed among Ontario soybean samples with differences largely attributable to location effects.

Key Words: Phosphorus availability, Phytate, Soybeans, Monogastric animals

50 Effect of supplementing corn-soybean-based diet with microbial phytase and organic acid in young pigs. F. O. Omogbenigun*, B. A. Slominski, and C. M. Nyachoti, *University of Manitoba, Winnipeg, MB*.

An in vitro assay and a 4-wk growth trial were conducted using 96 pigs weaned at 181 d to study the effect of microbial phytase (MP) and organic acid (OA) addition on nutrient digestion and growth performance. Four diets; positive control (formulated according to NRC, 1998; D1), negative control (D1 without inorganic phosphorus [P]; D2), D2 + phytase (500U/kg; D3), and D3 + OA (D4) were used. In the in vitro assay, diet samples were incubated under simulated gut conditions to determine phytate hydrolysis. Addition of MP increased (P=0.003) phytate hydrolysis by 54.5% over D1; this was further increased by 2.9% by adding OA. In the growth trial, each diet was randomly assigned to six replicate pens each with 4 pigs balanced for initial BW and sex. ADFI, ADG, and FCE were determined weekly. Six pigs per treatment were killed at the end of wk 4 to obtain ileal digesta, and the 3rd metatarsal bone from the hind right leg for nutrient digestibility and bone ash measurements, respectively. ADFI, ADG and FCE were similar among diets (P=0.79), although ADG was 6.5% higher in pigs fed D4 compared to D1. Pigs fed D3 and D4 had a higher (P=0.003) bone ash content than D1 fed pigs. Apparent ileal DM and CP digestibilities were similar ($P>0.10$) among diets and averaged 80.7 and 79.4%, respectively. Of all amino acids (AA), only apparent ileal digestibility of isoleucine, histidine and aspartic acid were increased ($P<0.05$) by MP and OA addition. Digestibilities of other AA were only numerically improved by MP and OA addition and that of essential AA averaged 79.4, 77.7, 80.1 and 81.6% for D1, D2, D3, and D4, respectively. Apparent ileal P digestibility was increased (P=0.0001) and the amount of P excreted reduced (P=0.03) by 19.9% due to MP + OA addition compared to D1. In conclusion, addition of MP and OA to pig starter diets improved P digestion and utilization and may also improve dietary AA utilization.

Key Words: Pigs, Microbial phytase, Organic acid

51 Utilization of apparent ileal digestible threonine intake for body protein deposition in the pig appears related to endogenous gut protein losses and microbial fermentation in the gut. C.L. Zhu*, Y. Yin, and C.F.M. de Lange, *University of Guelph, Guelph, ON, Canada*.

Previous studies showed that intake of soluble fiber (pectin) reduced utilization of apparent ileal digestible threonine (THR) intake for THR retention in body protein in pigs (from .87 to .79 at 0 and 120 g/kg diet pectin, respectively), while intake of insoluble fiber (cellulose) had little effect. The objective of this study was to relate THR utilization to aspects of digestion. Five barrows (16 to 46 kg BW), fitted with a simple T-cannula at the terminal ileum, were fed one of 5 experimental diets at 2.6 times maintenance energy requirements according to a 5 x 5 Latin square design. Pigs were adjusted to diets for 8 days prior to sampling feces and ileal digesta. Soybean and cornstarch-based diets were formulated with 0, 40, 80, 120 g/kg pectin or 80 g/kg cellulose, respectively, replacing cornstarch. At the distal ileum, flow (all in g/kg DM intake)