The 2010 Triennial Growth Symposium was held immediately before the Joint Annual Meeting of the American Society of Animal Science, American Dairy Science Association, Poultry Science Association, Asociación Mexicana de Producción Animal, Canadian Society of Animal Science, and the Western Section of the American Society of Animal Science in Denver, Colorado, in July 2010. The intent of the symposium was to identify and explore some new findings on the nutritional regulation of growth and development of domestic animals. Nutrition has a profound impact on the developing animal. The symposium program committee decided it was time for an update on recent advances in this area.

Crenshaw et al. (2011) began the symposium by reviewing recent developments in skeletal growth and development. Fibroblast growth factor 23 (FGF23), discovered in the last decade, is involved in a pathway for P homeostasis. An endocrine function of bone itself is described, producing FGF23, which then acts on renal tissues independent of the well known pathways involved in Ca homeostasis. The hormone downregulates P transporters to decrease renal absorption, in addition to downregulating enzymes involved in the conversion of vitamin D. Seminal papers are discussed showing the effects of recombinant FGF23 and FGF23 gene ablation in mice. It is emphasized that applications from understanding the role of FGF23 should lead to strategies for improving the efficiency of P use for skeletal growth and development.

Polymeric carbohydrates represent the largest portion of diets, and therefore energy, for pigs. Bach Knudsen (2011) reviewed the role of starch and nonstarch polysaccharides (NSP) on growth and development. The linkages and organization of the starch and NSP have a profound impact on how polymeric carbohydrates are digested and absorbed and affect how the carbohydrates influence gastrointestinal physiology. Starch is primarily degraded to glucose. However, others (i.e., those with β-linkages and NSP) are degraded by microbial enzymes and converted to mostly short-chain fatty acids and gases. The effects of these differences in digestion and absorption are reviewed, including the effect on endocrine response, available energy, available energy relative to protein, and the effect of polymeric carbohydrates on metabolism. Polymeric carbohydrate consumption has important effects on the endocrine response and growth and development.

Sartin et al. (2011) then addressed the regulation of feed intake by hormonal mechanisms, fasting, and disease. The mechanisms of the central nervous system, the periphery (i.e., the gastrointestinal tract and adipose tissue), fasting, and disease were summarized. Appetite results from a complex interaction of circulating nutrient metabolites, hormones, nutrients within the gastrointestinal tract, and the actions of these molecules in the central nervous system. Although this review primarily explores these interactions in ruminant species, important distinctions for nonruminants are discussed. In addition, new advances in this area are explored. Determining how feed intake is regulated in farm animal species will provide strategies to optimize nutrient intake in normal animals, as well as animals with reduced feed intake caused by outside influences (e.g., lactation, disease).

Cook (2011) focused on a novel technique to improve animal growth and feed efficiency. The work leading to host-targeted antibody strategies to reduce the effect of inflammatory response is reviewed. Evidence for reduced growth due to an immune response, including response to vaccination, normal vs. gnotobiotic animals, and subtherapeutic antibiotic use is presented. The mechanism of immune-induced reduction in growth and feed efficiency, including inflammatory cytokines, is reviewed. Muscle wasting associated with the cytokine response is linked to the PG pathways. Intestinal secretory phospholipase A2 has proven to be a useful target,
and the effect of orally administered egg yolk antibody against secretory phospholipase A2 on animal growth and feed efficiency was presented.

In addition to macronutrients, specific components of the diet can have direct effects on growth and development. Suryawan et al. (2011), presented by T. A. Davis, reviewed the effect of leucine on protein synthesis in neonatal pigs. It is well known that leucine stimulates protein synthesis in various tissues, including skeletal muscle; however, its mode of action is less clear. Regulation of neonatal growth and protein synthesis is reviewed, as well as the specific effects of leucine on protein synthesis and the activation of signaling to increase mRNA translation. In addition, it is unclear whether leucine itself or one of its metabolites acts to directly increase protein synthesis, and studies exploring this question are examined. It is clear that leucine is important in neonatal protein synthesis, with recent advances in this area focused on determining the mechanisms involved. Ultimately, it is hoped that these advances will lead to the use of exogenous leucine to promote growth.

Glutamine is an AA that has well described physiological functions, but is not known as an essential nutrient needed in diets of farm animals. Wu et al. (2011) addressed studies indicating that the status of glutamine as an essential nutrient may need to be examined. The abundance and functions of glutamine are reviewed, as well as the digestion and absorption of supplemental and peptide-bound glutamine. The synthesis and utilization of glutamine (dietary and endogenous) is discussed, and Wu et al. (2011) present data that indicate that supplemental glutamine, included at 1% of the diet, prevents intestinal dysfunction and increases growth performance and survival in early weaned pigs, improves fetal growth and the postweaning survival of piglets from supplemented gestating sows, and enhances milk production by lactating sows. Improving our understanding of the direct effect of AA, as well as other nutrients, on growth and development will increase the efficiency of farm animal production in the future.

The papers in this symposium provide reviews of our understanding of some of the ways nutrition and nutrients affect growth and development. Far too many nutritional components affect growth of farm animals to be presented in one symposium. It was the hope of the Program Committee that the papers presented give a well-rounded overview of some of the most novel and exciting work being conducted by scientists around the world. The advances in nutritional research presented here, among others not presented, will lead to strategies to improve the efficiency of production for all species of farm animals.

**LITERATURE CITED**


