Meat Science and Muscle Biology: How Does Pre- and Postnatal Muscle Development Affect Meat Composition, Quality and Value?

477 Coordinating myogenesis and angiogenesis: a novel role for the satellite cell in skeletal muscle growth. R. P. Rhoads*, K. L. Flann, and R. E. Allen, *University of Arizona*, *Tucson*.

The cellular basis for postnatal muscle growth and hypertrophy has been realized over the past several decades. Skeletal muscle is extremely responsive to environmental and physiological cues by modifying growth and functional characteristics in accordance with the demands placed on it. This ability extends to instances of injury or trauma, where skeletal muscle exhibits the capacity to regenerate despite being largely composed of post-mitotic, multi-nucleated fibers. The plasticity of skeletal muscle results, in large part, from a population of resident stem-like cells, often referred to as satellite cells. When needed, satellite cells proceed through a terminal differentiation program culminating in fusion competency to participate in myogenic activities. The importance of satellite cell activity to skeletal muscle growth and hypertrophy is underscored when events leading to disruptions in myonuclear accumulation occur during critical growth or repair phases leading to muscle growth deficits that cannot be overcome. Although traditionally viewed exclusively in a myogenic role, new efforts have revealed novel roles, based on spatial, temporal and functional characteristics, ascribed to the satellite cell during muscle growth and repair. For example, the satellite cell location within the skeletal muscle niche and ability to produce numerous growth factors suggest communication between myogenic and angiogenic cell types exist. Recent experiments provide evidence that activated satellite cells initiate a potent pro-angiogenic program that may participate in vascularization of skeletal muscle. Coordination of myogenesis and angiogenesis may therefore be accomplished through the secretion of soluble factors by activated satellite cells.

Key Words: skeletal muscle, satellite cell, angiogenesis

478 The energy metabolism impacts that come along with muscle fiber type and its effect on postmortem metabolism. T. M. Scheffler, J. M. Scheffler, S. Park, A. L. Grant, and D. E. Gerrard*, *Department of Animal and Poultry Sciences, Virginia Tech*, *Blacksburg*.

The meat industry has reduced the variation in product quality through modifications in animal handling protocols and implemented procedures that mask some negative quality attributes. Even so, however, carcasses with poor meat quality remain an inefficiency in the food production chain. Understanding meat quality development, therefore, is of utmost concern to the animal industry. Meat quality development is largely impacted by the rate and extent of postmortem metabolism. Recall muscle consists of a heterogeneous population of muscle cells, which collectively dictate the overall biochemical and contractile nature of muscle. The relationship between these interdependent muscle characteristics is difficult to separate given their intimate function within muscle fibers. Yet, depending on the physiological status of the animal, muscle has the ability to modify its functional characteristics to accommodate a myriad of cues. We have studied this "plastic" nature of muscle to address how muscle fiber type-specific characteristics affect muscle growth and meat quality development. We have utilized repartitioning agents, transgenic mice, and natural mutations to manipulate muscle to better understand underlying mechanisms controlling growth, adaptation, and metabolism. The capacity for lean growth may be determined by muscle fiber type composition, yet various pathways are responsible for this response. Indeed, integration of various signals, such as nutrient availability, energy status, hormones, is necessary to match precisely supply and demand. Moreover, the response to these cues is different in various fiber types and during different phases of growth. AMP activated protein kinase (AMPK) may be key in integrating these cues; it modulates multiple energy production and consumption pathways, and regulates protein turnover. Understanding these mechanisms that contribute to regulation of muscle hypertrophy and contractile and metabolic phenotype are important for optimizing the quantity and quality of meat.

Key Words: meat, muscle, energy

479 How growth and body composition can affect the quality of poultry meat? C. Berri*, E. Le Bihan-Duval, and M. J. Duclos, *INRA, UR083 Recherches Avicoles*, *Nouzilly, France*.

Although poultry products are diverse, the general trend is for portioned and further processed products to increase their market share. In this context, technological quality of poultry meat is an important aspect. In poultry, the processing ability of meat is highly related to the acidification process occurring in muscle post-mortem. This later is mainly determined by the amount of resting glycogen in the muscle at death and by the stress susceptibility of the bird before slaughter. Several studies highlighted the great impact of growth rate and body composition on these parameters in chicken. Indeed, selection for greater body weight or muscle development has induced histological and biochemical modifications of the muscle tissue. More precisely, in fast-growing broiler lines, as fiber size increased muscle glycogen reserve at death decreased and as a consequence breast meat exhibited higher ultimate pH, darker color and reduced drip loss. It has also been observed that lean chickens showed a comparatively lower level of glycogen stores than fat chickens, with again positive consequences on ultimate pH, color and water holding capacity of breast meat. Even though the genetic determinism of meat quality traits as well as the possibility to modulate them by nutrition have been established, the molecular mechanisms involved in chicken meat quality variations are still poorly described. Recently, several genomic programs allowed identifying QTL regions as well as genes and molecular pathways controlling muscle post-mortem metabolism and meat quality. These approaches constitute a promising way to better control and improve chicken breast meat properties. It would allow developing useful breeding tools, such as molecular markers, to select birds with expected meat properties, and help optimizing rearing practices, via the study of gene regulation.

Key Words: poultry meat, growth, genomics

480 ASAS Early Career Award Presentation: Prenatal muscle development affects beef composition and quality. M. Du*, *Department of Animal Science, University of Wyoming*, *Laramie*.

The quality of beef is determined by its marbling and tenderness. Marbling (intramuscular fat) is associated with the number and size of adipocytes. While the size of adipocytes can be increased during the fattening stage, the number of intramuscular adipocytes is largely determined during the late fetal and early postnatal stages. Adipogenesis inside skeletal muscle which forms intramuscular adipocytes are the sites for marbling fat accumulation. On the other hand, connective tissue which is synthesized by fibroblasts contributes to the background toughness of beef. Pre-natal skeletal muscle development involves myogenesis, adipogenesis and fibrogenesis, all of which are mainly derived

from mesenchymal stem cells (MSC). Switching the commitment of MSC from myogenesis to adipogenesis will increase intramuscular adipocytes, but to fibrogenesis will promote intramuscular collagen accumulation. Maternal nutrition and physiological status such as inflammation affects the differentiation of MSC to myogenesis, adipogenesis and fibrogenesis, which could permanently alter the amount of intramuscular fat and connective tissue in offspring skeletal muscle and thus the quality of beef

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Key Words: prenatal, meat, quality