Meat Science and Muscle Biology Symposium: Biochemical Mechanisms influencing Postmortem Proteolysis and the Identification of Protein Markers for Predicting Tenderness

634 The role of the muscle cell microenvironment on postmortem proteolysis. E. Huff-Lonergan* and S. Lonergan, *Iowa State University.*

Muscle cell metabolism reacts quickly to stimuli in living muscle and in the early postmortem period, thus the microenvironment of the muscle cell is very dynamic. Some of the changes in microenvironment that occur include loss of energy stores, a decline in pH, an increase in ionic strength, and a change in the oxidative status. The postmortem development of these changes can be influenced by genetics, ante mortem metabolism state, and postmortem handling of carcasses and muscle/meat. The resulting interplay between the intracellular environment and muscle enzymes and structural proteins is a large factor governing the amount and extent of postmortem proteolysis and meat tenderness that occurs. One family of enzymes in muscle that is sensitive to changes in pH and oxidative conditions is the calpain family. Both the rate and the extent of pH decline have a significant influence on the activity of μ- and m-calpain. In addition, oxidative changes in their environment can modify the activity of the calpain enzymes as well as their interactions with specific proteins, including their inhibitor, calpastatin. Structural proteins are also susceptible to oxidation and to denaturation by alterations in early postmortem pH. For example, oxidation of myosin, particularly the heavy chain region, has been shown to promote its aggregation and may potentially lead to cross-linking with other proteins in the myofibril, most notably titin. These changes in myosin may promote toughening of meat. Another microenviromental factor that may play a role in governing tenderness is the process of protein nitration. Nitrosylation is a potent signaling mechanism in living muscle and its effects are still evident in postmortem muscle. For instance, the activity of the protease μ-calpain is influenced by nitrosylation events. This posttranslational modification is among many that need to be examined in detail in early postmortem muscle. Understanding how the microenvironment of muscle cells influences changes like protein degradation, denaturation, oxidation and nitration is key to ultimately developing methods to predict and potentially control meat quality

Key words: calpain, skeletal muscle, meat tenderness

635 Orchestration of postmortem proteolysis following apoptosis onset. B. Yasmine[2], B. Samira[2], G. Mohamed[2], and O. Ahmed*[1], *[1]INRA de Clermont-Theix, St Genes Champanelle, France, [2]Unversity of Constantine, Constantine, Algeria.*

Meat tenderness variability is still a major problem for meat industry. All scientists agree that tenderization of meat upon storage results from a proteolytic degradation of myofibrils and associated components by endogenous muscle proteases. Progress in that domain thus followed the discovery of different proteolytic systems and their ability to mimic biochemical and structural changes affecting postmortem muscle. Despite the large controversy about the nature of the major proteolytic system responsible of meat tenderization, accumulating evidences support that this process is mutienzymatic in nature and involves a large set of endogenous proteolytic enzymes acting in a synergistic manner. The recent proposal that the first step of the conversion of muscle into meat is the onset of apoptosis is a real revolution in the meat science field. Apoptosis is a finally regulated process allowing elimination of excessive, damaged or potentially dangerous cells from an organism without damaging surrounding cells and contributing to the normal development of a multicellular organism during embryogenesis and the maintenance of tissue homeostasis in adults. Apoptosis is mediated by a particular group of cysteine peptidases called caspases, an acronym of cyteine aspartyl proteases. In that presentation we will overview different aspect of the apoptotic process: 1) how we came to that conclusion; 2) mechanisms and regulation of the process; 3) apoptosis is an energy dependent process but how the cell can provide enough energy for the onset of apoptosis in postmortem muscle?; 4) we will finely overview the consequences of apoptosis on muscle structure and how proteolytic systems may act all together.

Key words: apoptosis, muscle, proteolysis

636 Understanding postmortem proteolysis and identification of protein markers for tenderness using proteomics approaches. E. Veiseth-Kent* and K. Hollung, *Nofima Mat AS, Ås, Norway.*

Tenderness is a critical factor determining consumer acceptance of meat. Despite substantial research efforts aimed at revealing the critical factors determining meat tenderness, today′s level of understanding remains unable to explain a significant amount of the observed variation. Historically, research into postmortem proteolysis was conducted using techniques such as Western blotting and protease activity assays. While sensitive and specific, these techniques only provide insight into the actions of those specific proteins. A proteomics approach allows for a more global analysis of the dynamic process occurring with postmortem proteolysis. By expanding our focus beyond a limited set of candidates, new relationships and key players can be identified. Proteomics approaches in meat science have provided us with a better understanding of postmortem proteolysis and its relation to meat tenderness. This includes discovery of degradation products from proteins thought to be unaltered during postmortem storage and the involvement of heat shock proteins. Not surprisingly, proteomics has also been used by several groups to identify potential protein markers for tenderness. The power of these candidate markers to explain variation remains unclear, but it is certain that they will contribute to building a better picture of this complex process. However, applying this new knowledge to improve tenderness is a significant challenge. It is unlikely that online measurements of protein markers will ever be introduced as standard into meat processing plants. Fortunately, recent advances in technology and reduction in costs mean that today′s potential sires are routinely genotyped and data is being used to improve stock by genomic and marker-assisted selection. The success of genetic breeding programs is dependent upon access to high-resolution phenotype data, and if our efforts to detect potential protein markers for tenderness are successful and they have a sufficient genetic contribution, then it should be possible to associate these with genetic markers and improve breed and meat tenderness through selective breeding.

Key words: proteomics, proteolysis, tenderness