RESEARCH ABSTRACT
PORK QUALITY

Title: **PREDICTION OF PORK QUALITY USING RAMAN SPECTROSCOPY - NPB #15-078**

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Abstract
Investigations to determine the major contributors to meat tenderness have been conducted for many years. This is testimony to the persistence of the problem and to the elusiveness of a sustainable solution to the problem. Meat processors, chefs, and retailers all recognize that pork tenderness is a very important quality trait for their customers. Clearly, descriptors on labels and menus often use some verbiage to share that the pork item is tender. Postmortem processing has given processors several approaches to improve tenderness. What is needed is the ability to predict tenderness of pork with a rapid test, preferably early in the production chain. A practical approach is a method that can identify product that is not tender or will not become tender. Removal of pork loins that are not tender will have the favorable result of improving tenderness and decreasing the variability of tenderness of the remaining pork. Product identified as being inferior could then be targeted for a tenderness intervention to improve the product quality. Similarly, identification of pork loins that are of superior tenderness would allow producers, processors, and chefs to confidently market a premium product. **Therefore, the goal of the summarized work was to develop methods to rapidly identify pork loins that are of superior quality AND pork loins that are of inferior quality, with a specific focus on tenderness**.
There is a great need for a rapid, nondestructive analysis technique that can be used to predict consumer response to a pork product. This is especially true for on-line techniques that can be incorporated into the meat processing line. A wide range of physical and chemical methods have been developed and tested for this purpose, including various shearing techniques, pH value, image texture analysis, UV fluorescence, NIR, and ultrasound. Apart from shear force measurements, none of the above methods have found wide applications in the meat industry, mainly due to poor reproducibility and inconsistent correlation to sensory panel evaluations. **Raman spectroscopy** is a technique that has not been fully explored in meat quality assay. Sharing with other vibrational spectroscopic techniques such as Near Infrared spectroscopy (NIR) and Fourier transform infrared spectroscopy (FT-IR), Raman spectroscopy yields fingerprints of chemical functional groups that are directly correlated to chemical and physical properties of the pork samples, which ultimately determine the quality of the meat. *Unlike NIR and FT-IR, Raman spectroscopy is insensitive to water, which is a major component of meat and poses as significant background interference in NIR and FT-IR measurements*. This approach thus has the potential to overcome some of the pitfalls preventing other methods from being widely adopted. In addition,

Raman spectrosensing requires no sample preparation, and is nondestructive. It is possible to incorporate it into on-line meat processing to provide real-time, continuous monitoring of meat products. Raman spectra reveal the chemical and structural makeup of meat, which have strong correlation to the sensory attributes (e.g., tenderness) of meat.

Our objectives in this project are to 1) integrate Raman spectrosensing with mathematical predictive models to provide objective, rapid and reliable evaluation of meat quality that is consistent with sensory panel assessments; 2) to establish the correlation between temporal changes in meat composition and structure, Raman spectroscopic signatures of meat, and pork sensory quality to further enhance the predictive capability of these powerful techniques. Our rationale is that success in advancing this much-needed technology will expand our knowledge base on how to effectively and efficiently characterize the chemical and physical properties of pork samples, and how to relate subjective sensory attributes of pork samples to objective spectroscopic signatures.