

### H25 Muscle Protein Degradation in Postmortem Interval (PMI) Estimation: Recent Accomplishments and Current Challenges

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**Learning Overview:** After attending this presentation, attendees will better understand the current state of the art and a specific international collaboration project on postmortem protein degradation for use in PMI estimation.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by informing attendees that time-since-death estimation is a crucial topic in forensic routine, yet currently applied methods are often insufficient or produce unsatisfactory outcomes. New approaches, such as the one presented, are required to contribute to the methodical spectrum.

**Background:** Estimation of the PMI is one of the most challenging aspects of routine forensic work. Current available methods are often limited to a certain timeframe or may be insensitive due to specific case preconditions or the circumstances surrounding the death. The search for additional methods and respective postmortem biomarkers is, thus, a central topic in forensic science and has become of increasing interest since the rise of sophisticated molecular biology approaches over the past decades. This study proposes a novel approach based on muscle protein degradation that has shown great promise by a first successful application in a forensic case. However, respective impacts of individual and environmental influencing factors reveal an important task that necessarily has to be addressed to achieve significant practical relevance in PMI estimation. Also, the applicability to a large heterogeneity of cases requires an appropriate evaluation of the sufficiency and the limitations of a method.

**Methods:** This study investigated possible metabolic influences, such as injury/regeneration or atrophy, in a rodent model and humans. Variances of protein degradation kinetics in different muscle groups (thigh, calf, and abdominal muscle) in rats and humans were examined. A field and crime scene sampling protocol was implemented. The possible influence of changing weather conditions and insect activity on a pig model were investigated.

**Results:** Analysis of muscle protein degradation represents a promising new tool for PMI estimation and is based on a catabolic process that is well-preserved in different mammalian species. Thus, animal models—when thoughtfully employed—represent valid approaches to analyzing various possible influencing factors. This study successfully implemented field and crime scene protocols and demonstrated that postmortem protein patterns can clearly be distinguished from *in vivo* metabolism.

**Conclusion:** This study reinforces the importance of analyzing factors that may influence biomedical postmortem alterations used to estimate the PMI. It also highlights the advantages and utility of muscle protein degradation analysis as a tool for forensic investigations. Overall, it offers insight into the general requirements of novel approaches for time-since-death estimation and the specific challenges of incorporating muscle protein degradation analysis into routine forensic work.

#### Protein, Degradation, PMI Estimation