



B132 Protein Profiling of Decedent Scalp Hairs to Investigate the Potential Mechanisms for the Formation of Postmortem Root Bands

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After attending this presentation, attendees will better understand the proteomes from different segments of the pre-keratinized region in anagen hairs exhibiting and not exhibiting a Postmortem Root Band (PMRB). Manifestation of a PMRB is one form of decompositional change that is presented as an ellipsoidal-shaped banded area in anagen and early catagen-phase hairs derived from cadavers.¹⁻⁵ It has been demonstrated that these banded areas are gas pockets, as they appear dark in transmitted light microscopy and bright in reflected light microscopy.⁴ Although the microscopic characteristics of PMRBs have previously been well investigated, the mechanism for their formation requires further research.¹⁻⁵

This presentation will impact the forensic science community by contributing to the understanding of the possible biochemical mechanism(s) of the formation of a PMRB. The knowledge gained from this research will be useful to forensic science by providing support when determining whether the hair evidence was shed postmortem.

Anagen head hairs were collected at the Federal Bureau of Investigation Laboratory from human volunteers and at the University of Tennessee Knoxville Anthropology Research Facility from deceased donors of known postmortem interval. Hairs were trimmed to approximately 1cm from the proximal end to facilitate handling. A visual qualitative assessment of decomposition was performed for each hair using transmitted light microscopy. For each hair exhibiting a PMRB, three areas of the root were segmented for protein extraction: below (proximal), at (medial), and above (distal) the band. Hair segments (~300µm in length) of homologous locations were also obtained from postmortem and antemortem hairs that did not exhibit PMRBs. In total, at least 72 hair segments were processed for protein extraction and enzymatic digestion using trypsin.⁶

The peptide/protein composition of banded and non-banded hairs was characterized using nano-liquid chromatography/tandem mass spectrometry using labeled synthetic peptides and angiotensin added as internal standards. Chromatograms of the segments (i.e., proximal, medial, and distal) as well as the proteomes of these segments for both banded and non-banded hairs were compared. Preliminary qualitative and semi-quantitative analysis of protein profiles reveals subtle differences between the different hair segments. It was anticipated that the number, quantity, or modification of proteins in the non-PMRB hair segments may be different than in the PMRB hair segments because microscopic analysis of the banded segment showed significant decomposition. Results from this comparative proteomics analysis of the hair segments will be presented.



Reference(s):

1. Hietpas J. et al. Microscopical Characterization of Known Postmortem Root Bands Using Light and Scanning Electron Microscopy. *Forensic Science International*. <http://dx.doi.org/doi:10.1016/j.forsciint.2016.07.009>, 2016.
2. Koch S.L. et al. Taphonomy of hair-A study of postmortem root banding. *J. Forensic Sci.* 2013. 58: p. S52-S59.
3. Linch C.A., Prahlow J.A.. Postmortem microscopic changes observed at the human head hair proximal end. *J. Forensic Sci.* 2001. 46(1): p. 15-20.
4. Petraco N. et al. The morphology and evidential significance of human hair roots. *J. Forensic Sci.* 1988. 33(1): p. 68-76.
5. Tafaro J.T. The use of microscopic postmortem changes in anagen hair roots to associate questioned hairs with known hairs and reconstruct events in two murder cases. *J. Forensic Sci.* 2000. 45(2): p. 495-499.
6. Araki N., Moini M. Age Estimation of Museum's Wool Textiles from *Ovis aries* using Deamidation Rates Utilizing MALDI TOF MS Rapid Commun. *Mass Spectrom.* 2011, 25, 3396-3400.

Postmortem Hair Root Banding, Hair Decomposition, Liquid Chromatography