G54 Estimation of Postmortem Interval by Direct Analysis of the Skin Surface Through FT-NIR

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After attending this presentation, attendees will be familiarized with the basics of Fourier Transform-Near Infrared (FT-NIR) spectroscopy and multivariate analysis using common chemometric techniques such as Partial Least Squares (PLS) and Principal Component Analysis (PCA). In particular, the audience will learn about the potential for creating models for the estimation of the Postmortem Interval (PMI) when joining chemometrics and NIR spectroscopy. General ideas for the application of such techniques to other forensic problems may be also addressed.

This presentation will impact the forensic science community by introducing modeling techniques over NIR spectroscopy to the problem of estimating the postmortem interval in a fast, reliable, and rather accurate method. Besides, the procedure proposed requires minimal to none sample treatment or preparation and can be performed *in situ*.

The estimation of the PMI, the time since death, is of paramount importance and a significant challenge for the pathologists. Methods currently employed have considerable inaccuracy.

Following the developments of the last few years regarding the application of mid-infrared spectroscopy for studying skin, and the possibility of easy direct *in situ* analysis that has risen with fiber optics apparatus for Attenuated Total Reflectance-Fourier Transform Infrared (ATR-FTIR), the FT-NIR was applied spectroscopy to directly test the human skin for possible chemical changes occurring after death that could correlate with PMI.

The sample population consisted of 25 corpses (male and female) with different causes of death and ages ranging from 20 to 96 years old. The bodies were submitted to autopsy at the North Branch of Portuguese National Institute of Legal Medicine and Forensic Sciences and the spectra recorded at the premises by the local staff. FT-NIR spectra have been acquired using an Antaris 1 (Thermonicolet) spectrophotometer equipped with a diffuse reflectance fiber optical probe (SabIR, Thermonicolet). Spectra (in duplicate) were taken from the upper right lateral toraco-abdominal area and internal side of upper third of right arm at each postmortem acquisition point and the changes in skin chemistry were followed during time periods of 9 hours (minimum) to 69 hours (maximum), depending on the subject, until a maximum of 72 hours.

Several chemometrics techniques were applied for the multivariate analysis of the spectra, namely PCA, PLS, and Partial Least Squares Discriminant Analysis (PLS-DA). All modeling and data analysis was done using Matlab (version 7.9, Mathworks) and PLS toolbox 5.5.1 (Eigenvector Res1earch Inc.) for Matlab. On creating the model, specific functions were written for variable selection, using genetic algorithm, and for sample selection for cross-validation.

The models obtained, although having a restricted number of corpses available for calibration, present promising results.

Postmortem Interval, Infrared Spetroscopy, Skin Chemestry

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