D54 Analysis and Characterization of Children's Latent Fingerprint Residues by Infrared Microspectrometry and Gas Chromatography/Mass Spectrometry

Kathryn E. O'Brien, BS, and Corrie J. Brown, MS, Oak Ridge Institute of Science Education, 2501 Investigation Parkway, Quantico, VA 22135; and Diane K. Williams, PhD, and Brian A. Eckenrode, PhD, Federal Bureau of Investigation, Quantico, VA 22135*

Upon completion of this presentation, attendees will understand the chemical changes that occur in children's latent fingerprints as a function of time and temperature.

The presentation will impact the forensic science community by demonstrating how an understanding of the chemical changes that occur in children's latent fingerprints over time may lead to improved methods for collection of children's fingerprints from crime scene investigations.

Latent fingerprint residues from pre-pubescent children have been observed to disappear form crime scenes faster than those of adults. Therefore, a study was initiated to determine the chemistry of children's skin surface residues. Latent fingerprint residues were collected from fifty- seven children, ranging in age from one to eleven years. The fingerprints were deposited onto aluminum-coated glass slides and analyzed by infrared microspectrometry. The data suggest that there are three consistent classes of compounds present in the latent fingerprint residues of pre-pubescent children: protein, esters, and carboxylic acid salts. While a spectrum of pure squalene was not obtained, an unsaturation peak at approximately 3100 cm^{-1} was routinely observed in many of the latent fingerprint residues and is attributed to the presence of squalene in the residues. The time study, discussed below, was initiated to further understand the changes in the chemical composition of the fingerprint residues as a function of time.

To determine the stability of the compounds over time, data were collected every twenty-four hours, using the same experimental parameters, over a period of ninety-six hours. The percent change in the absorbance of both the salts and esters was recorded. The results suggest that the esters disappear more rapidly form the fingerprint residues of children relative to the salts. After a period of ninety-six hours, the percent change in the absorbance of the esters was approximately ninety-five while the percent change in the absorbance of the salts was approximately five. These results suggest that children's latent fingerprints have been historically difficult to recover because the salts were not being targeted by the developing agents. Additional analysis of the infrared data revealed that the unsaturation peak that was consistently observed at approximately 3100 cm^{-1} disappeared from all spectra after approximately two weeks while a second carbonyl peak appeared. These results are indicative of squalene oxidation and mass spectrometric analysis will be performed to confirm this supposition.

To further characterize the changes that occurred in the latent fingerprints as a function of time, gas chromatography with mass spectrometry experiments are currently being performed. The latent fingerprint residues that were collected on the glass slides will be extracted and analyzed to gain a better understanding of the complex chemical changes that were observed from studying the residues by infrared analysis. The mass spectrometry data will be discussed in the context of the chemical changes that occurred in the latent fingerprint residues after the residues were kept at ambient temperature for a period of more than four years. After completion of the mass spectrometry experiments, the data will be analyzed to gain a better understanding of the compounds that remain in children's fingerprint residues over extended time periods. The ultimate goal is to develop a better method of targeting the specific compounds in children's latent fingerprint residues so that the fingerprints can be recovered in crime scene investigations.

Latent Fingerprints, Infrared Microspectrometry, Gas Chromatography/Mass Spectrometry

 ** Presenting Author*