B125 Effects of Decomposition on the Recoverability of Biological Fluid Evidence

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After attending this presentation, attendees will understand how decomposition and environmental factors can affect traditional methods for detecting and identifying blood and semen evidence as well as the ability to recover human DNA from such samples.

This presentation will impact the forensic science community by demonstrating that traditional methods of detection and testing may not readily identify blood and semen evidence present on the clothing of a decomposing body, indicating that alternate methods of testing and sampling should be considered.

Several factors that influence the rate of human decomposition have been described, including temperature, access by insects, humidity, and rainfall.[1] These environmental factors, as well as purge fluid released during decomposition, can also interact with any evidence deposited on the clothing of a deceased individual.[2] This present research assessed how these combined factors affected the detection and identification of blood and semen evidence.

A 35- to 45-pound feeder pig (Postmortem Interval (PMI) <3 hours) was placed on a grassy area within the Boston University Outdoor Research Facility for a period of 22 days during late spring, the temperature averaging 61.8oF. Aliquots of 30µl of either human blood or semen were pipetted onto 1"x1" sections of a 95% cotton T-shirt. Twenty-two samples of each type were placed on top of and underneath the pig, as well as a similarly weighted bag of sand (control). One bloodstain and one semen stain were collected each day for a period of 22 days from each location, yielding eight samples per day. Each sample was analyzed within 30 hours of collection.

The blood samples beneath the control showed that environmental factors influenced the results of testing. Rain caused dilution and diffusion of the bloodstains and the color of the stains changed from red-brown to green-yellow. Kastle-Meyer (KM) testing was positive for all samples and ABAcard® HemaTrace® testing was positive for 14 of 22 samples, with the negative results occurring during days 12 to 22. Two stains that were negative at ten minutes turned positive shortly thereafter, suggesting that perhaps a longer development time may be required for compromised samples. The blood samples placed beneath the pig yielded positive KM results on all 22 days and positive HemaTrace® results through day ten. All bloodstains placed on top of the pig and control yielded positive KM and HemaTrace® results.

Semen samples from beneath the control began to show a decrease in fluorescence using an Alternate Light Source (ALS) by day three, and some areas of fluorescence occurred in a different location, indicating that the soluble components had diffused outward from the Original Region Of Deposition (ORD). Results for Acid Phosphatase (AP) and ABAcard® p30 were mostly positive through day 16. By day 17, the ORD no longer fluoresced or yielded positive AP or p30 results. With the exception of day ten, sperm were identified on all samples. Semen results from beneath the pig showed that even on day one, the ORD were only weakly fluorescent and by day four, fluorescent regions began appearing outside of the ORD. These migrated regions of fluorescence yielded positive results with AP spot and p30 testing but showed few or no spermatozoa when examined microscopically. As the days passed, the ORD were no longer fluorescent and AP mapping and p30 testing yielded negative results; however, spermatozoa could still be identified in almost all of the ORD through day 22.

Semen samples collected from on top of the control showed that semen stains retained fluorescence and tested positive for AP, spermatozoa, and p30 through 22 days of testing. Semen samples collected from on top of the pig yielded similar results until day 16, when the fluorescence began to fade and AP testing did not yield traditional color changes associated with a positive result. By day 18, fluorescence was no longer visible with an ALS at 450nm or 495nm; however, Ultraviolet (UV) light yielded positive fluorescence when used during days 19 to 21. Spermatozoa and p30 were identified on samples saturated with products of decomposition, even when presumptive screening techniques were negative (450nm-495nm) or showed an altered appearance (AP).

DNA analysis results of select stains will be presented.

References:

1. Mann RW, Bass WM, Meadows L. Time Since Death and Decomposition of the Human Body: Variables and Observations in Case and Experimental Field Studies. *Journal of Forensic Sciences* 1990, Jan;35(1): 103-111.
2. Clark MA, Worrell MB, Pless JE. Postmortem changes in soft tissues. In: Haglund WD, Sorg MH., editors. *Forensic Taphonomy: The Postmortem Fate of Human Remains*. Boca Raton: CRC Press, 1997;151-164.

Blood, Semen, Decomposition