H25 A Correlative Forensic Approach to the Dynamics of Decomposition in a Tropical Environment

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After attending this presentation, attendees will understand the importance of the integration and correlation of multiple dynamics in determining the Postmortem Interval (PMI).

This presentation will impact the forensic science community by discussing the correlation of the results; the accuracy and reproducibility of PMI determination can substantially be improved by the innovation in standardization and sampling, along with a multidisciplinary approach.

Decomposition dynamics are the predominant factors that influence PMI in any given environment. This provides important evidence of the spatiotemporal events involved in a death investigation; however, current techniques in PMI determination are limited in precise scope and provide inconsistent chronology. This study seeks to determine the dynamics of decomposition in a tropical environment to provide a more accurate PMI determination through the simultaneous integration of a series of techniques using a correlative approach. This is part of an ongoing investigation (2014/2015) into processes of decomposition in Puerto Rico, in order to establish the causal relationships in a tropical monsoonal climate (Köppen-Geiger classification: Am). A model organism (*Sus scrofa*) and location (protected wetland area) was used for monitoring and standardization. The on-site environment and climate was monitored, along with morphology, internal temperature, and entomology. Sampling and data collection were conducted three times daily and in triplicate. Specifically, climate monitoring was normalized utilizing onsite data, a nearby weather station, and the national weather service station. Measurements included wind speed, direction, surface pressure, temperature, humidity and precipitation.

Rate of decomposition and changes, including internal and external temperature probes, morphology, and entomological succession, were monitored by photography and sampling in all stages of decomposition. The total estimation of the entomological populations, species identification, and photography was taken on site. Representative samples were taken for offsite morphological and genetic characterization and dissection.

Multiple representative samples were taken of the diverse anatomical microenvironments of the corpse including the nasal, skin, oral, aural and anal cavities. These were used for the DNA extraction and metagenomic sequencing, primarily to determine microbial diversity (16S rRNA) of the tropical necrobiome. The microbiome has a high initial variability between sites due to predominate host-microbiome microenvironments of the living organism. The correlation between initial microbiota and necrobiota is poorly understood and as demonstrated may also carry a chronological correlation between temperature, humidity, and necrophage colonization.

Corpse decomposition lasted approximately 25 to 30 days; this process identified the five main stages of decomposition and associated arthropods. Entomological succession initiated with the arrival of crickets (Gryllidae) and carrion flies (Calliphora), followed by the Sarcophagidae and Muscidae. Cockroaches (Blatellidae) and ants (Formicidae) were also present at the site. The number of estimated insects and predominant species of corpse decomposition in this environment, including diurnal effects, is also discussed.

Decomposition processes occur at an elevated rate in the humid tropics, with temperatures ranging between 20°C-35°C, and a predominantly high humidity, ranging between 65%-100% Relative Humidity (RH). Rainfall was variable but reached up 200mm of rain. These factors are favorable for accelerated decomposition due to elevated microbial growth rates, diversity, and biochemical degradation. Diurnal cycles (night and day) have been shown to

affect both the rate of necrobiome and necrophage corpse decomposition. Internal microclimates, monitored within the corpse, detected temperatures exceeding those of the ambient at early stages of decomposition. The degree of entomological colonization and decomposition was significantly affected by rainfall, although this study was unable to determine the effect of wind as the wetland reserve area is relatively protected.

This experiment was a large-scale investigation to elucidate dynamics of decomposition in a tropical environment. A number of analyses are currently underway and the continuation of these will provide a clearer understanding of the relationship between the environment, the corpse, and the rate of decomposition.

The significance and importance of this research is consistent with an improved understanding of the rate of decomposition and the environmental factors that influence this rate. Additionally, through correlation of these results, innovation in standardization and in sampling, along with a multidisciplinary approach, the accuracy and reproducibility of PMI determination can be substantially improved.

Tropical Environment, Multidisciplinary, Correlative