A175 Defining a Reliable Human Decomposition Odor Profile for Forensic Canine Investigations

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After attending this presentation, attendees will discuss on-going research in determining the distinct volatile organic compounds and their relative ratios as they relate to the discovery of clandestine human burials.

This presentation will impact the forensic science community by providing insights into the difficulty of adequately and accurately measuring the distinct components that will be used in canine training aids to assist in field investigations.

This presentation will provide a better understanding of the challenges facing forensic canine specialists in both locating clandestine burials as well as the challenges facing forensic research chemists in defining a reliable volatile organic chemical (VOC) composition profile from which to train their canines. There are several key issues that need to be addressed, most importantly determining and optimizing the set of volatiles that accurately represent human decomposition and reduce or eliminate associations to other odors resulting from background and/or non-human sources. Surface and sub-surface VOC comparative analyses could be important to adequately delineate any differences in odor profiles for investigations. Determination of this set of volatiles will allow for more appropriate training of victim recovery canines across the forensics community. If canines can be trained using a common training aid, the overall location accuracy of clandestine burials should improve.

This presentation will impact the forensic community by enlightening a wider audience as to these issues, which in turn may lead to advances in research and development to address these key issues. As a result, a greater number of well trained, efficient canines would be available to consistently locate clandestine burials (i.e., buried or concealed human remains).

The use of canines in law enforcement and military applications is well-known. Among their many uses, canines are used to screen for drugs and explosives, to locate missing persons, to associate crime scene evidence with a suspect, and to locate victims of violent crimes. Qualitative and quantitative characterization of the VOCs resulting from human decomposition (i.e., odor) has been elusive. Determining the relevant VOCs amidst a wide array of potential markers for human evidence, both living and deceased, has not been adequately achieved. For example, locating a clandestine burial efficiently and independent of the time since death has long been a significant challenge for canines due to the wide range of chemicals measured, as well as the number of chemicals that are similar from a variety of confounding decomposing matrices or sources. Traditional air sampling techniques, new sampling devices, human surrogate testing, chemical mimics, and new analysis tools have been developed over the years to assist in addressing these questions. The overall goal of this research is to improve the detection and characterization of the most relevant VOCs for forensic investigative reasons, as well as to improve training models for cases such as these.

Air sampling via solid phase microextraction (SPME) and 400-mL canisters has been performed in two biotopes: Knoxville, Tennessee (Anthropological Research Facility, (ARF)) and Boston, Massachusetts. A GC×GC TOFMS system with a preconcentrator was used for measurements of human materials (e.g., tissue or clothing) both fresh and decomposing. A GC/MS system was used for SPME sample analysis and also whole air samples when this system was interfaced to a dual preconcentrator thermal desorption system. An existing and a new hand-held preconcentrator have been computer modeled with flow simulations based on recent experiments with a baseline prototype device under high sampling air flow conditions. Chemical mimic development and testing was performed with a variety of mixtures and actual field trials were performed using canines. Bloodhounds and Springer Spaniels were used to test mimic performance and to test human decomposition and suspect scent hypotheses.

Prior research in human decomposition has shown that there could be over 450 different VOCs emanating from human subjects buried at the ARF in TN. Subsequent research supports focusing on a manageable 50 based on a variety of factors including a systematic statistical analysis. Further narrowing of this list is currently underway with careful consideration of biotope controls and the analytical results therein. Comparison of these reduced lists to a variety of currently available research studies and those performed in this laboratory using human surrogates such as pigs, has

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indicated that commercially available mimics may not be acceptable for efficient canine human decomposition training based on the GC/MS and GC×GC TOFMS data. Research into understanding canine olfactory capabilities has also influenced the development of improved VOC collection devices and computational fluid dynamic simulations of a baseline system prototype, which indicates that a newly designed hand-held device once fabricated should be up to 40 times more sensitive for VOCs, once fabricated. This presentation will provide an overview of the many avenues of investigation involved in human (living/deceased) odor profile studies that are on-going in the research unit and in conjunction with the evidence response team unit's canine program.

Human, Decomposition, Volatiles

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