D57 Use of Canines to Detect Dried Human Blood and Instrumental Methods for the Determination of Odor Profiles

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After attending this presentation, attendees will learn about the principles of odor detection by canines, particularly human blood detection. Attendees will also learn of the volatile organic compounds comprising this odor and the methods for extracting and analyzing these volatiles.

This presentation will impact the forensic science community by expanding the general knowledge base concerning the abilities of canines and their use in support of law enforcement investigative challenges that require trace determinations of the Volatile Organic Compounds (VOCs) that compose the odor of dried blood.

It is widely accepted that canines have an exceptional aptitude for locating objects of interest based on odor. Recently, the first known detector canine trained specifically to locate small quantities of human blood has been utilized to assist crime scene technicians in locating hard-to-find blood spots for subsequent DNA analysis. It was hypothesized that this will be the first research to show, experimentally, that a canine is capable of locating miniscule quantities of human blood.

The capability of the blood detection canine to locate small blood spots of varying ages was evaluated using a canine that had been trained solely on aged blood, and had not been previously tested or exposed to fresh blood. To prepare the samples for evaluation, approximately one mg of blood (two blood drops) was placed onto carpet squares. The blood on the carpet squares was allowed to age in an open environment for a set amount of time. The age of the blood samples used ranged from one to twelve weeks. The canine successfully located all blood samples with no false alerts. This was the first time that the canine's ability to locate extremely small quantities of aged blood was demonstrated in an experimental setting.

In another set of experiments, the ability of the canine to locate fresh, compared to aged-blood was assessed. Two sets of samples containing human blood, aged and fresh, were presented to the canine. The aged set contained fresh blood spiked onto gauze pads and aged for two weeks prior to testing. The fresh set contained fresh blood spiked onto gauze pads within two hours of testing. The different gauze pads were placed in perforated cans for the canine to search. The canine responded positively to the aged blood samples, but did not show interest in the fresh blood. This indicates a change in odor profile from fresh to aged (decomposed) blood.

For the instrumental analysis of the odor profile of dried human blood of various ages, blood was drawn from three human subjects, placed in open glass vials, and allowed to age for a given amount of time before analysis. The headspace was extracted using Solid Phase Microextraction (SPME) and was analyzed by Gas Chromatography/Mass Spectrometry (GC/MS). The resulting odor profiles for each aged samples were compared. A unique group of VOCs were present in only the fresh sample, and there was a distinct change in odor signature from fresh blood to decomposed blood, occurring around Day 1 and Day 2. The VOCs detected on the first day represent the odor of fresh blood, while compounds detected after Day 1 represent the compounds that have evolved due to decomposition of the blood material, and the older samples show a continual change as the decomposition of the blood progresses.

In additional experiments, the odor signatures of dried human blood collected using several extraction methods in addition to SPME were compared. Extraction methods included SPME with various fiber types, dynamic headspace sampling onto a sorbent tube and activated charcoal sampling. The extraction methods were compared based both on the compounds in the odor profiles as well as their precision. Based on the VOCs identified, it was observed that the extraction techniques do not necessarily yield similar results, yet instead may be considered complimentary extraction methods. To gain a better understanding of which of these compounds might be recognized by blood-specific canines, mixtures of compounds based on the odor profiles determined by each extraction method were created and presented to the blood detection canine in order to observe whether the canine would elicit a similar response to the selected blood VOC mixtures as to the actual blood.

Canines, VOCs, Blood

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