## A188  Human Breath Analysis as a Forensic Tool: Detecting Prior Location and Suspect Activity of a Subject

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After attending this presentation, attendees will be familiar with the concept and applications of human breath analysis. They will also learn methods in which breath analysis can be applied to a forensic setting, specifically identifying the prior location or activity of an individual.

This presentation will impact the forensic community by highlighting a new research tool that may aid in linking an individual with a location, as well as possibly identify subjects working with illicit materials, e.g., drugs or explosives, before harm is done to humanity.

This presentation will demonstrate the use of human breath analysis using gas chromatography-mass spectrometry to detect chemical compounds present in breath in trace quantities. These compounds can provide information about the prior location or prior activity of a subject.

Identification of the prior location or activities of an individual can have important ramifications in the forensic community. A method that could identify if or when a subject was in a particular location would aid in associating a suspect with a crime scene. The ability to detect compounds on human breath that would indicate illicit activity, such as drug or explosive synthesis, would allow suspects to be identified early in the synthetic process and perhaps prevent distribution or a terrorist event.

All locations have a chemical signature caused by the compounds present in the air due to natural compounds, outgassing of materials, and the activities pursued in the space. For example, the air in a laboratory used to synthesize drugs will contain chemicals used in that synthesis which are not commonly found in a typical air sample. An individual in the location is consequently exposed to these compounds, generally present in very low concentrations. As an individual breathes, these compounds are drawn into the lungs and pass into the bloodstream via the pulmonary alveolar membrane. After leaving that location, the compounds are eliminated from the body at different rates and through different excretory systems; however, a significant portion of these compounds are eliminated through exhaling. Therefore, it was hypothesized that by collecting and analyzing human breath, these compounds can be detected and may provide information about the history of the subject.

Gas Chromatography-Mass Spectrometry (GC-MS) was used to analyze human breath samples collected before and after a series of exposures. Breath samples were obtained before and after a subject visited a hardware store and nail salon, and at several different locations. Chemical signatures were detected in these breath samples and traced back to a particular compound present in the air at each location, connecting the individual with a particular site. Breath samples were also obtained before and after controlled chemical exposures in the laboratory, including oral exposure to pseudoephedrine HCl, a common starting material in the synthesis of methamphetamine, and inhalation exposure to hexamine, a common starting material in the synthesis of explosives. The presence of these compounds was detected and monitored in breath samples for hours after exposure. As these experiments were performed on the small scale in a controlled environment, it is thought that real-world subjects would have an even higher level of exposure and would allow for these signatures to be detected over longer time courses.

**Breath Analysis, GC - MS, Suspect Activity**