## B136 Engineering Tools to Aid in the Collection of DNA Evidence at a Crime Scene

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The goal of this presentation is to introduce the community to the concept of computational fluid dynamic modeling applied to predict the location of trace levels of DNA in a particular space.

A goal of this project is the development of a general flow model that can be used as a forensics tool to aid in the recovery of DNA at the scene of a crime. This presentation will impact the forensic science community by demonstrating an empirical model for the collection of trace evidence and should be a powerful addition to the forensic scientist's armamentarium.

In 2005, the Government Accountability Office (GAO) published a report criticizing the various agencies involved in the response to the 2001 Amerithrax attack, citing their failure to use probability sampling in initial strategies, thus reducing the level of confidence in a negative result. The same principle could be applied to crime scene anaysis. Although guidelines for the collection and preservation of DNA evidence at a crime scene are well-documented, there has not been an empirical study describing the probability of finding trace levels of DNA at different sites within a crime scene. A powerful tool used in mechanical engineering is computational fluid dynamics (CFD), a modeling technique in which mathematical algorithms are applied to the analysis of fluid flows. The particulars of a space (e.g. volume, flow rates, vents) are variables in the millions of computer-driven calculations used to simulate the interaction of fluids and gases with complex surfaces.

The application of CFD to room air motion as a tool for human forensics can be broken into two categories. The first category involves enclosed, non-ventilated air spaces and requires analysis of natural convection and the associated heat and mass transfer. The second category is much more complicated and involves enclosed, ventilated air spaces. Both ventilated and non-ventilated air spaces pose a challenge to the recovery of human DNA material because of the extensive space air diffusion that occurs in a ventilated room. The use CFD to model the transport and deposition of human cells and DNA material in an enclosed air space with a goal of predicting optimum sample locations throughout that space has been evaluated.

A typical room was used to simulate a crime scene, and samples were collected in accord with standard evidence collection guidelines. Then, CFD modeling was applied to the space to identify the locations for which there was a high probability of finding trace levels of DNA. Using this technique, low levels of DNA were collected from areas that would not normally be sampled, thus representing evidence that would have been be lost in the absence of CFD modeling. The application of low copy number profiling protocols such as miniSTRs allowed for the recovery of additional genetic information. Results will be discussed.

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**Computational Fluid Dynamics, DNA Evidence, DNA Profiling**

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