E24 Introduction to the Science Behind Trace Evidence Examination

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After attending this presentation, attendees will gain a general introduction to the scientific method employed in the analysis of trace evidence, as well as the conclusions that can be expected from the various types of trace evidence examinations. Evidence included in the trace evidence category, such as animal and human hairs, natural and synthetic fibers, condom lubricants, gunshot residue, and paint will be discussed along with the different analysis methods used to examine those evidence types. Regarding the analysis methods used to examine trace evidence, a general but informative overview will be given on several analytical methods including optical and Polarized Light Microscopy (PLM), Scanning Electron Microscopy–Energy Dispersive Spectroscopy (SEM-EDS), Fourier transform infrared spectroscopy (FTIR), Raman spectroscopy, and Gas Chromatography – Mass Spectroscopy (GC-MS). The objective of discussing the analytical techniques is to expose the attendees to general types of evidence each method would be appropriate for, as well as what results that can be expected from each.

This presentation will impact the forensic science community by explaining the analytical methods used for analysis of trace evidence, along with the importance in the process of finding, interpreting, and properly testifying about the evidence. Even though trace evidence is usually circumstantial, and often cannot be used to identify an individual, it still plays an important role in forensic science. In addition to the direct comparison of questioned and known samples, trace evidence is vital in the evaluation of physical evidence to provide investigative leads to investigators in a variety of criminal investigations.

Trace evidence may be left behind at the crime scene, found on victims, and also taken with the perpetrators of crimes. The exchange of these traces often occurs without the knowledge of the perpetrator and is sometimes crucial in establishing a connection between the crime scene, the victim, and the suspect. DNA examination has evolved into a significant type of forensic evidence; however, trace evidence may be particularly important in establishing these connections in situations where suspect DNA is not recovered from a victim or the perpetrator's DNA profile is not listed in databases which law enforcement would use to make an identification of an unknown suspect. To give a better understanding of the occurrence of trace evidence, the authors will discuss the Locard Exchange Principle and different methods of transfer which can result in the depositing of various types of trace evidence.

This presentation will also discuss the strengths and weaknesses of the different trace evidence examinations, as well as what conclusions can be reached and how forensic scientists reach their conclusions and utilize trace evidence. As trace evidence is most commonly used as associative evidence as opposed to evidence that yields an identification of a suspect, the realistic strength of trace evidence analysis conclusions will be discussed, as well as some effective questions that can be asked in the courtroom to best portray to the jury the gravity of the results. Several case studies will be presented in which trace evidence played a crucial role in investigations and trials. Trace evidence is a valuable tool for forensic investigations as well a providing a solid scientific foundation to the trier of fact when determining the possible associations present in forensic casework.

Trace Evidence, Scientific Method, Evidence Transfer

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