

**Program: The Truth Behind Trace Evidence**

**Speaker:** Gina M. Londino-Smolar, MS, Chemistry and Chemical Biology, IUPUI

**Introduced by:** Karen Bumb Lauer

**Attendance:** 121

**Guests:** Patrick Kelleher, Bill Fohey, David and Mag Zauner, Morton and Rebecca Marcus, Beth Dawson, Ned Wysong

**Scribes:** Carol and Jim Mutter

**Editor:** Ed Nitka

Gina M. Londino-Smolar, MS, Chemistry and Chemical Biology, IUPUI School of Science, Senior Lecturer, Forensic and Investigative Sciences Program and Dept. of Chemistry and Chemical Biology as well as a faculty fellow with Teaching and Learning Technologies at IUPUI. She is currently a fellow of the American Academy of Forensic Sciences (AAFS) and the Chair of the Disciplines committee for the General Section and a member and President-Elect of the Council of Forensic Science Educators (COFSE). Gina has a B.S., Chemistry from Ball State University, Muncie and a Master's Degree in Analytical Chemistry from Purdue University, Indianapolis.

This talk was about the power of trace evidence and what we can determine from these small clues that many times are overlooked. The talk also covered the tools used to examine trace materials which can make these small items have a huge impact on a case were discussed. It will not always give definitive information, but it will likely provide circumstantial evidence. Rules of evidence are changing: the FBI is re-looking cases based on hair analyses; also burn patterns and bite marks – they're not seen as overpowering evidence any more. Also contamination of trace evidence is common – happens easily.

Fibers, hairs, glass, soil and paint chips belong to the trace category of evidence. Even a small amount of evidence that the examiner is trying to identify may link to a source or identify unique features. These can be used to connect a suspect to a victim or a crime scene. Locard's Exchange Principle states that any time two items come into contact with each other, information is exchanged; "Every contact leaves a trace". This was famously explained by Paul L. Kirk: "... It is factual evidence. Physical evidence cannot be wrong, it cannot perjure itself, it cannot be wholly absent. Only human failure to find it, study and understand it can diminish its value."

According to the most recent publicly-funded Crime Lab Census completed in 2014, 48% of functions performed by the laboratory are trace evidence related. Fire debris and unknown chemicals are the most common types of trace evidence and each is dealt with using extensive instrument techniques to determine the chemical composition of the trace material. Items such as fibers and paint, using microscopic techniques along with instrument analysis, commonly thought of as trace evidence.

The focus today was on the type of trace evidence that requires a microscope for analysis. This can be a standalone microscope or a microscope attached to a more powerful instrument.

Macroscopic features of hair include Proximal End (near the root), Shaft, and Distal end (tip end)

Microscopic features of hair include the Cuticle (overlapping scales), Cortex (inside indicates pigment), and Medulla (center made up of cells or air pockets). Hair cannot be identified to an individual without skin/DNA. Minimum amount of material needed to get DNA – 15 cells.

Fibers are similar to hairs in that they are very easily transferred from place to place and are seen commonly at crime scenes. When fibers are found and collected, they are most likely used as circumstantial evidence, linking a victim or suspect to a particular place or the crime scene. Fibers may be able to show if a person came into contact with the material where the fibers originated; remember every contact leaves a trace. One of the more popular cases with fibers is the Atlanta Child Murders from 1979 to 1981. Wayne Williams was arrested and convicted for two of the adult murders and many of the child murders were attributed to Williams. There was mostly circumstantial evidence used in the case, including fibers. See Mind Hunter, the Hulu series season 2

Animal fibers: Most common types include: wool, cashmere, angora, silk

Plant fibers are very common and usually curly/twisted

Mineral fibers – have only one refracting index (e.g. asbestos, glass-wool)

Manufactured fibers:

- Cellulosic Based – can be made from natural materials for example Rayon, Acetate, and Tri-acetate).
- Synthetics - may be more practical because they have very different or enhanced properties in comparison to natural materials.
- A look at fiber cross sections – may determine the end product.

Microscopic Tools -- Specialized for forensics. For example:

- Comparison Polarizing Light Microscope – can see things side by side, or one at a time or overlap them.
  - o Scanning Electron Microscope with X-ray Analysis (SEM with EDS) uses x-ray defraction – magnification up to 10,000x. These are used to find gunshot residue – barium, antimony & lead
- UV-Vis Microspectrophotometry (MSP) uses spectrometer with magnifier for very small colored objects such as single fibers
- Infrared MSP – vibrational changes within the molecules. Commonly used with paint chips

Remember -- Every contact leaves a trace and can be identified by a forensic analyst!



**Gina M. Londino-Smolar**