B149 Crime Scene Culture: How Inadvertent Collection of Bacteria Affects DNA Profiling Success

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After attending this presentation, attendees will better understand the external factors impacting DNA evidence stability and its impact on DNA profiling success. Attendees will also learn how microbiological organisms, collected with the sample, at crime scenes can significantly impact the results.

This presentation will impact the forensic science community by increasing knowledge of the need to preserve or process DNA evidence, especially from touch or compromised samples, in a timely manner. Increasing casework analysts' knowledge of the biological factors impacting their results will allow them to take necessary precautions to ensure that the sample collected at the crime scene has not degraded prior to analysis.

In recent years, a combination of new technologies being introduced into the market and the increasing impact of the use of DNA to solve crimes has led to both increased reliance on DNA and more collections. One often-overlooked area is the impact that biological materials, collected with the samples at the crime scene, can have on the resulting DNA profile. Bacteria, fungi, and enzymes such as DNases can have a dramatic impact on the stability of a DNA sample, possibly breaking it down before it ever reaches an analyst's bench for extraction and amplification.

This presentation will describe the studies performed on mock crime scene samples to study the specific effects of microbes and enzymes on the collected sample. Blood, saliva, and touch samples were deposited on various surfaces from picnic tables and bricks to plastic knives and shoe soles. After deposition, the samples were placed outside in the environment for a few days to simulate and stimulate normal bacterial, fungal, and enzymatic activity that can occur at a crime scene. After a few days in the environment, the samples were collected using the wet/dry swab method with a cotton swab and placed in a swab box. Accelerated aging experiments were performed on the samples by placing them in various temperature (room temperature, 37°C, and 56°C) and humidity (ambient ~20%-40% RH and >60% RH) conditions.

At selected time intervals, samples were removed and analyzed for DNA profiling success and for enzymatic activity and microbial growth. Bacterial activity was evaluated by incubating the mock evidence swabs in nutrient broth to observe turbidity in addition to inoculating nutrient agar plates to obtain single colony isolates. To evaluate DNase activity from the collected mock crime scene samples, DNase Test agar plates with methyl green were streaked with the collected swabs. DNase Test agar contains embedded DNA polymers that form a complex with the methyl green. In the presence of DNase activity, the embedded DNA depolymerizes and the methyl green/DNA complex fades into clear zones of agar surrounding the DNase positive bacteria. Some of the single colony isolates demonstrated DNase activity that may have a significant impact on obtaining a DNA profile from low-level or touch samples.

By combining the data obtained from the bacterial and enzymatic assays with the data from the DNA profiling, interesting observations and correlations were determined. Not only was microbial and enzymatic activity dependent on the surface of deposition, but it also affected the stability of the DNA collected. The results presented from this study will highlight bacterial and enzymatic activity and how it correlates to the resulting DNA profile.

Collecting a sample from an individual or from a crime scene is only one aspect of obtaining a DNA profile. Depending on the surface and suspected biological stain, analysts may need to take additional steps to ensure sample integrity. True success is when that profile can be used to identify a missing person, solve a crime, or exonerate a wrongfully convicted individual.

DNase, Bacteria, Evidence Collection

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