

## **THE EFFECT OF A HARSH ENVIRONMENT AND INDIRECT HUMAN ACTIVITY ON THE PERSEVERANCE OF DNA**

Sarah Cavanaugh, Nani Grimmer, Michael Neal Parsons, Jacqueline Crossler, Donia Slack  
Bode Technology, Inc

Locating reliable evidentiary samples for DNA analysis becomes more complicated as time between deposition of a biological sample and collection of said sample increases. Exposure to environmental factors can also decrease the chances of obtaining a DNA profile. Certain factors such as temperature, humidity, and substrate, are known to negatively affect DNA recovery, and a number of theories have been used by forensic scientists to help locate areas from which the best possible biological sample can be collected. However, a comprehensive and quantitative study regarding environmental impact and the effect of contaminating human traffic and activity on DNA profile recovery has not yet been published.

The research presented will show a comprehensive longitudinal study to determine the optimum locations at a crime scene that are best suited for biological evidence collection and to assess sample reliability for DNA analysis after eighteen months. This effort consisted of two concurrent studies: Study 1 examined DNA sample recovery by taking into account biological sample type, human traffic flow through a room, evidence placement within the room, substrate and time. Study 2 examined DNA recovery by taking into account biological sample type, ambient environment (hot and humid or room temperature), substrate and time.

For both studies, six replicate sets of mock evidence fluid samples: blood, semen, saliva, urine, oily fingerprints and regular fingerprints were deposited on substrates and exposed to the environment in question for an 18 month time frame. Study 1 had two different substrates available and Study 2 used nine different substrates. Sample sets were collected, extracted and analyzed after 0, 3, 6, 9, 12 and 18-month time periods. Any DNA profile obtained was compared to the sample's known profile to calculate percent profile recovery and contamination (designated by the number of additional, unassociated alleles).

JMP®, a powerful Design of Experiments (DOE) statistics program, was used to create the test plan of both studies as well as analyze all the data and make correlations between the ability to recover the correct profile and the various factors (time, environment, and substrate) being evaluated. The JMP® software is able to analyze a response based on the effects of multiple factors. This type of experimental design and statistics capability is novel for the forensic field and allows the user to interpret a smaller data set with fewer replicates while still determining strong correlations.

After 18 months, the majority of samples were highly degraded and/or contaminated, as would be expected. However, more partial profiles were recovered from fluids such

as blood and oily fingerprints after the extended time period than all other fluids. This study also provides quantitative data for the best substrates from which to recover evidentiary samples, the environments most likely to maintain viable DNA sources, and relative contamination amounts for both. Lastly, this presentation demonstrates the power of JMP® Design of Experiments software, a novel tool for large scale studies within the forensics research field.