On the leading edge of forensic science

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W20 On the Leading Edge of Forensic Science

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After attending this presentation, attendees will better understand new developments in forensic science that may have impact on their work.

This presentation will impact the forensic science community by providing an overview of some of the new developments in forensic science and by opening a forum for the discussion of issues that arise regarding such developments. A wide variety of developments that will soon impact forensic science have been identified within the Think Tank Committee of the Forensic Sciences Foundation, Inc.

The development of drones and the forensic issues concerned with finding digital traces is seen as one of the topics. The use of drones in forensics is also one of the topics, especially as the methods have become much more attractive due to a drop in prices and increased availability.

The forensic discipline of firearm and tool mark identification currently relies on the optical micro-comparison of features that were produced by movement or by the impression of tool-bearing surfaces. The comparisons are conducted side-by-side with comparison microscopy, incorporating the skill and artistry of the examiner to balance the tool mark surface positions, angles, and illumination. If sufficient agreement is observed, a subjective determination of identity may be concluded. While proven to be accurate with a low false positive error rate, there has been renewed interest in objective comparison methods that are based on the actual 3D measurements of tool mark surfaces that are compared using statistical methods to objectively "measure" the similarity of the two surfaces. This presentation will review the most recent emerging technologies in surface topography measurements, their adaptation to firearm and tool mark analysis, and recent research in the objective measurement of similarity.

Another important topic is the investigation within a Chemical, Biological, Radiological, and Nuclear (CBRN) crime scene as the interrogation of CBR agents presents a variety of problems. Primary among those at the scene is an intense degree of political scrutiny and a high thermal burden. How do you accurately take high value samples when you are in a Level A "spacesuit"? How do you know where they are and what should you prioritize in the 20 minutes of air that you will have on the scene? The European Commission Generic Integrated Forensic Toolbox (GIFT) is answering these questions and can share some of the data.

The capabilities and usage of field instrumentation are growing rapidly. While these instruments do not have the versatility of laboratory instruments, they are being designed to carry out specific critical *in situ* field tasks that save time and money and reduce laboratory analyses. For example, hand-held Raman has been used for the detection of organic compounds such as controlled substances; however, since the detection is based on spectroscopic techniques, the results are preliminary and only good for screening purposes — findings still need to be analyzed by confirmatory laboratory techniques such as separation followed by mass spectrometry. To address this need, the George Washington University is developing a hand-held, ultra-fast capillary electrophoresis mass spectrometry for on-site, real-time analysis of chemical and biological compounds with optical isomer separation capability.

By allowing forensic analyses to be performed in real time at the crime scene or nearby facilities, valuable forensic information can be provided at the beginning of the investigation and can thus increase the quality of law enforcement. By introducing robust, easy-to-use portable forensic technology, the efficacy of the criminal justice system can be improved; however, such benefits can only partly be accomplished when the results are of an indicative nature and detailed analyses at a forensic laboratory remain necessary. The full potential of real-time forensic investigations can only be realized when the results can also be used as evidence in court. The Netherlands Forensic Institute (NFI) recently published a vision on integrated forensic platforms to merge the speed provided by real-time forensic analysis with the quality standards of accredited laboratory methods. Currently, the NFI is working on several such dedicated platform solutions that would enable DNA profiling, the chemical identification of illicit drugs, and the study of large amounts of digital evidence. This technological revolution could lead to a new role for forensic institutes in which forensic experts are focused on designing, developing, and maintaining forensic platforms, allowing other professionals in the criminal justice system to examine the physical, chemical, biological, and digital evidence. Forensic institutes could then focus their usually scarce expert capacity to interdisciplinary investigations in complex cases and forensic intelligence.

New Developments, Robotics, Automation