Professional Review and Commentary

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a The views expressed are those of the authors and do not necessarily reflect the view, the position, or the policy of Forensic Science Review or members of its editorial board.

Forensic Science Review’s Professional Review and Commentary section highlights contemporary issues and events in the profession of forensic science. To contribute updates or commentary or to recommend books for review, please contact Mike Baylor (mbaylor@nc.rr.com), Jeff Teitelbaum (Jeff.Teitelbaum@wsp.wa.gov), or Ray Liu (rayliu@uab.edu).
3-D Printed Guns, Update — Worldwide

The types of operable guns that can now be made at home using 3-D printers include AK-47s, Glocks, Berettas, Rugers, and various other semiautomatic weapons. With 3-D printers costing as little as $250, these guns are incredibly inexpensive to make. Using fully realized design plans that are freely available on the Internet, many guns can be made for less than $10. Particularly worrisome to law enforcement personnel is the fact that these guns are untraceable, since they have never been registered and carry no serial number, and they are virtually undetectable at airport or other types of security detectors. One of the shortcomings of guns made from printed plastic is their tendency to crack or even shatter from the explosive impact of firing a bullet. Many of these guns, in fact, are capable of firing only a single shot before they are rendered useless. Firearms enthusiasts are now experimenting with new types of ammunition that could extend the lifespan of the guns. Bullets are housed in very thick steel shells that absorb the bulk of the explosion without transferring it on to the gun itself, and early test results are proving successful.

Internet Drug Commerce After Silk Road — Worldwide

Last year, when the US government shut down Silk Road, the underground drug and firearms website, many in law enforcement believed that this would act as a deterrent to other black-market websites. Quite the contrary, hundreds of new sites have sprung up and are using technology in even more sophisticated ways to protect their anonymity and to thrive in the so-called “darknet”. The FBI, in conjunction with other law enforcement agencies worldwide, is attempting to raid and close the sites as quickly as possible. One of the closures was the Silk Road 2 site, which came online just after the original Silk Road was seized. Even though Silk Road 2 had been operating for less than a year, the site was averaging over $8 million in monthly sales, and, like all the illicit drug sites, used bitcoins as the only accepted currency. Agora, another website still online, currently lists over 16,000 items for sale, most of them illegal. Among the items listed: fake identity documents, credit cards, counterfeit currency, firearms, ammunition, and drugs of every category and potency.

3-D Printed Designer Drugs? — Worldwide

As if 3-D printed guns weren’t enough of a concern to those in law enforcement, two chemistry research laboratories have announced prototypes of a 3-D printer that can produce highly customized and highly sophisticated drug formulas. Chemists at Glasgow University and Louisiana Tech University imagine a future where patients will be able to purchase and download a digital prescription, purchase “chemical ink”, and proceed to print out the drug at home on a 3-D printer. The molecular 3-D printers that they have developed can create chemical compounds rather than the 3-dimensional objects that are currently in vogue.

Advocates of this technology cite the many potential benefits of drug printing, such as refining a drug to meet the specific needs of a patient, but the obvious concern is that the printers could be used to create designer drugs at home, drugs that could be of any type and any potency. With the possibility of printing illegal drugs at home, probably at a fraction of the cost of purchasing them on the open market, perhaps the government will ultimately resort to something akin to the legal marijuana model where the state sells a formerly illegal product that is now produced according to strict guidelines.

Microgram Bulletin — United States

A publication that has been a valuable resource to forensic chemists for many decades has been moved to a “restricted” status by the US Drug Enforcement Administration. A version of the newsletter, titled the Microgram Bulletin LE, will continue to be published, but it will not be publicly accessible.

The first issue of the newsletter, then called the Microgram, came out in 1967, a publication of the Bureau of Drug Abuse Control (which became the Bureau of Narcotics and Dangerous Drugs, which became the Drug Enforcement Administration). The newsletter was retitled the Microgram Bulletin in 2002 (Figure 1), and, over the years, it has presented methods for synthesizing drugs, updates on clandestine laboratories, techniques used for smuggling controlled substances, alerts about new drugs, literature references, drug scheduling actions, and many other items of topical interest. It is hoped that the Microgram Bulletin will ultimately be restored to a public access status.

FBI DNA Quality Assurance Standards Include Rapid DNA Analysis — United States

The FBI has updated its DNA databasing standards to include an Addendum to the Quality Assurance Standards (QAS) for DNA Databasing Laboratories Performing Rapid DNA Analysis and Modified Rapid DNA Analysis Using Rapid DNA Platforms. Rapid DNA analyses are
being used or being implemented in numerous local and regional crime laboratories across the nation to decrease the turnaround time for obtaining DNA results for law enforcement agencies.

Louis Grever, former executive assistant director of the Science and Technology Branch of the FBI, commented, “This expansion of the QAS enables improved productivity in forensic laboratories, which can aid in the reduction of the DNA testing backlogs that have been the focus of concern for law enforcement, legislators, and concerned citizens for some time now. It is an important milestone as we enable the use of rapid DNA analysis in ways that are actionable for law enforcement in our local communities.”

The new addendum details the requirements and standards that accredited laboratories performing Rapid DNA analysis or modified Rapid DNA analysis must comply with in order for those results to be considered for submission to the Combined DNA Index System (CODIS). Laboratory Checklists and Auditing documents are available to ensure that the participating laboratories comply with the Quality Assurance Standards. The newly developed quality assurance standards went into effect on December 1, 2014. Laboratories may now be able to purchase Rapid DNA technology with Department of Justice grant funding for the allowable purposes outlined by the QAS.

NIST Report Details Dynamics of Deadly Chicago House Fire — United States

A new National Institute of Standards and Technology (NIST) computer-modeling study of a 2012 Chicago house fire reveals the conditions that unleashed a surge of searing gases, leading to the death of a veteran firefighter.

NIST examined the fire dynamics of the incident at the request of the National Institute for Occupational Safety and Health (NIOSH) and the Chicago Fire Department. Simulations conducted with NIST’s Fire Dynamics Simulator examined the fire’s temperature and pressure at various locations and the resulting flow path. With the agency’s Smokeview visualization software, NIST
researchers also developed a graphical representation of the fire’s behavior and the conditions that firefighters likely experienced during the course of their interior operations.

The simulation shows that fire in a covered back porch caused a closed steel-faced, wood-framed door to crumble, releasing pressure and causing hot gases to pour into the adjoining hallway where the victim and another firefighter were advancing a fire hose. The coincidental timing of the responders’ “interior attack” and the door’s failure proved to be deadly. In less than 5 seconds, the flow of gases caused the hallway temperature to soar, from about 60 °C (140 °F) to at least 260 °C (500 °F), the study found.

The victim, a 54-year-old captain, was overwhelmed by the rush of fire gases. He was removed to the exterior, revived by paramedics, and transported to a hospital, where he died.

The study is published as a NIST report (NIST Technical Note 1838) as well as a video summary. These research outputs “provide a clear start-to-finish analysis of a tragic, real-life fire event,” commented Donald Hroma, district chief in the Safety Division of the Chicago Fire Department. “They afford a very useful perspective. The Chicago Fire Department and others across the country will use these tools in training and to inform decisions on how to improve the ways we approach and attack fires.”

Since 1999, NIOSH has issued reports on 15 fires in which changes in flow paths have resulted in 17 “line-of-duty” deaths of firefighters, in addition to civilian deaths and injuries to responders. Failure of a door or window, collapse of a ceiling, and uncoordinated ventilation during a firefighting operation are among the variety of factors that can rapidly change a fire’s flow path.

Including the Chicago tragedy, NIST has used its Fire Dynamics Simulator to study six fires that have resulted in firefighter deaths. Insights into fire behavior and thermal conditions gleaned from these studies have helped to shape research aimed at improving the safety and effectiveness of firefighters. Recent NIST research, conducted with Underwriters Laboratories, several fire departments, and other organizations, demonstrates that applying water from the exterior of a burning structure — before attacking the fire from the inside — can reduce the potential for high-speed flows of hot gases to develop and ignite. (Source: National Institute of Standards and Technology)
3D Surface Mapping. The technology for matching a 3-dimensional footprint from a crime scene has not changed much in decades. Technicians often make a physical cast of the footprint impression. Mapping a footprint found in soil with lasers could potentially save time and improve accuracy. NIST researchers published a paper last fall on a new scanning imaging system they say could be applied to forensic footprint profiling.

The paper, published in *Optics Express* in October 2014, explains that the system is capable of scanning 3-dimensional images at distances of up to 10.5 m with accuracy within a micrometer and precision within 10 μm.

The system has wide dynamic range, enabling precise 3D mapping of targets with varied surface types and reflective properties (see Figure 2). NIST researchers demonstrated the range by scanning footprints in soil, vegetation such as cactus (imaging individual spines), and complex mechanical devices such as a piston for a motorcycle. Read more about the research at www.nist.gov/pml/div686/20141007_ladar.cfm.

Cloud Computing Forensics. The NIST Cloud Computing Forensic Science Working Group is reviewing public comments on a draft report, *NIST Cloud Computing Forensic Science Challenges*. The draft was issued for public review and comment in June 2014.

The draft report summarizes 65 challenges that cloud computing poses to forensic science investigators who uncover, gather, examine, and interpret digital evidence to help solve crimes. The NIST Cloud Computing Forensic Science Working Group is an international body of cloud and digital forensic experts from industry, government, and academia.

Through the report, the working group aims to initiate a dialogue on forensic science concerns in cloud computing ecosystems. “The long-term goal of this effort,” explains NIST’s Martin Herman, co-chair of the working group, “is to build a deeper understanding of, and consensus on, the high-priority challenges so that the public and private sectors can collaborate on effective responses.”

Cloud computing is revolutionizing how digital data are stored, processed, and transmitted. It enables convenient, on-demand network access to a shared pool of configurable computing resources, including servers, storage, and applications. Benefits include cost savings, convenience, and greater flexibility in how businesses and other consumers employ information technology.

The characteristics that make this new technology so attractive also create challenges for forensic investigators who must track down evidence in the ever-changing, elastic, on-demand, self-provisioning cloud computing environments. Even if they seize a tablet or laptop computer at a crime scene, digital crime fighters could come up empty-handed if these devices are linked to pooled resources in the cloud.

Technical challenges — the focus of the draft report — abound, but almost all intersect with legal and organizational issues. The 65 challenges that the working group identified are divided among nine categories. These include architecture, data collection, analysis, standards, training, and “anti-forensics” such as data hiding and malware. To learn more about cloud computing at NIST and to see the draft publications, go to http://www.nist.gov/itl/itl-cloud-computing-forensic-science.cfm.

Center, Committee, Symposium, and Webinar Forensic Science Center of Excellence. NIST is in the process of setting up a new Forensic Science Center of Excellence. The center’s mission will be to establish a firm scientific foundation for the analytic techniques used in two important branches of forensic science, pattern evidence and digital evidence.
The planned center will work on scientific advances in probabilistic methods and information technology tools, as well as the necessary infrastructure to educate and train forensic science practitioners in using the new methods. The center will help expand NIST’s expertise in the field and promote interactions among NIST, academia, and various stakeholders in the forensic science community.

The application deadline for US academic institutions and nonprofit organizations interested in funding to host the center was Dec. 11, 2014. The earliest anticipated start date for awards is March 2015. For more information, please see www.nist.gov/coe/forensics/index.cfm.

Organization of Scientific Area Committees. NIST’s OSAC is moving forward having made more than 500 appointments to various committees and subcommittees by the end of 2014. The OSAC is working to develop discipline-specific standards of practice to improve quality and consistency in forensic science analyses.

OSAC members were chosen from more than 1,500 applicants. Most of the members, 57%, are forensic science practitioners. About 20% are researchers, and 10% are educators and trainers. The remainder is split among R&D technology partners, quality assurance managers, attorneys, and judges.

Federal employees make up 27% of OSAC, while state and local government employees make up 18% and 19%, respectively. OSAC members come from every state with the exception of North Dakota. OSAC subcommittees will meet in person for the first time in early 2015. To see the latest OSAC updates, go to www.nist.gov/forensics/osac.

Forensics@NIST Symposium. NIST held its third Forensics@NIST symposium in December 2014. A popular meeting to highlight NIST forensic science research, Forensics@NIST is held about every two years and is a combination of technical presentations, tours, and a poster session. This year’s keynote address, “Are Judges Losing Confidence in Forensic Science?” was given by the honorable Judge Jed S. Rakoff, who serves as a US District judge for the Southern District of New York and an adjunct professor at Columbia Law School.

The technical program, which spanned the two days, included the following presentations:

- Overview to Computer Forensics and Forensic Biometrics;
- National Software Reference Library (NSRL);
- NSRL Next Generation — Diskprinting;
- Computer Forensic Tool Testing (CFTT);
- CFTT — Mobile Forensics;
- CFTT — Federated Testing;
- Biometrics Overview;
- Latent Fingerprints;
- Introduction to Forensic Genetics;
- Update in NIST SRM 2391c – PCR-based DNA Profile Testing;
- Complex DNA Mixture Interpretation;
- Rapid DNA Typing and PCR Protocols;
- Typing SNPs with Next-Generation Sequencing;
- Sequencing SNRs: Variation and Nomenclature;
- Congruent Matching Cells (CMC) — Theory and Application in Firearm and Evidence Identification;
- Estimating Error Rates for Image-Related Forensic Evidence Identification;
- Objective 2D and 3D Analysis of Consecutively Manufactured Tools;
- Development of a Ballistic Toolmark Research Database;
- Advancements in Polymer Bullet Replication Techniques;
- Introduction to Statistical Measurements;
- Decisions in the Analysis of Low-Template DNA; and
- Statistical Friction Ridge Analysis (see Figure 3).

Tours during the symposium showcased NIST’s forensic research facilities for ballistics and body armor testing, national X-ray standards for bulk-explosives detection, mobile platforms/devices for fingerprints and latent prints, robotic intelligence systems, the NIST SPHERE (simulated photo degradation by high-energy radiant exposure) to mimic environmental exposure, the NIST Center for Neutron Research, the trace contraband detection, and the NIST Museum. A link to the archived webcast is available on this webpage: www.nist.gov/forensics/forensics-at-nist-2014.cfm.

Figure 3. NIST’s Soweon Yoon, Elham Tabassi, and Hari Iyer presented “Statistical Friction Ridge Analysis: Algorithms for Matching Minutiae Configurations and Evaluating Likelihood Ratios”. The project is aimed at developing statistical methods for quantitating the uncertainty associated with claims of exact match between latent fingerprints obtained at crime scenes and reference prints. The approach, underlying theoretical rationale, and performance of the algorithms and likelihood ratios on real data were discussed in the presentation. (Photo courtesy of National Institute of Standards and Technology.)
DNA Analyst Webinars. The NIST Forensic Science Program held a two-part NIST DNA Analyst Webinar Series: Probabilistic Genotyping and Software Programs. During each webinar, forensic DNA experts from local, national, and international agencies gave presentations to address challenges in interpreting DNA mixtures. Forensic laboratories are increasingly analyzing samples with low levels of DNA such as evidence from burglaries and other property crimes.

The webinars were intended for anyone interested in probabilistic genotyping software packages to aid in the evaluation of mixed DNA profiles. Part 1, originally webcast on May 28, 2014, is online at www.nist.gov/forensics/nist-dna-analyst-webinar-series-pt1.cfm.


NIST Forensic Science News Alerts

Interested individuals can sign up to receive NIST forensic science news alerts by going to www.nist.gov/forensics and entering their e-mail address in the shaded sign-up box on the left side of the page. Visit the NIST forensic science newsroom at www.nist.gov/forensics/newsroom.cfm.

### Table 1. Accredited forensic science educational programs in North America

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<th>Institution; program’s housing unit; city, state</th>
<th>Information of the program director</th>
<th>Program emphasis</th>
<th>Degree offered</th>
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* M.S. = Master of Science; B.S. = Bachelor of Science; M.F.S. = Master of Forensic Science; M.P.S. = Master of Professional Studies.

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**UPCOMING EVENTS**

**American Academy of Forensic Sciences — Annual Meeting**
February 16–21, 2015; Hyatt Regency Orlando Orlando, FL, US

**American Society of Crime Laboratory Directors (ASCLD) — Annual Symposium**
April 26–30, 2015; Marriott Wardman Park Washington, DC, US

**Computer and Enterprise Investigation Conference 2015**
May 18–21, 2015; Caesars Palace Las Vegas, NV, US

**Mid-Atlantic Association of Forensic Scientists (MAAFS) — Annual Meeting**
May 18–22, 2015; Hyatt Regency Chesapeake Bay Cambridge, MD, US

**European Workplace Drug Testing Society (EWDTS) 2015 Conference**
May 28–29, 2015; San Malhoa Hotel Lisbon, Portugal

**Drug and Alcohol Testing Industry Association (DATIA) 2015 Annual Conference**
June 2–4, 2015; Trump National Doral Miami, FL, US

**International Association for Identification (IAI) — 100th International Education Conference**
August 2–8, 2015; Sacramento Convention Center Sacramento, CA, US
NEW FORENSIC SCIENCE BOOKS/CD-ROMS

The Basics of Digital Forensics — The Primer for Getting Started in Digital Forensics, 2nd ed
J. Sammons
Syngress/Elsevier: Waltham, MA, US; 2014

Commingled Human Remains — Methods in Recovery, Analysis, and Identification
B. J. Adams, J. E. Byrd

Crime Scene Investigation Procedural Guide
M. S. Maloney, D. Housman, R. M. Gardner

Environmental Forensics Fundamentals: A Practical Guide
I. G. Petrisor

Expert Report Writing in Toxicology: Forensic, Scientific and Legal Aspects
M. D. Coleman

Forensic DNA Collection at Death Scenes: A Pictorial Guide
R. Williams, R. Kahn

Forensic Document Examination — Fundamentals and Current Trends
J. A. Lewis

Forensic Neuropathology, 3rd ed
J. E. Leestma

Mass Spectra of Designer Drugs 2014 (CD-ROM)
P. Rösner

Maurer/Wissenbach/Weber LC-MSn Library of Drugs, Poisons and Their Metabolites (CD-ROM)
H. H. Maurer, D. K. Wissenbach, A. A. Weber

Misleading DNA Evidence — Reasons for Miscarriages of Justice
P. Gill

Simpson’s Forensic Medicine, 13th ed: Irish Version
J. Payne-James, C. McGovern, R. Jones, S. Karch, J. Manlove

Toxicological Aspects of Drug-Facilitated Crimes
P. Kintz (Ed)
The famous Alexander Pope quotation of “To err is human; to forgive, divine” — with the less articulate addition of “to repeat is stupid” — could be the mantra of Peter Gill’s new book. My overall impression after reading this is akin to the dread of having just reviewed a complicated Quality Assurance corrective action plan for a series of nonconforming works.

The subject matter is intended for forensic scientists, lawyers, judges, and policymakers, and it will be most understood by those who are tasked with the interpretation and presentation of DNA evidence in court. It may seem puzzling to readers in the general public that crime labs in the developed world typically participate in accreditation programs and have significant resources dedicated to quality assurance of their DNA services, and yet, misleading DNA evidence can end up in the work product of these crime labs.

The book starts off by defining “Trace-DNA”, which is generally associated with analysis of cells deposited by contact or touch. The sensitivity of DNA analysis has improved to a level requiring a high complexity of thought in interpreting the results. Besides deposition of DNA evidence from participants during an act of violence or contention, there are other possible explanations for the presence of DNA that are discussed. The second chapter explores root-cause analysis of error in some specific cases. Important factors concerning source-level and activity-level reporting are discussed. The essentials of statement writing alone could provide a topic for a spirited DNA section meeting. With Chapter 3 comes the beginning of corrective action, and a framework for interpreting low-level DNA evidence is presented. There is a good discussion on evidence from under fingernails as well as the use of the probabilistic approach for reporting DNA interpretations. Chapter 4 brings in considerations of national DNA databases and yes, more mathematical considerations. The final chapter includes a summary of the Meredith Kercher case and the role of trace DNA interpretation and contamination issues.

Although not best described as an entertaining read, this is a book that should be read by all who work in DNA laboratories. Since involvement in a serious nonconforming DNA analysis event is an uncommon occurrence, there is a risk of complacency and a belief that interpretation errors or serious contaminations can never happen where you work. However, history has shown that wherever people are involved, there will be errors. Risk comes with the rapidity of DNA technology advances: Change can outpace our resources to properly interpret the results. While the case examples discussed in Gill’s book are from the UK/Europe, no country or lab is immune to having similar occurrences. Throughout the book there are 12 recommendations that make up preventative actions in the book’s corrective action plan to help avoid the pitfalls of trace DNA interpretation and high-sensitivity DNA analysis. These may be both interesting and of value to the reader.