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Evidence Management Steering Committee Report: Expanded Bibliography

NIST/NIJ Evidence Management Steering Committee

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NIJ NATIONAL INSTITUTE OF JUSTICE ADVANCING JUSTICE THROUGH SCIENCE

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U.S. Department of Commerce
Howard Lutnick, Secretary

National Institute of Standards and Technology
Craig Burkhardt, Acting Under Secretary of Commerce for Standards and Technology and Acting NIST Director

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Abstract

In 2018 in conjunction with the National Institute of Justice (NIJ), the National Institute of Standards and Technology (NIST) assembled a group of multidisciplinary experts, the Evidence Management Steering Committee (EMSC), to develop a plan to (1) provide recommendations for the retention, preservation, integrity, and disposition of evidence and property and (2) encourage the adoption of practice improvements, through education and engagement, of the broad community of U.S. justice system stakeholders involved in evidence management. The EMSC oversaw four major activities: an evidence management survey (NIST SP 1500-33B), a review of existing literature in forensic evidence management (this bibliography); a stakeholder workshop; and the dissemination of findings from these activities (NIST SP 1500-33A and https://doi.org/10.18434/mds2-3834, which provides the survey data).

Keywords

Bibliography; evidence; evidence management; forensic; forensic evidence; forensic science.

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Acknowledgments

The NIST/NIJ Evidence Management Steering Committee (EMSC) is responsible for the compilation of this expanded bibliography, which contains resources that were available while the committee was active. Committee members' names and their affiliations during that time (2018 – 2022) are provided below.

Due to NIST staff departures, this report and the two that accompany it were prepared but not published during the tenure of the Committee. Vincent Desiderio and Katherine Sharpless, both in NIST's Special Programs Office, updated information where appropriate and finalized the publications.

NIST/NIJ Evidence Management Steering Committee Members

Suzi Doerff, CEO, Police Evidence Audits, LLC

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Melisse Huffmaster, Evidence Vault Director, Las Vegas Metropolitan Police Department

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This document provides citations for the published resources that informed the content and recommendations found in the Evidence Management Steering Committee Report: Opportunities to Strengthen Evidence Management Processes. We have included abstract excerpts (210 words or fewer) and keywords published with the resource. The intent is to enable end users to search for specific topics of interest using keywords and phrases.

A

Adams, Z. J., & Hall, M. J. (2003). Methods used for the killing and preservation of blowfly larvae, and their effect on post-mortem larval length. *Forensic Science International*, *138*(1-3), 50-61. https://doi.org/10.1016/j.forsciint.2003.08.010

Abstract/Abstract Excerpt
A record of the length of the largest larvae collected from a corpse can be used to estimate the age of the oldest larvae present and, therefore, give an estimate of minimum time since death. Consequently, factors that affect post-mortem larval length will impact on any estimate of PMI based on it. Methods used to kill and preserve larvae are known to affect post-mortem length. This study looks at the effects of different preservatives, and variations in the protocol used for killing larvae by immersion in a hot water bath = [hot water killed; HWK], on the length of dead larvae of two common blowfly species…Both temperature and duration significantly affected post-mortem length. Maximum length was attained after at least 60 s immersion. The amount of post-mortem decomposition that occurred after the larvae were placed in preservative could be greatly reduced by increasing the duration of immersion and/or increasing the water temperature…Maximum length was recorded after 12 h storage and the rate of expansion was highest during the first 3 h in this preservative. After long-term storage (290 days), larvae killed and preserved in the same way were on average 0.7% longer than immediately after death and 0.6% (0.11 mm) smaller than when last measured (after 28 days storage).

Keywords
forensic entomology, blowflies, PMI, larval length, larval killing methods, larval preservation methods

Ahn, N. Y., & Lee, D. H. (2021). Forensics and anti-forensics of a NAND flash Memory: From a copy-back program perspective. *IEEE Access*, *9*, 14130-14137. https://doi.org/10.1109/ACCESS.2021.3052353

Abstract/Abstract Excerpt
This paper proposes a safe copy-back program operation in a NAND flash memory, which is targeting digital forensics for a variety of reasons. Due to the background management operation of the NAND flash memory, the original data is highly likely to remain without truly being deleted. We have carefully investigated the possibility of data exposure due to a copy-back program operation, among, frequently used management operations as such data exposure increases the possibility of privacy invasion. We propose a safe copy-back program operation that lowers the possibility of privacy invasion. And we additionally introduce various techniques for solving the reliability problem of adjacent cells caused by the proposed copy-back program

operation. For example, when deleting the original data in a copy-back program operation, overwriting is performed to minimize program disturbance. Also, after acquiring the victim cell information of the adjacent cell before proceeding with overwriting, program prohibition is determined on each page buffer based on the victim cell information. Our research results are meaningful for forensics and anti-forensics issues to be raised regarding NAND flash memories. We look forward to the development of NAND flash memories that guarantee privacy in subsequent studies.

Keywords
forensic, anti-forensic, NAND flash memory, copy-back program, deletion operation, privacy, hacker, overwriting, program disturbance, victim cell, program prohibition

Alruwaili, F. E. (2021). CustodyBlock: A distributed chain of custody evidence framework. *Information*, *12*(2). https://doi.org/10.3390/info12020088

Abstract/Abstract Excerpt
With the increasing number of cybercrimes, the digital forensics team has no choice but to implement more robust and resilient evidence-handling mechanisms. The capturing of digital evidence, which is a tangible and probative piece of information that can be presented in court and used in trial, is very challenging due to its volatility and improper handling procedures. When computer systems get compromised, digital forensics comes into play to analyze, discover, extract, and preserve all relevant evidence. Therefore, it is imperative to maintain efficient evidence management to guarantee the credibility and admissibility of digital evidence in a court of law. A critical component of this process is to utilize an adequate chain of custody (CoC) approach to preserve the evidence in its original state from compromise and/or contamination. In this paper, a practical and secure CustodyBlock (CB) model using private blockchain protocol and smart contracts to support the control, transfer, analysis, and preservation monitoring is proposed. The smart contracts in CB are utilized to enhance the model automation process for better and more secure evidence preservation and handling. A further research direction in terms of implementing blockchain-based evidence management ecosystems, and the implications on other different areas, are discussed.

Keywords
forensic, cybersecurity, distributed ledger technology (DLT), smart contract, blockchain

Amankwaa, A., & McCartney, C. (2020). Gaughran vs the UK and public acceptability of forensic biometrics retention. *Science & Justice*, *60*(3), 204-205. https://doi.org/10.1016/j.scijus.2020.04.001

Abstract/Abstract Excerpt
This commentary provides a response to the European Court of Human Rights ruling in the case of Gaughran vs. the United Kingdom on 13 February 2020. The Court ruled that the indefinite retention of DNA, fingerprints, and facial images from all convicted adults was disproportionate. Using data from a survey on public attitudes, we examine the public acceptability of the police retention of forensic biometrics from the population.

Keywords
forensic biometrics, forensic databases, retention, privacy, public security, public attitudes

Anderson, J. M., Matthies, C. F., Greathouse, S. M., & Chari, A. V. (2021). The unrealized promise of forensic science: An empirical study of its production and use. *Berkeley Journal of Criminal Law, 20*(1), 121-180. https://doi.org/10.15779/Z389882N75

Abstract/Abstract Excerpt
In theory, forensic science provides objective, dispassionate evidence in criminal justice proceedings often charged with emotion, cognitive biases, and the failings of human recollection. By being theoretically objective and independent from other actors and processes in the criminal justice process, forensic science has the potential to make the criminal process more reliable by reducing both wrongful convictions and unsolved crimes… we collected data on the prevalence and use of forensic evidence in five jurisdictions in multiple stages of the criminal process. We also analyzed existing data on crime labs and conducted an experimental survey of prosecutors and criminal defense attorneys to measure the effect of forensic evidence on the plea-bargaining process. … Despite the theoretical potential of forensic science to improve the reliability of the criminal process, the way it is actually used squanders many of its advantages. As a result, the potential of forensic evidence to improve the criminal process remains largely unrealized.

Keywords
Not indicated by the author(s)

Arthur, K., Olivier, M., Venter, H. (2007). Applying The Biba Integrity Model to evidence management. In: Craiger, P., Shenoi, S. (eds). *Advances in digital forensics III*. The International Federation for Information Processing, 242, 317-327. Springer. https://doi.org/10.1007/978-0-387-73742-3_22

Abstract/Abstract Excerpt
This paper describes the design of an integrity-aware Forensic Evidence Management System (FEMS). The well-known Biba integrity model is employed to preserve and reason about the integrity of stored evidence. Casey's certainty scale provides the integrity classification scheme needed to apply the Biba model. The paper also discusses the benefits of using an integrity-aware system for managing digital evidence.

Keywords
evidence management, Biba integrity model, Casey's certainty scale

B

Back, J. & Hughes, J. (2018). *Lithium Battery Safety*. Environmental Health and Safety. University of Washington. https://www.ehs.washington.edu

Abstract/Abstract Excerpt
Lithium batteries have become the industry standard for rechargeable storage devices. They are common to University operations and used in many research applications.
Lithium-ion battery fires and accidents are on the rise and present risks that can be mitigated if the technology is well understood. This paper provides information to help prevent fire, injury and loss of intellectual and other property.

Keywords
Not indicated by the author(s)

Badu-Boateng, A., Twumasi, P., Salifu, S. P., & Afrifah, K. A. (2018). A comparative study of different laboratory storage conditions for enhanced DNA analysis of crime scene soil-blood mixed sample. *Forensic Science International*, *292*, 97-109. https://doi.org/10.1016/j.forsciint.2018.09.007

Abstract/Abstract Excerpt
…This work aimed at identifying the most appropriate method of storing crime scene soil-blood mixed sample prior to analysis at the laboratory. Human blood was mixed with soil and stored at three different storage conditions (i.e., Room temperature/25 °C, 4 °C and −20 °C). Samples stored at room temperature saw significant reduction in DNA concentration as storage time increased (P = 0.001). Samples stored at 4 °C saw a drastic decrease in DNA concentration just after two weeks of storage. By the eighth week of storage at 4 °C, there was no detectable DNA (P = 0.000). Samples stored at −20 °C recorded no specific pattern in decrease or increase in DNA concentration for the entire 12 week storage (P = 0.324). There were full STR Profiles generated for room temperature stored samples and −20 °C stored samples throughout the study. There were full, partial and null Profiles generated for 4 °C stored samples depending on the sample storage duration. In conclusion, −20 °C was identified as the best storage condition for soil-blood mixed sample followed by room temperature and 4 °C, respectively.

Keywords
crime scene, Quanti Filer trio kit, Global Filer amplification kit, electrophoresis, DNA extraction, forensic DNA analysis

Baj, J., Ciesielka, M., Buszewicz, G., Maciejewski, R., Budzynska, B., Listos, P., & Teresinski, G. (2021). COVID-19 in the autopsy room requirements, safety, recommendations and pathological findings. *Forensic Science, Medicine and Pathology*, *17*(1), 101-113. https://doi.org/10.1007/s12024-020-00341-1

Abstract/Abstract Excerpt
Modern technologies enable the exchange of information about the expansion of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection and the continually increasing number of the coronavirus disease 2019 (COVID-19) cases almost in real time. The gravity of a current epidemiological situation is represented by the mortality rates, which are scrupulously updated daily. Performing autopsies on patients with either suspected or confirmed COVID-19 is of high importance since these might not only improve clinical management but also reduce the risk of SARS-CoV-2 infection expansion. The following paper aimed to present the most crucial aspects of SARS-CoV-2 infection from the point of view of forensic experts and pathologists, recommendations and safety precautions regarding autopsies, autopsy room requirements, possible techniques, examinations used for effective viral detection, recommendations regarding burials, and gross and microscopic pathological findings of the deceased who died due to SARS-CoV-2 infection. Autopsies remain the gold standard for determining the cause of death. Therefore, it would be beneficial to perform autopsies on patients with both suspected and confirmed COVID-19, especially those with coexisting comorbidities.

Keywords
COVID-19, autopsy, forensic, postmortem computed tomography, burial

Balk, C. (2015). Reducing contamination in forensic science. *Themis: Research Journal of Justice Studies and Forensic Science*, *3*(1). https://doi.org/10.31979/THEMIS.2015.0312

Abstract/Abstract Excerpt
The sensitivity of modern forensic techniques has drastically increased, with sensitive technology detecting even the smallest traces of DNA evidence left behind. This has made it possible to detect DNA profiles deposited through contamination. When DNA contamination occurs in forensic science, it has the potential to change the outcome of a criminal investigation and may have significant social and financial repercussions. A compilation of global research shows that DNA evidence transfer can occur during forensic product manufacturing, the fingerprinting process, or even autopsy and crime lab examinations. These vital areas of the forensic investigation are vulnerable to contamination, and national standards should address this susceptibility. Understanding the origins of contamination events provides the greatest insight into preventing their occurrence and maintaining the integrity of forensic evidence.

Keywords
forensic science, DNA profiles, contamination

Ballou, S., Stolorow, M., Taylor, M., et al. (2013). *The Biological Evidence Preservation Handbook: Best Practices for Evidence Handlers*. NIST. https://nvlpubs.nist.gov/nistpubs/ir/2013/NIST.IR.7928.pdf

Abstract/Abstract Excerpt
The report of the Technical Working Group on Biological Evidence Preservation offers guidance for individuals involved in the collection, examination, tracking, packaging, storing, and disposition of biological evidence. This may include crime scene technicians, law enforcement officers, healthcare professionals, forensic scientists, forensic laboratory managers, evidence supervisors, properly managers, storage facility personnel, lawyers, testifying experts, court staff and anyone else who may come into contact with biological evidence. While many of the recommendations relate to the physical storing, preserving, and tracking of evidence at the storage facility, this handbook also covers transferring the material between the storage facility and other locations, and discusses how the evidence should be handled at these other locations.

Keywords
biological evidence, evidence preservation, forensic science, law enforcement

Ballou, S. M., Williams, S. R., Taylor, M. K., et al. (2015). *Biological Evidence Preservation: Considerations for Policy Makers*. NIST. https://nvlpubs.nist.gov/nistpubs/ir/2015/NIST.IR.8048.pdf

Abstract/Abstract Excerpt
Biological Evidence Preservation: Considerations for Policy Makers is a policy brief intended to provide guidance to legislators, advocates, and managers within criminal justice agencies that influence policy. The content in this document is informed by an in-depth analysis of current State legislation in existence as of the date of this document's publication. Using examples from existing State statutes, and a thorough examination of current trends, law, scientific literature and the expertise of the membership, the following report discusses key legislative provisions and recommends statutes, rules, or policies to be implemented by states to improve the preservation of biological evidence.

Keywords
forensic science, DNA, evidence, policy

Beaucham, C. M., Kristin; Burr, Gregory. (2015). *Evaluation of Indoor Environmental Quality in Police Intake, Processing, and Storage at a Medical Examiner's Office*. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, HHE 2015-0017-3240, 2015 July, 1-17. https://stacks.cdc.gov/view/cdc/36589

Abstract/Abstract Excerpt
…Employees in the police evidence intake, processing, and storage areas were concerned about inadequate ventilation. We visited in March 2015 to evaluate the areas of concern…We measured temperature, relative humidity, carbon monoxide, and carbon dioxide; visually assessed the building's heating, ventilating, and air-conditioning systems; measured airflow at supply diffusers; interviewed employees about their work history and health and safety concerns; and reviewed work-related injury and illness reports…To improve the indoor environmental quality, we recommended the medical examiner's office (1) keep temperature and relative humidity within comfort guidelines, (2) supply air as designed and meet current ventilation guidelines, (3) improve housekeeping, (4) prohibit eating and drinking where evidence is handled and processed, and (5) develop standard operating procedures for cleaning spills. We recommended employees report work-related health concerns to their supervisor and seek information from a healthcare provider knowledgeable in occupational medicine and indoor environmental quality issues.

Keywords
indoor-air-pollution, indoor-environmental-quality, laboratories, medical-personnel, office-equipment, ventilation-systems, materials-storage, temperature-measurement, relative-humidity, oxides, air-conditioning, air-flow, health-surveys, comfort-zones, temperature-regulation, respiratory-system-disorders, skin-disorders, work-operations, training, occupational-medicine

Beck, O., Mellring, M., Lowbeer, C., Seferaj, S., & Helander, A. Measurement of the alcohol biomarker phosphatidyl ethanol (PEth) in dried blood spots and venous blood-importance of inhibition of post-sampling formation from ethanol. *Analytical and Bioanalytical Chemistry,* 413, 5601-5606. https://doi.org/10.1007/s00216-021-03211-z

Abstract/Abstract Excerpt
Phosphatidylethanol (PEth) is a group of phospholipids formed in cell membranes following alcohol consumption by action of the enzyme phospholipase D (PLD). PEth measurement in whole blood samples is established as a specific alcohol biomarker with clinical and forensic applications. However, in blood specimens containing ethanol, formation of PEth may continue after sampling leading to falsely elevated concentrations. This study evaluated the use of dried blood spot (DBS) and microsampling specimens to avoid post-sampling formation of PEth. Filter paper

cards and three commercial devices for volumetric microsampling of finger-pricked blood were assessed, using PEth-negative and PEth-positive whole blood fortified with 2 g/L ethanol. PEth (16:0/18:1) was measured by LC–MS/MS. Post-sampling formation of PEth occurred in wet blood and in the volumetric devices, but not filter paper cards, when stored at room temperature for 48 h. Addition of an inhibitor of PLD, sodium metavanadate (NaVO3), eliminated post-sampling formation during storage and drying. In conclusion, the present study confirmed previous observations that PEth can be formed in blood samples after collection, if the specimen contains ethanol. The results further demonstrated that post-sampling formation of PEth from ethanol also occurred with commercial devices for volumetric dried blood microsampling...

Keywords
alcohol biomarker, DBS, microsampling, phosphatidylethanol, phospholipase D, inhibition

Belchior, F., & Andrews, S. P. (2016). Evaluation of cross-contamination of nylon bags with heavy-loaded gasoline fire debris and with automotive paint thinner. *Journal of Forensic Sciences*, *61*(6), 1622-1631. https://doi.org/10.1111/1556-4029.13185

Abstract/Abstract Excerpt
Nylon bags are used for packaging fire debris in several countries, particularly in Europe. The possibility of cross-contamination during transport from the fire scene to the laboratory, in normal casework conditions in the U.K., was studied for two brands of nylon bags, using simulated heavy-loaded fire debris. Three experiments were carried out with each brand, using as sample a piece of cotton fabric soaked with gasoline. One experiment was carried out using automotive paint thinner (oxygenated solvent). Each sample was sealed in a nylon bag and stored in contact with eight empty bags. The empty bags were analyzed at regular intervals for a period of time up to 8 weeks, using SPME and GC/MS. Cross-contamination was found for components of gasoline (toluene and C_2-alkylbenzenes) in the two brands of nylon bags used, after 4 days and 2 weeks. Cross-contamination using automotive topcoat thinner was detected after 2 days.

Keywords
forensic science, fire debris, nylon bag, evidence container, packaging, contamination

Bini, C., Ceccardi, S., Trento, C., D'Oria, C., Carano, F., Riccardi, L. N., & Pelotti, S. (2015). Analysis of aged seminal stains by current forensic DNA approach. *Forensic Science International: Genetics Supplement Series*, *5*, E248-E249. https://doi.org/10.1016/j.fsigss.2015.09.099

Abstract/Abstract Excerpt
'Cold' cases involving sexual assault can be solved decades after investigations analyzing DNA from stored evidence, collected when current forensic method were not developed. To evaluate the influence of time and storage conditions on presumptive test and DNA analysis, three aged seminal stains date back to the first half of the '900, recovered during restoration work of the Institute of Legal Medicine of the University of Bologna, were analyzed by the semenogelin test, microscopic identification of spermatozoa, autosomal, Y-chromosome and X chromosome STRs, and mitochondrial DNA analysis. All samples displayed a weak positive reaction for semenogelin test and the sperm heads were clearly identified. The number of detectable autosomal and Y-STRs was strongly correlated to the DNA degradation index, except for one specimen showing a high degradation index but enough DNA to obtain a composite profile. STRs included in the Minifiler kit and smaller STRs in ESX System were reproducible in all analyzed specimens. Aged seminal stains may be successfully analyzed by current forensic methods, even if the selection of appropriate amplicons size based on DNA amount and its degradation index is mandatory to predict the success probability in casework.

Keywords
DNA, forensic, sexual assault, seminal stains

Bodziak, W. J. (2017). *Forensic Footwear Evidence: Detection, Recovery and Examination*. CRC Press.

Abstract/Abstract Excerpt
(Book description) The utilization of footwear impression evidence continues to evolve with new materials, equipment and techniques, providing an increased ability to detect, record, enhance, and examine this form of evidence. Recently developed technology now allows investigators to more efficiently or, in some cases, instantly link multiple crime scenes where impressions have been produced by the same perpetrator.

Keywords
Not indicated by the author(s)

Bollinger, K., Salyards, J., Satcher, R., and Shute, R. (2020). *A Landscape Study of Laboratory Information Management Systems (LIMS) for Forensic Crime Laboratories*. Forensic Technology Center of Excellence, U.S. Department of Justice, Office of Justice Programs, National Institute of Justice, Office of Investigative and Forensic Sciences. https://forensiccoe.org/private/5ff49f614eb00

Abstract/Abstract Excerpt
(from Report Overview) The National Institute of Justice (NIJ)'s Forensic Technology Center of Excellence (FTCoE) at RTI International worked with a variety of forensic crime laboratory personnel, including crime laboratory directors, unit chiefs, laboratory information management system (LIMS) administrators, information technology (IT) professionals, and analysts, to perform this landscape study of available LIMS systems, and their adoption. The FTCoE strives to provide valuable resources that promote the
use of technologies in the forensic community. A landscape study is a comprehensive overview of market participants, their products including insight on features to inform purchasing decisions and future adoption. This report gives a comprehensive look at the
benefits of having a LIMS, the range of solutions available, and guidelines for successful LIMS implementation.

Keywords
Not indicated by the author(s)

Bryk, J. (2014). Infrastructure, equipment and the technical and legal procedures for securing and storing problematic trial evidence: A development project carried out by the police academy in Szczytno. *Internal Security*, *6*(2), 127-133.

Abstract/Abstract Excerpt
…Current legal regulations do not establish rules for everyday activities regarding handling problematic trial evidence. The analysis of these regulations indicates that there is a necessity to solve the problem of securing problematic trial evidence and the problem of retaining a sufficient amount of such evidence for the needs of the trial process. This is very important at the stage of securing and storing this evidence for the needs of the trial process. This results from the fact that dangerous trial evidence poses a serious threat to the life and health of human beings and the natural environment. Tasks in the project will allow a description of a representative model of proceedings as regards problematic trial evidence in the context of its disclosure and storage. It is not without significance that the project has a technical aspect, which will allow the creation of a database of the different kinds of problematic trial evidence and their properties. This will facilitate the work of law enforcement agencies and the justice system. Special attention should be drawn to the modification of a mobile installation to make it possible to eliminate problematic

trial evidence as well as to the creation of prototype versions of equipment and devices in the area of transportation technology…

Keywords
crime, objects and substances posing a threat to life and health, securing, storing, trial evidence

Budowle, B., Schutzer, S. E., Burans, J. P., Beecher, D. J., Cebula, T. A., Chakraborty, R., . . . Yadev, J. (2006). Quality sample collection, handling, and preservation for an effective microbial forensics program. *Applied and Environmental Microbiology*, *72*(10), 6431-6438. https://doi.org/10.1128/aem.01165-06

Abstract/Abstract Excerpt
(from Introduction) The collection and preservation of microbial forensic evidence are paramount to efficient and successful investigation and attribution. If evidence (when available) is not collected, degrades, or is contaminated during collection, handling, transport, or storage, the downstream characterization and attribution analyses may be compromised. Retrieving sufficient quantities and maintaining the integrity of the evidence increase the chances of being able to characterize the material to obtain the highest level of attribution possible. This paper presents issues related to the practices of sample collection, handling, transportation, and storage and includes recommendations for future directions for the field of microbial forensics and people participating in it. The recommendations apply to the NBFAC, as well as to other facilities and practitioners.

Keywords
Not indicated by the author(s)

Bugelli, V., Campobasso, C. P., Verhoff, M. A., & Amendt, J. (2017). Effects of different storage and measuring methods on larval length values for the blow flies (Diptera: Calliphoridae) *Lucilia sericata* and *Calliphora vicina*. *Science & Justice*, *57*(3), 159-164. https://doi.org/10.1016/j.scijus.2016.10.008

Abstract/Abstract Excerpt
We examined the influence of different killing and storing methods on two forensically important blow flies, *Lucilia sericata* and *Calliphora vicina.* For the latter species we additionally were evaluating three different length measurement methods. The results of both experiments suggest that it is possible to kill and store fly larvae directly in (not hot) ≥ 70%-ethanol. This simplifies the sampling and storing of fly evidence at the crime scene. We also compared the influence of three different measuring methods for estimating the length of L1–L3 *C. vicina* larvae by

using a) a ruler with a 0,1 mm scaling, b) a geometrical micrometer and c) a computer-aided stereomicroscope. No significant differences were detected, supporting the view, that a simple tool like a geometrical micrometer can produce reliable results. This study helps to simplify the sampling and evaluation of entomological evidence and to backup or questioning existing guidelines and best practice recommendations.

Keywords
forensic entomology, sampling, storage, best practice, blow flies

Bugelli, V., Campobasso, C. P., Zehner, R., & Amendt, J. (2019). How should living entomological samples be stored? *International Journal of Legal Medicine*, *133*(6), 1985-1994. https://doi.org/10.1007/s00414-019-02114-0

Abstract/Abstract Excerpt
Sampling and storing insect evidence alive are important tasks in forensic entomology as it can impact survival and growth rates. To investigate the effect of cooling and storing of insect evidence before its arrival in the laboratory, samples of all three larval stages of the blow fly species *Lucilia sericata* and *Calliphora vicina* were analyzed. A first group was stored at room temperature and a second one in a refrigerator (~ 5 °C) for 16 h, all without air, supply of food, and sawdust. Afterwards, they were kept at 6–8 °C in a Styrofoam box for 8 h, simulating a transport situation…The remaining alive specimens were reared at 25 °C until adult's eclosion for estimating a possible storage impact on survival during later development. The results were then compared with a control which was not temporarily stored and chilled but left feeding in boxes with an air-permeable lid on food substrate at 25 °C…Findings provide scientific evidence for the recommendation to store larval samples at cold temperatures with both oxygen and food supply. The high MR for samples of the last larval stage clearly shows the need for a fast delivery after sampling and a more sophisticated storage procedure like…Storing live samples at room temperature without air access should be avoided.

Keywords
Forensic entomology, sampling, storage, *Calliphora vicina*, *Lucilia sericata*

Byun, S., Park, J., Appiah, W. A., Ryou, M.-H., & Lee, Y. M. (2017). The effects of humidity on the self-discharge properties of $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$/graphite and $LiCoO_2$/graphite lithium-ion batteries during storage. *RSC Advances*, *7*(18), 1915-1921. https://doi-org.ezproxy.library.unlv.edu/10.1039/C6RA28516C

Abstract/Abstract Excerpt
To investigate the effects of the exposure of battery tabs to humidity on the self-discharge properties of full-cell type lithium-ion batteries (LIBs), we assembled two different types of LIBs, composed of NCM/graphite or LCO/graphite, and compared their discharge retention abilities after storage in humid conditions (90% relative humidity (RH)) with and without battery tab protection. Regardless of the type of cathode active materials, tab protection improved the calendar lives of LIBs. For NCM/graphite, battery tab protection shows an approximate 50% improvement in the discharge capacity compared to the case without battery tab protection after storage in humid conditions (51.1% and 34.6% of the initial discharge capacity for tab-protected and non-protected LIBs, respectively). In contrast, LCO/graphite reveals a smaller change in the discharge capacity retention for the same experimental condition because they show superior capacity retention abilities regardless of battery tab protection (85.6% and 82.0% retention of the initial discharge capacity for tab-protected and non-protected LIBs, respectively). We suggested that these results come from the induction effect of polar water molecules, which pulls electrons to the battery tab side, resulting in lithium ion loss from the graphene layers to the liquid electrolyte.

Keywords
Not indicated by the author(s)

C

California Commission of Peace Officer Standards and Training. (2013). *Law Enforcement Evidence & Property Management Guide*. POST Management Counseling Services Bureau. https://post.ca.gov/portals/0/post_docs/publications/Evidence_and_Property_Management.pdf

Abstract/Abstract Excerpt
(from the Foreword) The purpose of the POST Law Enforcement Evidence & Property Management Guide is to provide standardized recommended guidelines for the management of the evidence and property function, detailing best practices for the submission, receipt, storage, and disposition of evidence and property items in the agency's care and control. Agencies should use this guide to create or amend policies and procedures to ensure the integrity of the evidence and property process, protect the evidentiary value of property, and restore property to its owners in a timely fashion.

Keywords
Not indicated by the author(s)

Campbell, R., Feeney, H., Fehler-Cabral, G., Shaw, J., & Horsford, S. (2017). The National Problem of Untested Sexual Assault Kits (SAKs): Scope, Causes, and Future Directions for Research, Policy, and Practice. *Trauma Violence Abuse*, *18*(4), 363-376. https://doi.org/10.1177/1524838015622436

Abstract/Abstract Excerpt
Victims of sexual assault are often advised to have a medical forensic exam and sexual assault kit (SAK; also termed a "rape kit") to preserve physical evidence (e.g., semen, blood, and/or saliva samples) to aid in the investigation and prosecution of the crime. Law enforcement are tasked with submitting the rape kit to a forensic laboratory for DNA (deoxyribonucleic acid) analysis, which can be instrumental in identifying offenders in previously unsolved crimes, confirming identify in known-offender assaults, discovering serial rapists, and exonerating individuals wrongly accused. However, a growing number of media stories, investigative advocacy projects, and social science studies indicate that police are not routinely submitting SAKs for forensic testing, and instead rape kits are placed in evidence storage, sometimes for decades. This review article examines the growing national problem of untested rape kits by summarizing current research on the number of untested SAKs in the United States and exploring the underlying reasons why police do not submit this evidence for DNA testing. Recommendations for future research that can guide policy and practice are discussed.

Keywords
sexual assault, reporting/disclosure, offenders

Chappell, J. S., & Lee, M. M. (2010). Cathinone preservation in khat evidence via drying. *Forensic Science International*, *195*(1-3), 108-120. https://doi.org/10.1016/j.forsciint.2009.12.002

Abstract/Abstract Excerpt
A primary concern with the forensic analysis of the khat plant (*Catha edulis*) has been the need to preserve the principle psychoactive component, cathinone, which converts to the less-active substance, cathine, after harvesting. The loss of cathinone has serious legal implications since it is a Schedule I controlled substance under federal regulations in the United States, while cathine is Schedule IV. A common misconception is that cathinone is highly unstable once the plant is harvested, and may be undetectable upon drying and prolonged storage. However, drying the plant material will preserve cathinone. Numerous seizures of a dried form of khat…have been made in recent years, suggesting that drying the plant material is a viable approach to preserve khat evidence for both storage and reanalysis. A qualitative and quantitative study of the composition of khat samples seized as dried plant material has found the khat alkaloids to be relatively stable for a monitored period of 3 years, and cathinone has remained identifiable while stored at room temperature for over 10 years. Studies of green khat (received moist) have also determined that drying the moist leaves at either room temperature or by the application of heat are suitable methods to preserve cathinone in the dried material…

Keywords
Khat, cathinone, cathine, liquid chromatography, gas chromatography–infrared spectroscopy, Graba

Ciolino, L. A., Mesmer, M. Z., Satzger, R. D., Machal, A. C., McCauley, H. A., & Mohrhaus, A. S. (2001). The chemical interconversion of GHB and GBL: forensic issues and implications. *Journal of Forensic Sciences*, *46*(6), 1315-1323. https://pubmed.ncbi.nlm.nih.gov/11714141/

Abstract/Abstract Excerpt
…the interconversion of GHB and GBL in a variety of aqueous media was studied. The effects of solution pH and time were determined by spiking GHB or GBL into pure water and buffered aqueous solutions, and determining the GHB and GBL contents at various time intervals. The degree of GBL hydrolysis to GHB was determined for several commercial aqueous-based GBL products, and further studied as a function of time. The effects of temperature and time were also

determined for five commercial beverages spiked with GHB or GBL. GHB and GBL contents were determined using high performance liquid chromatography (HPLC). GHB and/or GBL confirmations were made using gas chromatography-mass spectrometry (GC-MS) and/or infrared spectroscopy (IR). Solution pH, time, and storage temperature were determined to be important factors affecting the rate and extent of GBL hydrolysis to GHB…These studies show that hydrolysis of GBL to GHB does occur in aqueous-based solutions, with samples and time frames that are relevant to forensic testing. Implications for forensic testing and recommendations are discussed.

Keywords
forensic science, GHB, GBL, gamma-hydroxybutyric acid, gamma-butyrolactone, gamma-hydroxybutyrate, interconversion, stability, high performance liquid chromatography

Corradini, B., Alu, M., Magnanini, E., Galinier, M. E., & Silingardi, E. (2019). The importance of forensic storage support: DNA quality from 11-year-old saliva on FTA cards. *International Journal of Legal Medicine*, *133*(6), 1743-1750. https://doi.org/10.1007/s00414-019-02146-6

Abstract/Abstract Excerpt
…we assess the recoverability and the integrity of DNA from 11-year-old saliva on FTA cards using a forensic quantitative real-time polymerase chain reaction (qPCR) commercial assay. The quality after long-term storage was investigated in order to evaluate if the FTA device could assure enough stability over time, applying some internally validated quality criteria of the STR profile. According to our results, when saliva sample is properly transferred onto FTA cards and then correctly stored according to the manufacturer's instructions, it is possible to recover sufficient amounts of DNA for human identification even after more than a decade of storage at ambient temperature. Degradation affected the quality of results especially when the Degradation Index exceeds the value of 2.12, requiring modifications of the standard internal workflow to improve the genotyping quality. Above this value, the application of a "corrective factor" to the PCR normalization process was necessary in order to adjust the recommended manufacturer's PCR DNA input taking into account the degradation level. Our results demonstrated the importance to consider in predictive terms the parameters obtained with the real-time quantification assay, both in terms of quantity (DNA concentration) and of quality (DI, inhibition)...

Keywords
STR typing, FTA cards, degradation, DNA quantification

Czerwinska, J., Parkin, M. C., Dargan, P. I., George, C., Kicman, A. T., & Abbate, V. (2018). Stability of mephedrone and five of its phase I metabolites in human whole blood. *Drug Testing and Analysis*. https://doi.org/10.1002/dta.2525

Abstract/Abstract Excerpt

…While the instability of mephedrone has been investigated before, there is currently no data regarding the stability of mephedrone metabolites. In this study, a liquid chromatography–tandem mass spectrometry method for the simultaneous quantification of mephedrone and five of its phase I metabolites (dihydro-mephedrone, nor-mephedrone, hydroxytolyl-mephedrone, 4-carboxy-mephedrone and dihydro-nor-mephedrone) in human whole blood has been developed and validated. Samples were extracted by a mixed mode solid-phase extraction and analyzed on a pentafluorophenylpropyl column. The method was successfully validated for selectivity, linearity (0.2–2 to 10–100 ng/mL), limits of detection (50–500 pg/mL) and quantification (200–2000 pg/mL), precision (0.924–8.27%), accuracy (86.6–115%), carryover, recovery (32.5–88.3%), and matrix effects (71.0–108%). Analyte stability in human whole blood preserved with sodium fluoride/potassium oxalate was assessed at +4°C and −20°C after 24 hours, 48 hours, 4 days, and 10 days of storage. Instability was observed in samples stored at +4°C: nor-mephedrone and 4-carboxy-mephedrone lost 40.2 ± 6.7% and 48.1 ± 4.8%, respectively, of their initial concentration at low concentration level and 33.8 ± 4.2% and 44.6 ± 6.5%, respectively, at high concentration level after 10 days. All analytes were more stable at −20°C where the highest loss of 22.6 ± 6.9% was observed for 4-carboxy-mephedrone after 10 days…

Keywords

LC-MS/MS, mephedrone, metabolites, stability, whole blood

D

Depauw, S. (2020). In search of a free movement of forensic evidence: Towards minimum standards to determine evidence admissibility? *Journal of Forensic and Legal Medicine*, 74. https://doi-org.ezproxy.library.unlv.edu/10.1016/j.jflm.2020.102021

Abstract/Abstract Excerpt
In coming to a European Forensic Evidence Area, a European Union ambition to be reached by 2020, judicial cooperation in criminal matters should be levelled-up. Grounded on the legal basis provided by the Lisbon Treaty, this research identifies the minimum standards to be developed by looking into the actions taken both from a legal and from a forensic-scientific perspective to standardize the collection, storage and use of forensic expert evidence. In examining the feasibility of such standards, primary sources of legislation, policy documents and case-law on a European level are compared with a comparative study of domestic norms in six jurisdictions. Depending on the phase in the chain of custody and fundamental principle involved, but also on the level of cooperation between the forensic and legal actors, it was noticeable that the comparison led to different conclusions, depending on the refusal grounds provided by the member states and the necessity of intervention at the European level to safeguard the underlying fundamental values.

Keywords
evidence admissibility, judicial cooperation in criminal matters, forensic evidence

Dixon, R. B., Mbeunkui, F., & Wiegel, J. V. (2015). Stability study of opioids and benzodiazepines in urine samples by liquid chromatography tandem mass spectrometry. *Journal of Analytical Science and Technology*, *6*(1), 17. https://doi.org/10.1186/s40543-015-0057-2

Abstract/Abstract Excerpt
Background: The stability of opioids and benzodiazepines was studied in patient urine samples stored at different temperatures over 30 days. Methods: Samples were prepared by solid phase extraction and quantified by liquid chromatography coupled to a tandem triple quadrupole mass spectrometer. Results: Sample storage conditions affected the stability of all drugs investigated. The concentrations of hydromorphone and oxymorphone in urine samples from patients who had taken hydrocodone, morphine, and/or oxycodone increased significantly over 30 days of storage. Conclusions: These data suggest that results from long-term-stored urine samples with opioids and benzodiazepines should be cautiously interpreted. This study indicates that the biotransformation of parent drugs to metabolites still occurs

during sample storage at ambient temperatures.

Keywords
benzodiazepine; opioid, opiate, solid phase extraction, triple quadrupole mass spectrometry, liquid chromatography

Doran, G. S., Deans, R., De Filippis, C., Kostakis, C., & Howitt, J. A. (2018). Air quality inside police drug safes and drug storage areas. *Journal of Analytical Toxicology*, *42*(5), 360-364. https://doi.org/10.1093/jat/bky011

Abstract/Abstract Excerpt
…Air samples were taken from inside eight drug safes and one small storage room at nine city and country police stations, as well as a large centralized drug evidence storage vault…Sorbent tubes containing charcoal were used to determine whether any drug residues could be detected in the air, and to identify the types of chemicals present. Carbon traps were extracted and analyzed by LC–MS-MS for a suite of 22 licit and illicit drug residues and 2 metabolites. Carbon traps and SPME fibers were also analyzed by GC–MS for general volatile organic compound (VOC) residues. No detectable drug residues, either as airborne dust or vapor, were found in the safes, the storage room or the large central repository vault. No drugs were detected in any of the 34 urine samples collected at 8 of the 10 sampling locations, while only one of the five hair samples was positive for cocaine (9 pg/mg) provided by police exhibit officers at 3 of the 10 sampling locations. VOC analysis identified a variety of solvents associated with drug manufacture, plasticizers, personal care products and volatiles associated with plants such as cannabis…strong chemical odors emanating from drug safes are unlikely to be drug residues due to low volatility of drugs, and are more likely VOCs associated with their manufacture or from plant growing operations…

Keywords
Not indicated by the author(s)

E

El Mahjoub, A., & Staub, C. (2000). Stability of benzodiazepines in whole blood samples stored at varying temperatures. *Journal of Pharmaceutical and Biomedical Analysis*, *23*(6), 1057-1063. https://doi.org/https://doi.org/10.1016/S0731-7085(00)00393-9

Abstract/Abstract Excerpt
…Spiked blood was stored at four different temperatures (room temperature, 4°C, −20°C and −80°C) and analyzed at selected times during one year. Determination was performed on the first, third and seventh day during the first week, then once a week for three weeks, once every two weeks for four weeks, then once a month for 4 months and finally, once every 2 months…At room temperature, the concentration of all benzodiazepines decreased over one year to 100 and 70% for low and high concentrations, respectively. At 4°C, the decrease was between 90 and 100% for low concentrations and between 50 and 80% for high concentrations. At −20°C, the measured decrease was between 10 and 20% for high and low concentrations, respectively. At −80°C, the measured loss was not significant at high concentration except for midazolam. However, at low concentration the determined decrease was between 5 and 12%. The data collected suggests that quantitative results concerning long-term stored samples should be interpreted with caution in forensic cases. Further investigations concerning the stability of drugs in whole blood or other biological samples, additional methods of identification and determination as well as the establishment of optimal storage conditions should be undertaken in forensic cases.

Keywords
Benzodiazepines, storage condition, HPLC, long-term stability, forensic toxicology

F

Federal Bureau of Investigation. (2019). *Handbook of Forensic Services*. https://www.fbi.gov/file-repository/handbook-of-forensic-services-pdf.pdf

Abstract/Abstract Excerpt
(from Introduction) The Handbook of Forensic Services provides guidance and procedures for safe and efficient methods of collecting, preserving, packaging, and shipping evidence and describes the forensic examinations performed by the FBI's Laboratory Division.

Keywords
Not indicated by the author(s)

Fent, K. W. D., Srinivas; West, Christine; Gibbins, John; Smith Jerome. (2011). *Evaluation of Police Officers' Exposures to Chemicals While Working Inside a Drug Vault*. CDC. https://www.cdc.gov/niosh/hhe/reports/pdfs/2010-0017-3133.pdf

Abstract/Abstract Excerpt
(from Summary) In November 2009, NIOSH received an HHE request from a police department in Kentucky. The request concerned possible health effects from working inside a vault used to store drug evidence, including marijuana, cocaine, methamphetamine, and oxycodone. We conducted evaluations in December 2009 and July 2010… We recommend that the employer develop written policies and SOPs to ensure health and safety for employees working inside the drug vault. Employees should be trained on these policies and SOPs, and all training should be documented. All drug vault employees should participate in the medical surveillance program and wear recommended personal protective equipment. If the recommendations provided in this report are implemented, the use of respirators is not necessary inside the drug vault…

Keywords
NAICS 922120 (Police Protection), drugs, drug vault, drug storage, evidence, police, narcotics, cocaine, marijuana, methamphetamine, oxycodone, surface contamination

Ferguson, C. E., Duff, M. C., Clark, E. A., Chapman, G. K., Leggitt, J. L., & Monson, K. L. (2011). Effects of radiation on established forensic evidence containment methods. *Journal of Radioanalytical and Nuclear Chemistry*, *288*(2), 455-465. https://doi.org/10.1007/s10967-010-0952-3

Abstract/Abstract Excerpt
The Federal Bureau of Investigation (FBI) Laboratory is currently exploring needs and protocols for the storage of evidentiary items contaminated with radioactive material. While a large body of knowledge on the behavior of storage polymers in radiation fields exists, this knowledge has not been applied to the field of forensics and maintaining evidentiary integrity. The focus of this research was to evaluate the behavior of several traditional evidentiary containment polymers when exposed to significant alpha, beta, gamma, neutron and mixed radiation sources. Doses were designed to simulate exposures possible during storage of materials. Several products were found to be poorly suited for use in this specific application based on standardized mechanical testing results. Remaining products were determined to warrant further investigation for the storage of radiologically-contaminated evidence.

Keywords
evidence, containment, polymer, forensic, irradiation

Florida Department of Law Enforcement. (2013). *Crime Laboratory Evidence Submission Manual*. http://www.flaccreditation.org/docs/resources/2013EvidenceSubmissionManuel.pdf

Abstract/Abstract Excerpt
(from introduction) The Florida Department of Law Enforcement Crime Laboratory System has developed this manual for the criminal justice community to provide useful information for submitting evidence to any of the state-operated laboratories. This publication is intended to provide instructions for special handling and submission of exhibits to a crime laboratory.

Keywords
Not indicated by the author(s)

Forbes, S. L., Rust, L., Trebilcock, K., Perrault, K. A., & McGrath, L. T. (2014). Effect of age and storage conditions on the volatile organic compound profile of blood. *Forensic science, medicine, and pathology*, *10*(4), 570-582.

Abstract/Abstract Excerpt
Cadaver-detection dogs are used by the police to locate missing persons, victims of homicide, and human remains following mass disasters. Training is conducted using a variety of training aids including blood which can be hours, weeks or months old and stored under variable conditions. The aim of this study was to chemically profile human blood using solid-phase microextraction coupled with gas chromatography–mass spectrometry to determine how the volatile organic compound (VOC) profile changed over time and under variable storage conditions. The VOC profiles of fresh and degraded blood were analyzed as well as blood stored at room temperature, refrigerated, and frozen. Fresh and degraded blood samples produced distinctive VOC patterns with VOC profiles becoming more complex over time. Freezing the blood produced a complex VOC profile that was clearly discriminated from the VOC profile for blood stored at room temperature or in a refrigerator. This study highlights the importance of standardizing the age and storage conditions when using blood as a training aid to ensure cadaver-detection dogs are exposed to an accurate representation of the blood VOCs they may encounter at a scene.

Keywords
decomposition chemistry, VOC profile, blood detection, solid phase microextraction, gas chromatography–mass spectrometry, cadaver-detection dogs_

Forensic Technology Center of Excellence (FTCoE). (2015). *In-Brief: Organic Gunshot Residue Analysis for Potential Shooter Determination*. U.S. Department of Justice, National Institute of Justice, Office of Investigative and Forensic Sciences. https://nij.ojp.gov/library/publications/organic-gunshot-residue-analysis-potential-shooter-determination

Abstract/Abstract Excerpt
X-ray fluorescence (XRF) was tested as a technique for screening hand swabs for the presence of metals associated with GSR (lead, barium, and antimony). Because XRF is a non-destructive analytical method, it can be combined with other methods in the field or laboratory in sequence to produce effective screening. Lead was found to be the most useful target element for XRF. Barium screening was ineffective, and antimony appeared in only a few positive samples. GSR detection based only on lead, however, may be subject to false positives. Although it is possible to perform IMS analyses in the research laboratory, significant work must be done before IMS can be used reliably in the field for organic GSR (OGSR) screening. The key development needed is a large population study and generalization of pattern-

matching algorithms for differentiating shooters from non-shooters, along with an associated probability. Differential mobility spectrometry (DMS) is a promising alternative to IMS for OGSR detection. Additional work is needed before a full validation study can be conducted. This report notes that the ability to detect specific OGSR compounds collected from hands at some time post-firing depends on the time elapsed, evaporative loss, loss to skin permeation, sampling efficiency, storage conditions, sample preparation, and instrumental method.

Keywords
Not indicated by the author(s)

Fort, C., Jourdan, T., Kemp, J., & Curtis, B. (2017). Stability of Synthetic Cannabinoids in Biological Specimens: Analysis Through Liquid Chromatography Tandem Mass Spectrometry. *Journal of Analytical Toxicology*, *41*(5), 360-366. https://doi.org/10.1093/jat/bkx015

Abstract/Abstract Excerpt
The focus of this study was to determine the stability of four synthetic cannabinoids, XLR-11, UR-144, AB-Pinaca and AB-Fubinaca in biological specimens for the purpose of casework processing prioritization. The study used human whole blood spiked with the compounds of interest to mimic real forensic laboratory samples submitted for synthetic cannabinoid analysis. The spiked whole blood specimens were incubated under one of three temperature conditions: room or ambient (22°C), refrigerated (4°C) and frozen (−20°C) for a period of 12 weeks. Study specimens were then extracted using a forward alkaline extraction at pH 10.2 and analyzed using a liquid chromatograph tandem mass spectrometer (LC–MS-MS). Under all incubation conditions results showed that AB-Fubinaca, AB-Pinaca and UR-144 were relatively stable while XLR-11 significantly degraded at ambient and refrigerated conditions. Frozen storage conditions were the only tested parameter able to preserve and stabilize all four compounds over the three month period. Therefore, it should be suggested that forensic blood evidence suspected of containing synthetic cannabinoid compounds should be stored in frozen conditions.

Keywords
Not indicated by the author(s)

Fraser, I., Meier-Augenstein, W., & Kalin, R. M. (2008). Stable isotope analysis of human hair and nail samples: the effects of storage on samples. *Journal of Forensic Sciences*, *53*(1), 95-99. https://doi.org/10.1111/j.1556-4029.2007.00607.x

Abstract/Abstract Excerpt
When submitting samples for analysis, maintaining sample integrity is essential. Appropriate packaging must be used to prevent damage, contamination or loss of sample. This is particularly important for stable isotope analysis by isotope ratio mass spectrometry as this technique is capable of detecting subtle differences in isotopic composition with great precision. In a novel study, scalp hair and fingernail samples were placed in five different types of packaging, routinely used in forensic laboratories and stored for 6 weeks and 6 months. Samples were subsequently cleaned and submitted for 13C/12C, 15N/14N, 2H/1H and 18O/16O analysis. Results from 13C analysis indicate that type of packaging can cause slight changes in 13C abundance over time. Differences were noted in the 15N isotope signatures of both hair and nail samples after 6-week storage, but not after 6 months. This apparent discrepancy could be a result of the packaging not being properly sealed in the 6 weeks study. Fewer differences were noted when analyzing samples for 2H and 18O abundance.

Keywords
forensic science, isotope ratio mass spectrometry, hair, nails, storage, plasticizers, coatings

G

Geneva International Centre for Humanitarian Demining. (2002). *Explosive Remnants of War (ERW) Underwired Explosive Events in Ammunition Storage Areas*. https://www.files.ethz.ch/isn/26686/ERW_No2.pdf

Abstract/Abstract Excerpt
(from Foreword) The present report identifies the risks and hazards to the local community in the post-conflict environment from undesired explosive events in ammunition storage areas. Unfortunately, only very limited quantitative evidence can be currently obtained from the post-conflict environment, therefore quantitative evidence from stockpiles of ammunition under national control in other situations is also used to illustrate the risks. The risks are broadly similar whether the stockpile is abandoned or under some form of national or international control.

Keywords
Not indicated by the author(s)

Glicksberg, L., & Kerrigan, S. (2017). Stability of Synthetic Cathinones in Blood. *Journal of Analytical Toxicology*, *41*(9), 711-719. https://doi.org/10.1093/jat/bkx071

Abstract/Abstract Excerpt
Preliminary reports have indicated that some of the synthetic cathinones are unstable in biological matrices. It is important to understand drug stability in biological evidence so that analytical findings can be interpreted appropriately. The objective of this study was to systematically evaluate the concentration, temperature and analyte-dependent stability of synthetic cathinones in preserved blood using liquid-chromatography/quadrupole-time of flight-mass spectrometry (LC/Q-TOF-MS). Cathinone stability was investigated at frozen, refrigerated, ambient and elevated temperature (-20°C, 4°C, 20°C and 32°C)…Biological evidence may be subjected to a variety of environmental conditions prior to, and during transport to the laboratory. These findings highlight the need to consider the potential for both temperature and analyte-dependent differences. Due to the inherent instability of certain drugs within the class, quantitative drug findings in toxicological investigations must be interpreted with caution, and within the context of specimen storage and integrity.

Keywords
Not indicated by the author(s)

Glicksberg, L., & Kerrigan, S. (2018). Stability of Synthetic Cathinones in Urine. *Journal of Analytical Toxicology*, *42*(2), 77-87. https://doi.org/10.1093/jat/bkx091

Abstract/Abstract Excerpt
In this report, we evaluate the concentration, pH, temperature and analyte-dependent effects on cathinone stability in preserved human urine. A total of 22 synthetic cathinones were evaluated at 100 ng/mL and 1,000 ng/mL in pH 4 and pH 8 urine over 6 months. Specimens were stored at −20°C, 4°C, 20°C and 32°C. The stability of synthetic cathinones was highly dependent on urine pH and storage temperature…Biological evidence may be subjected to a variety of environmental conditions prior to, and during transport to the forensic laboratory. These findings demonstrate the inherent instability of certain cathinone species in biological evidence under some conditions. Moreover, this study highlights the need for quantitative drug findings in toxicological investigations to be interpreted cautiously, and within the context of specimen storage and integrity.

Keywords
Not indicated by the author(s)

Gordon, G. W., Saul, T. B., Steadman, D., Wescott, D. J., & Knudson, K. (2018). Preservation of hair stable isotope signatures during freezing and law enforcement evidence packaging. *Forensic Chemistry*, *11*, 108-119. https://doi.org/10.1016/j.forc.2018.10.004

Abstract/Abstract Excerpt
Stable isotope signatures of bioelements are utilized for geolocation of unknown human remains. Hair in particular can generate a high-temporal resolution record of recent travel history, providing critical investigative leads. However, systematic studies of law enforcement packaging materials and evidence packaging protocols are needed, including the full range of sample types and conditions anticipated in casework. Arm 1 of this study examined the impact of freezing storage on hair samples using the FBI's recommended storage materials (paper, plastic) and Mesa Police Department's evidence packaging guidelines for varying periods of freezing storage (three weeks, five months). Hair studied was from individuals of different ancestry, including cosmetic treatments (relaxer, dyes), and exposure to decomposition fluids outdoors for up to 10 months. Arm 2 evaluated longer-term storage, comparing hair stored in a desiccator to hair frozen at −20 °C for up to four years…experimental and longer-term storage studies demonstrated δ13C, δ15N, and δ18O values had no significant offsets between frozen samples and those stored at room temperature. However, there were small systematic offsets (+2 to +3‰) in δ2H values, with frozen samples being enriched in 2H compared to controls. In a minority of samples frozen for >six months, δ2H offsets of >9‰ were observed, an amount that could impact the interpretation of an individual's geographic travel history.

Keywords
hair, stable isotope analysis, geolocation, isotope ratio mass spectrometry, evidence packaging

Grutters, M. M., Dogger, J., & Hendrikse, J. N. (2012). Performance testing of the new AMPAC fire debris bag against three other commercial fire debris bags. *Journal of Forensic Sciences*, *57*(5), 1290-1298. https://doi.org/10.1111/j.1556-4029.2012.02132.x

Abstract/Abstract Excerpt
Fire debris evidence is collected and stored in a wide range of containers, including various polymer bags. Four different polymer bags have been investigated, including the NYLON, DUO, ALU, and AMPAC bags. The latter is the successor of the Kapak Fire DebrisPAK™. Microscopy and infrared spectroscopy were used to elucidate the composition of the bags. Gas chromatography/mass spectrometry was used to investigate performance parameters such as background volatiles, leak rate, cross-contamination, recovery, and sorption. The NYLON bag was susceptible for leakage and cross-contamination and showed decreased recoveries. The DUO and ALU bags showed some background volatiles, sorption, and poor recoveries. The AMPAC bag performed excellent: low background, no leakage or cross-contamination, good recoveries, and only traces of sorption. Heat sealing proved to be the best method of closure. Preliminary studies on AMPAC bags showed that polyethylene clamps are easy to use on-site and preserve ignitable liquids adequately for a limited period of time.

Keywords
forensic science, fire debris, evidence bag, evidence container, ignitable liquid analysis, fire debris bag, packaging

H

Hoiseth, G., Fjeld, B., Burns, M. L., Strand, D. H., & Vindenes, V. (2014). Long-term stability of morphine, codeine, and 6-acetylmorphine in real-life whole blood samples, stored at -20 degrees C. *Forensic Science International*, *239*, 6-10. https://doi.org/10.1016/j.forsciint.2014.03.008

Abstract/Abstract Excerpt
…For the analytes detected after intake of heroin (6-acetylmorphine (6-AM), morphine and codeine), long-time stability in real life whole blood samples are studied in only a small number of cases…Whole blood post mortem (*n* = 37) and whole blood samples from living persons (*n* = 22) containing morphine and codeine as well as 6-AM in blood or urine were selected. All cases represented intake of heroin. All samples contained fluoride and were initially analyzed and stored in normal conditions (−20 °C) for 4–9 years. All samples were then reanalyzed using the same analytical methods and the results were compared…This study showed that in real life whole blood samples, the concentrations of morphine and codeine are relatively stable during long-term storage at −20 °C. 6-AM on the other hand, shows a considerable decrease in concentrations that is important to consider when interpreting results from reanalyzes of forensic cases.

Keywords
stability, storage, morphine, codeine, 6-Monoacetylmorphine

Houck, M. M., McAndrew, W. P., Porter, M., & Davies, B. (2015). A Review of Forensic Science Management Literature. *Forensic Science Review*, *27*(1), 53-68.

Abstract/Abstract Excerpt
The science in forensic science has received increased scrutiny in recent years, but interest in how forensic science is managed is a relatively new line of research. This paper summarizes the literature in forensic science management generally from 2009 to 2013, with some recent additions, to provide an overview of the growth of topics, results, and improvements in the management of forensic services in the public and private sectors. This review covers only the last three years or so and a version of this paper was originally produced for the 2013 Interpol Forensic Science Managers Symposium and is available at interpol.int.

Keywords
accreditation, crime laboratory, crime scene, education, effectiveness, efficiency, evidence, forensic science, FORESIGHT, funding, law, law enforcement, leadership, management, personnel, planning, policy, privatization, quality, staffing.

Howlett, S. E., Castillo, H. S., Gioeni, L. J., Robertson, J. M., & Donfack, J. (2014). Evaluation of DNAstable (TM) for DNA storage at ambient temperature. *Forensic Science International: Genetics*, *8*(1), 170-178. https://doi.org/10.1016/j.fsigen.2013.09.003

Abstract/Abstract Excerpt
…Two groups of samples consisting of different DNA quantities were investigated, one ranging from 20 to 400 ng (group 1) and the other one ranging from 1.4 to 20 ng (group 2). The DNA samples with and without DNAstable™ were stored at four different temperatures [∼25 °C (room temperature), −20 °C, 37 °C or 50 °C]. DNA degradation over several months was monitored by SYBR® Green-based qPCR assays and by PCR amplification of the core CODIS STR markers for group 1 and 2 DNA samples, respectively. For the time points tested in this study (up to 365 days), the findings indicate that the −20 °C controls and the DNAstable™ protected samples at room temperature provided similar DNA recoveries that were higher compared to the unprotected controls kept at RT, 37 °C or 50 °C. These results suggest that DNAstable™ can protect DNA samples with effectiveness similar to that of the traditional −20 °C freezing method. In addition, extrapolations from accelerated aging experiments conducted at high temperatures support that DNAstable™ is an effective technology for preserving purified DNA at room temperature with a larger protective impact on DNA samples of low quantity (<20 ng).

Keywords
forensic science, long-term DNA storage. DNAstable™, room-temperature storage, qPCR, STRs

Huertas, T., Jurado, C., Salguero, M., Soriano, T., & Gamero, J. (2019). Stability studies in biological fluids during post-analysis custody. Opiate compounds derived from heroin consumption. *Forensic Scient International*, *297*, 326-334. https://doi.org/10.1016/j.forsciint.2019.02.016

Abstract/Abstract Excerpt
In Forensic Toxicology, the evidence have to be maintained under custody for, at least, one year. Depending on the conditions and duration of storage, drug concentrations might have changed considerably since the first analysis. The aim of this study is to evaluate *in vitro* stability of opiate compounds, derived from heroin consumption, 6-acetylmorphine (6-MAM), morphine (MOR) and codeine (COD), in blood and urine, during post-analysis custody. Parameters evaluated were: time of custody, temperature, addition of preservative (blood) and pH (urine)…In conclusion, the study showed that the most labile opiate compound is 6-MAM. Its stability mainly depends on urine pH or the addition of preservative, in blood samples. The best storage conditions for samples from heroin consumers are in the freezer, at -20 °C. In addition, blood samples must be added with 1%NaF and urine

samples must be buffered at pH 4.

Keywords
stability, post-analysis custody, heroin related compounds

I

Ivanova, N. V., & Kuzmina, M. L. (2013). Protocols for dry DNA storage and shipment at room temperature. *Molecular Ecology Resources*, *13*(5), 890-898. https://doi.org/10.1111/1755-0998.12134

Abstract/Abstract Excerpt
…We evaluated three dry-state DNA stabilization systems: commercial Biomatrica® DNAstable® plates, home-made trehalose and polyvinyl alcohol (PVA) plates on 96-well panels of insect DNA stored at 56 °C and at room temperature. Controls included unprotected samples that were stored dry at room temperature and at 56 °C, and diluted samples held at 4 °C and at −20 °C. PCR and selective sequencing were performed over a 4-year interval to test the condition of DNA extracts. Biomatrica® provided better protection of DNA at 56 °C and at room temperature than trehalose and PVA, especially for diluted samples. PVA was the second best protectant after Biomatrica® at room temperature, whereas trehalose was the second best protectant at 56 °C. In spite of lower PCR success, the DNA stored at −20 °C yielded longer sequence reads and stronger signal, indicating that temperature is a crucial factor for DNA quality which has to be considered especially for long-term storage. Although it is premature to advocate a transition to DNA storage at room temperature, dry storage provides an additional layer of security for frozen samples, protecting them from degradation in the event of freezer failure. All three forms of DNA preservation enable shipment of dry DNA and PCR products between barcoding facilities.

Keywords
biomatrica, DNA preservation, dry storage, PVA, trehalose

J

Jones, Z. V., Gwinnett, C., & Jackson, A. R. W. (2019). The effect of tape type, taping method and tape storage temperature on the retrieval rate of fibers from various surfaces: An example of data generation and analysis to facilitate trace evidence recovery validation and optimization. *Science & Justice*, *59*(3), 268-291. https://doi.org/10.1016/j.scijus.2018.12.003

Abstract/Abstract Excerpt
This paper outlines a series of experiments that investigated the effect of four factors on the rate at which target fibers could be recovered from surfaces by tape lifting. The factors were tape type (with two levels, namely: J-LAR and Crystal Tabs), tape storage temperature (three levels: −5 °C, room temperature [19 ± 1 °C] and 35 °C), taping method (two levels: zonal and one-to-one) and surface (12 levels: each being a surface type commonly encountered at crime scenes). This resulted in 144 unique experimental conditions. For each of these, five repeat fiber recovery rate determinations were carried out, generating 720 data points. All surfaces were clean and dry prior to target fibers being transferred and recovered. In all cases, the tapes were applied to the surfaces at 19 ± 1 °C. These experiments showed that the surfaces can be divided into three stable clusters based on the median and interquartile range of the fiber retrieval rate achieved from each of them. Also, they showed that, in terms of the proportion of the target fibers retrieved, *typically* and setting aside interaction effects: Crystal Tabs outperformed J-LAR; rolls of tape stored at −5 °C and 35 °C outperformed those stored at room temperature; one-to-one taping outperformed zonal taping…

Keywords
Fiber recovery, tapelifting, zonal taping, one-to-one taping, tape storage temperature, validation

K

Karinen, R., Andresen, W., Smith-Kielland, A., & Morland, J. (2014). Long-term storage of authentic postmortem forensic blood samples at -20 degrees C: measured concentrations of benzodiazepines, central stimulants, opioids and certain medicinal drugs before and after storage for 16-18 years. *Journal of Analytical Toxicology*, *38*(9), 686-695. https://doi.org/10.1093/jat/bku080

Abstract/Abstract Excerpt
The long-term stability of benzodiazepines, opioids, central stimulants and medicinal drugs in authentic postmortem blood samples was studied. All together, 73 samples were reanalyzed after storage at −20°C for 16–18 years. At reanalysis samples containing diazepam, nordiazepam and flunitrazepam demonstrated only small changes during long-term storage when mean and median drug concentrations were compared, while clonazepam concentrations tended to decrease. Samples containing amphetamine, morphine, codeine and 'acidic' medicinal drugs as paracetamol and meprobamate also showed small changes over 16–18 years in mean and median drug concentrations at a group level. For many drugs, however, single samples could demonstrate marked concentration changes, both increases and decreases during storage. For 'alkaline' medicinal drugs, concentration losses were observed in most cases.

Keywords
Not indicated by the author(s)

Karinen, R., Oiestad, E. L., Andresen, W., Smith-Kielland, A., & Christophersen, A. (2011). Comparison of the stability of stock solutions of drugs of abuse and other drugs stored in a freezer, refrigerator, and at ambient temperature for up to one year. *Journal of Analytical Toxicology*, *35*(8), 583-590. https://doi.org/10.1093/anatox/35.8.583

Abstract/Abstract Excerpt
The aim of this study was to evaluate the stability of stock solutions of a variety of illegal and medicinal drugs, important in forensic analysis, when stored refrigerated or at ambient temperature compared to solutions stored in a freezer. Stock solutions in methanol, acetonitrile, or a mixture of acetonitrile/methanol were transferred to autosampler vials and analyzed after storage for one month, three months, six months, and one year at ambient temperature, in a refrigerator, and in a freezer. Some of the compounds investigated, such as morphine and amitriptyline, showed to be stable for at least one year when stored at ambient temperature, but others, such as prometazine and olanzapine, nearly vanished when stored at ambient temperature for one month.

Keywords
Not indicated by the author(s)

Kerrigan, S. (2013). Sampling, storage and stability. In Negrusz, A. & Cooper, G. (Eds.). *Clarke's analytical forensic toxicology (335-354).* The Pharmaceutical Press.

Abstract/Abstract Excerpt
Appropriate selection, sampling and proper storage of biological evidence are important, yet sometimes overlooked, steps in forensic toxicology. These factors, in combination with drug stability, can profoundly impact the interpretation of results and the outcome of forensic casework. Criteria surrounding each of these are presented and discussed in the material that follows. Further reference to tissue sampling will also be found in other chapters in this book and will be cross-referenced within the text where appropriate.

Keywords
Not indicated by the author(s)

L

Latta, J., & Giles, R. (2019). *International Association for Property and Evidence, Inc. Professional Standards*. International Association for Property and Evidence, Inc. https://home.iape.org/resourcesPages/IAPE_Downloads/IAPE_Resources/IAPE-Professional-Standards/IAPE_Standards_3.0.pdf

Abstract/Abstract Excerpt
The IAPE Board of Directors is charged with the duties of advancing the scope of knowledge and enhancing professionalism within the field of property and evidence management. To help achieve this goal, the IAPE has adopted professional standards in a number of important property and evidence handling procedures. Adhering to these standards should assure any agency that reasonable steps have been taken to obtain a secure and efficient property and evidence management system. Not adhering to these recommended standards will increase the likelihood of problems associated with the operation of the unit.

Keywords
Not indicated by the author(s)

Lee, S. B., Clabaugh, K. C., Silva, B., Odigie, K. O., Coble, M. D., Loreille, O., . . . Crouse, C. A. (2012). Assessing a Novel Room Temperature DNA Storage Medium for Forensic Biological Samples. *Forensic Science International: Genetics*, *6*(1), 31-40. https://doi-org.ezproxy.library.unlv.edu/10.1016/j.fsigen.2011.01.008

Abstract/Abstract Excerpt
The ability to properly collect, analyze and preserve biological stains is important to preserving the integrity of forensic evidence. Stabilization of intact biological evidence in cells and the DNA extracts from them is particularly important since testing is generally not performed immediately following collection. Furthermore, retesting of stored DNA samples may be needed in casework for replicate testing, confirmation of results, and to accommodate future testing with new technologies…Results indicate no substantial differences between the quality of samples stored frozen in liquid and those samples maintained dry at ambient temperatures protected in SM. For long-term storage and the storage of low concentration samples, SM provided a significant advantage over freezer storage through higher DNA recovery. No detectable inhibition of amplification was observed at the recommended SM concentration and complete profiles were obtained from genomic DNA samples even in the presence of higher than recommended concentrations of the SM storage medium. The ability to stabilize and protect DNA from degradation at ambient temperatures for extended time periods could have tremendous impact in simplifying and improving sample storage

conditions and requirements. The current work focuses on forensics analysis; however, this technology is applicable to all endeavors requiring storage of DNA.

Keywords
DNA storage, DNA recovery, short tandem repeat analysis, freeze–thaw, trehalose, SampleMatrix, QIAsafe, DNA stability

Lee, S. B., Crouse, C. A., Kline, M. C., Crouse, C. A., & Kline, M. C. (2013). Optimizing Storage and Handling of DNA Extracts. *Forensic Science Review, 22*(2), 131-144.

Abstract/Abstract Excerpt
Nucleic acid sample storage is of paramount importance in forensic science as well as in epidemiological, clinical, and genetic laboratories…Efficient storage of the extracted DNA/RNA is needed to ensure the stability of the sample over time for retesting of the CODIS STRs, mtDNA, YSTRs, mRNA, and other future marker-typing systems. Amplification of some or all of these markers may fail because the biological material has been highly degraded, contains inhibitors, is too low in quantity, or is contaminated with contemporary DNA. Reduction in recovery has been observed with refrigerated liquid DNA extracts and also those exposed to multiple freeze-thaw cycles. Therefore, the development of optimal storage and amplification methods is critical for successful recovery of profiles from these types of samples since, in many cases, retesting is necessary. This review is divided into three sections. The Introduction and Background covers forensic DNA storage, factors that influence DNA stability, and a brief review of molecular strategies to type non-optimal DNA. Section I covers the importance of DNA extract storage in forensic and non-forensic DNA databanks and the mechanisms responsible for loss during storage. Finally, Section II covers strategies and technologies being utilized to store DNA.

Keywords
DNA storage; FTA; Sample matrix; trehalose

Lewis, L., & Christensen, A. M. (2016). Effects of Aluminum Foil Packaging on Elemental Analysis of Bone. *J Forensic Sci*, *61*(2), 439-441. https://doi.org/10.1111/1556-4029.12994

Abstract/Abstract Excerpt
Burned skeletal material is often very fragile and at high risk for fragmentation during packaging and transportation. One method that has been suggested to protect bones in these cases is to carefully wrap them in aluminum foil. Traces of aluminum, however, are known to transfer from foil packaging materials to food products. If such transfer occurs between aluminum foil and bones, it could interfere

with subsequent chemical, elemental and isotopic analyses, which are becoming more common in forensic anthropological investigations. This study examined aluminum levels in bones prior to and following the use of aluminum foil packaging and storage for a 6-week period. Results indicate no significant change in the detected levels of aluminum ($p > 0.05$), even when packaged in compromised foil and exposed to elevated temperatures. Aluminum foil can therefore continue to be recommended as a packaging medium without affecting subsequent chemical examinations.

Keywords
forensic science, forensic anthropology, skeletal remains, evidence packaging, aluminum foil, elemental analysis

Li, Z., McNally, A. J., Wang, H., & Salamone, S.J. (1998). Stability study of LSD under various storage conditions. *Journal of Analytical Toxicology*, *22*(6), 520-525. https://doi.org/10.1093/jat/22.6.520

Abstract/Abstract Excerpt
A controlled study…to determine the stability of LSD in pooled urine…followed over time at various temperatures, in different types of storage containers, at various exposures to different wavelengths of light, and at varying pH values. LSD concentrations were measured quantitatively by the Abuscreen RIA and by HPLC using a fluorescence detection method. Good correlation was observed between the immunoassay and the fluorescent integrity of the LSD molecule. Thermostability studies were conducted in the dark with various containers. These studies demonstrated no significant loss in LSD concentration at 25 degrees C for up to 4 weeks. After 4 weeks of incubation, a 30% loss in LSD concentration at 37 degrees C and up to a 40% at 45 degrees C were observed. Urine fortified with LSD and stored in amber glass or nontransparent polyethylene containers showed no change in concentration under any light conditions. Stability of LSD in transparent containers under light was dependent on the distance between the light source and the samples, the wavelength of light, exposure time, and the intensity of light. After prolonged exposure to heat in alkaline pH conditions, 10 to 15% of the parent LSD epimerized to iso-LSD. Under acidic conditions, less than 5% of the LSD was converted to iso-LSD…

Keywords
Not indicated by the author(s)

Library of Congress. (n.d.) *Care, Handling, and Storage of Audio Visual Materials*. https://www.loc.gov/preservation/care/record.html

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

Library of Congress. (n.d.) *Care, Handling, and Storage of Books*. https://www.loc.gov/preservation/care/books.html

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

Library of Congress. (n.d.) *Care, Handling, and Storage of Comic Books*. https://www.loc.gov/preservation/care/comics.html

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

Library of Congress. (n.d.) *Care, Handling, and Storage of Photographs*. https://www.loc.gov/preservation/care/photo.html

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

Library of Congress. (n.d.) *Care, Handling, and Storage of Scrapbooks and Albums*. https://www.loc.gov/preservation/care/albums.html

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

Library of Congress. (n.d.) *Care, Handling, and Storage of Works on Paper*. https://www.loc.gov/preservation/care/paper.html

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

Library of Congress. (n.d.) *Preservation Measures for Newspapers*. https://www.loc.gov/preservation/care/newspap.html

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

Lou, J. J., Mirsadraei, L., Sanchez, D. E., Wilson, R. W., Shabihkhani, M., Lucey, G. M., . . . Yong, W. H. (2014). A review of room temperature storage of biospecimen tissue and nucleic acids for anatomic pathology laboratories and biorepositories. *Clinical Biochemistry*, *47*(4), 267-273. https://doi.org/10.1016/j.clinbiochem.2013.12.011 (Biorepositories and Biobanks)

Abstract/Abstract Excerpt
…The purpose of the study was to review the current status of room temperature biospecimen storage…Formalin-fixed paraffin embedded (FFPE) tissues have great value but their use is limited by cross-linking and fragmentation of nucleic acids, as well as loss of enzymatic activity. Stabilization solutions can now robustly preserve fresh tissue for up to 7 days at room temperature. For longer term storage, commercial vendors of chemical matrices claim real time stability of nucleic acids of over 2 years and their accelerated aging studies to date suggest stability for 12 years

for RNA and 60 years for DNA. However, anatomic pathology biorepositories store mostly frozen tissue rather than nucleic acids. Small quantities of tissue can be directly placed on some chemical matrices to stabilize DNA, however RNA and proteins are not preserved. Current lyophilization approaches can preserve histomorphology, DNA, RNA, and proteins though RNA shows moderate degradation after 1-2 years. Formalin-free fixatives show improved but varying abilities to preserve nucleic acids and face validation as well as cost barriers in replacing FFPE specimens. The paraffin embedding process can degrade RNA. Development of robust long-term room temperature biospecimen tissue storage technology can potentially reduce costs for the biomedical community in the face of growing targeted therapy needs and decreasing budgets.

Keywords
room temperature, tissue, biospecimen, biorepository, biobank

M

Magalhaes, T., Dinis-Oliveira, R. J., Silva, B., Corte-Real, F., & Nuno Vieira, D. (2015). Biological evidence management for DNA analysis in cases of sexual assault. *Scientific World Journal*, *2015*, 365674. https://doi.org/10.1155/2015/365674

Abstract/Abstract Excerpt
Biological evidence with forensic interest may be found in several cases of assault, being particularly relevant if sexually related. Sexual assault cases are characterized by low rates of disclosure, reporting, prosecution, and conviction. Biological evidence is sometimes the only way to prove the occurrence of sexual contact and to identify the perpetrator. The major focus of this review is to propose practical approaches and guidelines to help health, forensic, and law enforcement professionals to deal with biological evidence for DNA analysis. Attention should be devoted to avoiding contamination, degradation, and loss of biological evidence, as well as respecting specific measures to properly handle evidence (i.e., selection, collection, packing, sealing, labeling, storage, preservation, transport, and guarantee of the chain custody). Biological evidence must be carefully managed since the relevance of any finding in Forensic Genetics is determined, in the first instance, by the integrity and quantity of the samples submitted for analysis.

Keywords
Not indicated by the author(s)

McAndrew, W. P., & Houck, M. M. (2020). Interpol review of forensic science management literature 2016–2019. *Forensic Science International: Synergy*. https://doi.org/10.1016/j.fsisyn.2020.01.007

Abstract/Abstract Excerpt
This paper reviews and summarizes the forensic management literature from late 2016 to late 2019, covering laboratory decision making, business strategy, and industry identity and transparency. The review papers are also available at the Interpol website at: https://www.interpol.int/content/download/14458/file/Interpol%20Review%20Papers%202019.pdf.

Keywords
forensic science, management, decision making, strategy, laboratory, transparency

McCartney, C., & Shorter, L. (2020). Police retention and storage of evidence in England and Wales. *International Journal of Police Science & Management*, *22*(2), 123-136. https://doi.org/10.1177/1461355719891741

Abstract/Abstract Excerpt
Central to the operation of the appellate system, is the ability of individuals who claim that their conviction is in error, to revisit and re-examine evidence gathered during the investigation, as well as that relied upon at their trial. High-profile miscarriages of justice have often only been remedied when there has been defense access to materials post conviction. There is also an imperative for forces to retain evidence in investigations in which no perpetrator has been detected or convicted, to facilitate cold case reviews. In order to give effect then to an appellate system and enable cold case reviews, evidence needs to be retained and properly stored. If materials are not retained and stored correctly, then re-investigations are rendered impossible. Retention is especially critical in respect of physical materials that could be subject to forensic examination. With the progress of science and technology, and the interpretation of results, it is essential that such physical…materials are retained for future (re)evaluation… concludes that justice demands that we accept that the proper retention and storage of materials is fundamental to the fair and effective operation of our criminal justice system, and ensures that the Court of Appeal can fulfil its remit in addressing wrongful convictions and forces can pursue justice in cold cases.

Keywords
police investigation, evidence, criminal justice, miscarriages of justice, forensic science

Mercer, C., Abarno, D., Hearnden, P., & Linacre, A. (2019). DNA transfer between evidence bags: is it a means for incidental contamination of items? *Australian Journal of Forensic Sciences*, *53*(1), 256-270. https://doi.org/10.1080/00450618.2019.1699957

Abstract/Abstract Excerpt
With the increasing sensitivity of DNA profiling systems, the opportunity to detect incidental DNA transferred between evidential items has increased. Evidence bags are assumed to be DNA transfer vectors which can cause an inadvertent transfer of DNA between items, yet little has been studied to indicate the extent of this transfer. This study aimed to provide insight into the levels of DNA accumulating on evidence bags through exhibit handling and storage. Casework exhibit bags were sampled during storage and mock exhibit bags were sampled after replicating exhibit handling protocols. DNA concentrations recovered from casework exhibit packages were highly variable and produced profiles containing up to at least seven contributors. The DNA concentration and profile complexity was higher in samples

taken from packages after exhibit examination. It was observed that DNA from the exhibit can be transferred to the exterior of the bag during the process of packaging and un-packing the item. Profile complexity from mock exhibit packages increased with time spent in the exhibit storeroom. With the introduction of highly sensitive DNA profiling systems, procedures involving the handling, transport and storage of exhibits should be assessed to ensure that best-practice contamination minimization procedures are being utilized.

Keywords
contamination, STR DNA profiling, DNA transfer, trace DNA

Moretti, M., Freni, F., Carelli, C., Previdere, C., Grignani, P., Vignali, C., Cobo-Golpe, M., & Morini, L. (2021). Analysis of cannabinoids and metabolites in dried urine spots (DUS). *Molecules, 26*(17). https://doi.org/10.3390/molecules26175334

Abstract/Abstract Excerpt
Dried urine spots (DUS) represent a potential alternative sample storage for forensic toxicological analysis. The aim of the current study was to develop and validate a liquid chromatographic tandem mass spectrometric procedure for the detection and quantitative determination of cannabinoids and metabolites in DUS. A two-step extraction was performed on DUS and urine samples. An LC-MS/MS system was operated in multiple reaction monitoring and positive polarization mode. The method was checked for sensitivity, specificity, linearity, accuracy, precision, recovery, matrix effects and carryover. The method was applied to 70 urine samples collected from healthy volunteers and drug addicts undergoing withdrawal treatment. The method was successfully developed for DUS. LODs lower than 2.0 ng/mL were obtained for all the monitored substances. All the validation parameters fulfilled the acceptance criteria either for DUS or urine. Among the real samples, 45 cases provided positive results for at least one compound. A good quali-quantitative agreement was obtained between DUS and urine. A good stability of THC, THCCOOH and THCCOOH-gluc was observed after a 24 h storage, in contrast to previously published results. DUS seems to provide a good alternative storage condition for urine that should be checked for the presence of cannabinoids and metabolites.

Keywords
Dried urine spots, cannabinoids, THC, THCCOOH, THCOOH-gluc, LC-MS/MS

Mozayani, A., & Parish-Fisher, C. (2018). *Forensic Evidence Management: From Crime Scene to the Courtroom*. CRC Press.

Abstract/Abstract Excerpt
(from Description) Forensic Evidence Management: From the Crime Scene to the Courtroom provides best practices policies for forensic science entities and their employees to maintain chain of custody and evidence integrity throughout the course of evidence collection, storage, preservation, and processing. The focus of the book will be to address the issues related with evidence handling and analysis inside the forensic laboratory, in particular, and to offer best practices and guidelines from leading forensic experts in the field. Forms of evidence covered include biological, chemical, trace, firearm, toolmark, fingerprint, and a host of other types recovered at crime scenes. The book concludes with a chapter on ethics, bias, and ethical practices in evidence handling in the field and laboratory analysis.

Keywords
Not indicated by the author(s)

N

National Forensic Science Technology Center. (2012). *A Simplified Guide to Fingerprint Analysis*. https://www.forensicsciencesimplified.org/prints/Fingerprints.pdf

Abstract/Abstract Excerpt
(from Introduction) We touch things every day: a coffee cup, a car door, a computer keyboard. Each time we do, it is likely that we leave behind our unique signature—in our fingerprints. No two people have exactly the same fingerprints. Even identical twins, with identical DNA, have different fingerprints. This uniqueness allows fingerprints to be used in all sorts of ways, including for background checks, biometric security, mass disaster identification, and of course, in criminal situations

Keywords
Not indicated by the author(s)

National Forensic Science Technology Center. (2012). *A Simplified Guide to Footwear and Tire Impressions*. https://www.forensicsciencesimplified.org/fwtt/FootwearTireTracks.pdf

Abstract/Abstract Excerpt
(from Introduction) When a perpetrator hides evidence of a crime, it's commonly called "covering their tracks." For instance, an individual burglarizes a home and uses a cloth to wipe away any fingerprints before leaving. He thinks he has covered his trail; but he may not realize the impressions his shoes or tires make could also be used to link him to the scene of the crime. These footwear and tire track impressions are referred to as "pattern evidence" because the impressions form a unique pattern. Shoes and boots leave prints and impressions specific to their particular brand, style and size. The tread on each tire of a vehicle may provide investigators with similar information.

Keywords
Not indicated by the author(s)

National Forensic Science Technology Center (2012). *Crime Scene Investigation: A Guide for Law Enforcement*.

Abstract/Abstract Excerpt
(from Acknowledgements) This updated Crime Scene Investigation: A Guide to Law Enforcement is a revision of the original publication published in January 2000, and borrows heavily from that work. The original publication was based upon the work

of the National Crime Scene Planning Panel and additional Technical Working Group Members. Their contributions remain as vital today as when the original Guide was published. To develop this expanded edition, a Review Committee of recognized experts was assembled. This committee selected additional material from content developed for Department of Justice−funded crime scene projects, Scientific Working Groups and other open-source documents, which are reflected in the Reference section. Additional vetting of the material was accomplished through recognized subject matter experts.

Keywords
Not indicated by the author(s)

National Institute of Justice, U.S. Department of Justice. (2008). *Electronic Crime Scene Investigation: A Guide for First Responders*. https://www.ojp.gov/pdffiles1/nij/219941.pdf

Abstract/Abstract Excerpt
(from Introduction) This guide is intended to assist State and local law enforcement and other first responders who may be responsible for preserving an electronic crime scene and for recognizing, collecting, and safeguarding digital evidence. It is not all inclusive but addresses situations encountered with electronic crime scenes and digital evidence. All crime scenes are unique and the judgment of the first responder, agency protocols, and prevailing technology should all be considered when implementing the information in this guide. First responders to electronic crime scenes should adjust their practices as circumstances—including level of experience, conditions, and available equipment—warrant. The circumstances of individual crime scenes and Federal, State, and local laws may dictate actions or a particular order of actions other than those described in this guide. First responders should be familiar with all the information in this guide and perform their duties and responsibilities as circumstances dictate.

Keywords
Not indicated by the author(s)

National Park Service. (1997). Storing and handling plaster objects. *Conserv O Gram, 8*(2), 1-4. https://www.nps.gov/museum/publications/conserveogram/08-02.pdf

Abstract/Abstract Excerpt
(opening paragraph) Plaster objects are associated with duplication methods in both art and science. Sculpture, paleontology and the decorative arts are primary sources for a variety of plaster artifacts. This Conserve O Gram describes the properties of plaster objects and provides guidance on storing and handling these materials.
Keywords
Not indicated by the author(s)

New York City Office of Chief Medical Examiner. (2016). *Forensic Biology Evidence and Case Management Manual.* https://www1.nyc.gov/site/ocme/services/fbio-evidence-and-case-management-manuals.page

Abstract/Abstract Excerpt
(landing page description) This manual contains procedures related to (1) evidence intake, distribution, and return; and (2) case handling, including evidence examination guidelines; handling, evaluation, and troubleshooting of cases which are in progress; report writing and reviews.

Keywords
Not indicated by the author(s)

O

Ogden, S. *2.1 Temperature, Relative Humidity, Light, and Air Quality: Basic Guidelines for Preservation*. (1999). Northeast Document Conservation Center. https://www.nedcc.org/free-resources/preservation-leaflets/2.-the-environment/2.1-temperature,-relative-humidity,-light,-and-air-quality-basic-guidelines-for-preservation

Abstract/Abstract Excerpt
(First paragraph of document) Control of temperature and relative humidity is critical in the preservation of library and archival collections because unacceptable levels of these contribute significantly to the breakdown of materials. Heat accelerates deterioration: the rate of most chemical reactions, including deterioration, is approximately doubled with each increase in temperature of 18°F (10°C). High relative humidity provides the moisture necessary to promote harmful chemical reactions in materials and, in combination with high temperature, encourages mold growth and insect activity. Extremely low relative humidity, which can occur in winter in centrally heated buildings, may lead to desiccation and embrittlement of some materials. (Note: material currently under review)

Keywords
Not indicated by the author(s)

Oham, C., Michelin, R. A., Jurdak, R., Kanhere, S. S., & Jha, S. (2021). B-FERL: Blockchain based framework for securing smart vehicles. *Information Processing & Management*, *58*(1). https://doi.org/10.1016/j.ipm.2020.102426

Abstract/Abstract Excerpt
The ubiquity of connecting technologies in smart vehicles and the incremental automation of its functionalities promise significant benefits, including a significant decline in congestion and road fatalities. However, increasing automation and connectedness broadens the attack surface and heightens the likelihood of a malicious entity successfully executing an attack. In this paper, we propose a Blockchain based Framework for sEcuring smaRt vehicLes (B-FERL). B-FERL uses permissioned blockchain technology to tailor information access to restricted entities in the connected vehicle ecosystem. It also uses a challenge–response data exchange between the vehicles and roadside units to monitor the internal state of the vehicle to identify cases of in-vehicle network compromise. In order to enable authentic and valid communication in the vehicular network, only vehicles with a verifiable record in the blockchain can exchange messages. Through qualitative arguments, we show that B-FERL is resilient to identified attacks. Also, quantitative evaluations in an emulated scenario show that B-FERL ensures a suitable response time and required storage size compatible with realistic scenarios. Finally, we

demonstrate how B-FERL achieves various important functions relevant to the automotive ecosystem such as trust management, vehicular forensics and secure vehicular networks.

Keywords
Blockchain, vehicular network, integrity, electronic control units (ECUs), challenge-response

Ostojic, L., & Wurmbach, E. (2017). Analysis of fingerprint samples, testing various conditions, for forensic DNA identification. *Science & Justice*, *17*(1), 35-40. http://dx.doi.org/10.1016/j.scijus.2016.08.009

Abstract/Abstract Excerpt
…DNA obtained from fingerprints varies greatly in quality and quantity, which ultimately affects the quality of the resulting STR profiles. Additional difficulties can arise when fingerprint samples show mixed STR profiles due to the handling of multiple persons. After applying a tested protocol for sample collection (swabbing with 5% Triton X-100), DNA extraction (using an enzyme that works at elevated temperatures), and PCR amplification (AmpFlSTR® Identifiler® using 31 cycles) extensive analysis was performed to better understand the challenges inherent to fingerprint samples, with the ultimate goal of developing valuable profiles (≥50% complete). The impact of time on deposited fingerprints was investigated, revealing that while the quality of profiles deteriorated, full STR profiles could still be obtained from samples after 40 days of storage at room temperature…Tests on glass, plastic, paper and metal (US Quarter dollar, made of Cu and Ni), common substrates in offices and homes, showed best results for glass, followed by plastic and paper, while almost no profiles were obtained from a Quarter dollar. Important for forensic casework, we also assessed three-person mixtures of touched fingerprint samples…The samples were processed separately for DNA extraction and STR amplification. The results included a few single source profiles and distinguishable two person mixtures. On average, this approach led to two profiles ≥50% complete per touched object. Some STR profiles were obtained more than once thereby increasing the confidence.

Keywords
Forensic science, touched items, fingerprints, admixed samples, substrates, short tandem repeat

P

Pasternak, Z., Luchibia, A. O., Matan, O., Dawson, L., Gafny, R., Shpitzen, M., . . . Jurkevitch, E. (2019). Mitigating temporal mismatches in forensic soil microbial profiles. *Australian Journal of Forensic Sciences*, *51*(6), 685-694. https://doi.org/10.1080/00450618.2018.1450897

Abstract/Abstract Excerpt
Forensic implementation of soil bacterial DNA profiling is limited by the potential for temporal mismatch of DNA profiles, e.g. after storage or seasonal changes. We compared profiles of samples retrieved at one location over 14 years after air-drying, freeze-drying and –80 °C freezing storage. Sample mismatch in freeze-dried and air-dried samples was significant after two years and continued to increase yearly, whereas profiles after –80 °C freezing remained unchanged for many years. In an attempt to mitigate inter-seasonal temporal mismatches, e.g. when months pass between crime and seizure of evidence, soils sampled in winter and summer were exposed to artificial 'summer' and 'winter' conditions, respectively, and their DNA profiles were compared. Differences were small between soil types, larger between seasons and largest between 'natural' and 'artificial' seasons. Understanding sources of temporal variations is critical for storage of forensics samples and for developing mitigation procedures that could help overcome these time-induced limitations.

Keywords
soil, bacteria, TRFLP, sample storage, temporal mismatch

Pellegrini, M., Graziano, S., Mastrobattista, L., Minutillo, A., Busardo, F. P., & Scarsella, G. (2017). Stability of Drugs of Abuse in Urine Samples at Room Temperature by Use of a Salts Mixture. *Curr Pharm Biotechnol*, *18*(10), 815-820. https://doi.org/10.2174/1389201019666171211155043

Abstract/Abstract Excerpt
…Methods: Two different urine samples were prepared with and without salt mixture, stored at room temperature and then analyzed by gas chromatography-mass spectrometry at 0, 1, 7, 15, and 30 days after collection/preparation to look for eventual analyte degradation. Results: Methamphetamine showed no significant changes with respect to the time of collection/ preparation (T0) up to 7 days later (T7), with or without salt mixture addiction. Then a significant degradation occurred in both salted and non-salted urine. BE decrease was observed starting from day 1 after sample collection in salted and not salted samples, respectively. Salt addition seemed to reduce at least the initial BE degradation, with a significant difference ($p<0.001$) at 7 and 15 days of storage. However, the degradation was not more

prevented in salted samples at 30 days of storage. A 20% decrease of MOR concentration was observed starting from day 1 after collection/preparation, both in salted and not salted samples with no subsequent decrease. With regard to THCCOOH, a significant decrease was observed starting from 7 days after collection/preparation, with or without adding the salt mixture. However, when comparing salted versus non salted samples at each time point, a statistically significant difference was observed at 7 and 30 days of storage.

Keywords
Drugs of abuse, analyte stability, room temperature, gas chromatography-mass spectrometry (GC-MS), urine sample, salt mixture

Peter, W. P. (2015). *Forensic Evidence Field Guide*. Elsevier.

Abstract/Abstract Excerpt
(Description) Forensic Evidence Field Guide: A Collection of Best Practices highlights the essentials needed to collect evidence at a crime scene. The unique spiral bound design is perfect for use in the day-to-day tasks involved in collecting evidence in the field. The book covers a wide range of evidence collection and management, including characteristics of different types of crime scenes (arson, burglary, homicide, hit-and-run, forensic IT, sexual assault), how to recover the relevant evidence at the scene, and best practices for the search, gathering, and storing of evidence. It examines in detail the properties of biological/DNA evidence, bullet casings and gunshot residue, explosive and fire debris, fibers and hair, fingerprint, footprint, and tire impression evidence, and much more. This guide is a vital companion for forensic science technicians, crime scene investigators, evidence response teams, and police officers.

Keywords
Not indicated by the author(s)

Peterson, J. S., Ira; Baskin, Deborah; Johnson, Donald. (2006). *The Role and Impact of Forensic Science in the Criminal Justice Process* (2006-DN-BX-0094). https://www.ncjrs.gov/pdffiles1/nij/grants/231977.pdf

Abstract/Abstract Excerpt
Over the past twenty-five years, the forensic sciences have made dramatic scientific breakthroughs (DNA typing, physical evidence databases, and new scientific instrumentation) but studies are needed to assess the contribution of such advancements on the role and impact of scientific evidence in criminal case processing. Targeted studies have evaluated the value of DNA evidence in property

crime investigations, but no studies have reviewed the full array of scientific evidence present at crime scenes. In 2006, the National Institute of Justice funded this project to address the following four goals: Objective 1—Estimate the percentage of crime scenes from which one or more types of forensic evidence is collected; Objective 2—Describe and catalog the kinds of forensic evidence collected at crime scenes; Objective 3—Track the use and attrition of forensic evidence in the criminal justice system from crime scenes through laboratory analysis, and then through subsequent criminal justice processes; and Objective 4—Identify which forms of forensic evidence contribute most frequently (relative to their availability at a crime scene) to successful case outcomes.

Keywords
Not indicated by the author(s)

Q

No entries.

R

Rahikainen, A. L., Palo, J. U., de Leeuw, W., Budowle, B., & Sajantila, A. (2016). DNA quality and quantity from up to 16 years old post-mortem blood stored on FTA cards. *Forensic Science International*, *261*, 148-153. https://doi.org/10.1016/j.forsciint.2016.02.014

Abstract/Abstract Excerpt
Blood samples preserved on FTA cards offer unique opportunities for genetic research. DNA recovered from these cards should be stable for long periods of time. However, it is not well established as how well the DNA stored on FTA card for substantial time periods meets the demands of forensic or genomic DNA analyses and especially so for from post-mortem (PM) samples in which the quality can vary upon initial collection. The aim of this study was to evaluate the time-dependent degradation on DNA quality and quantity extracted from up to 16 years old post-mortem bloodstained FTA cards…According to our results, DNA stored on FTA cards is rather stable over a long time period. DNA extracted from this storage medium can be used as human identification purposes as the method used is sufficiently sensitive and amplicon sizes tend to be <400 bp. However, DNA integrity was affected during storage. This effect should be taken into account depending on the intended application especially if high quality DNA and long PCR amplicons are required.

Keywords
FTA cards, DNA extraction, quantification, inhibition, degradation, forensic genetics

Raja, S., Thomas, P. S., & Stuart, B. H. (2010). A study of storage conditions and treatments for forensic bone specimens using thermogravimetric analysis. *Journal of Thermal Analysis and Calorimetry*, *99*(3), 869-872. https://doi.org/10.1007/s10973-010-0699-7

Abstract/Abstract Excerpt
Bone provides an important source of forensic evidence. The storage conditions of bone have been recognized as a factor in maintaining the integrity of such evidence. Thermogravimetric analysis (TG) has been employed to examine the effects of storage environments and preparation methods on the structural properties of pig bones. A comparison of oven and freeze drying has been made to study the effect of storage conditions. A comparison has also been made of ground bone specimens with cut specimens. Freeze-dried hand ground specimens provided the most consistent results and, thus, this is the recommended method of preparation of bone specimens for TG analysis.

Keywords
bone, forensic, thermogravimetric analysis

Reesu, G. V., Augustine, J., & Urs, A. B. (2015). Forensic considerations when dealing with incinerated human dental remains. *Journal of Forensic and Legal Medicine*, *29*, 13-17. https://doi.org/10.1016/j.jflm.2014.10.006

Abstract/Abstract Excerpt
Establishing the human dental identification process relies upon sufficient post-mortem data being recovered to allow for a meaningful comparison with ante-mortem records of the deceased person. Teeth are the most indestructible components of the human body and are structurally unique in their composition. They possess the highest resistance to most environmental effects like fire, desiccation, decomposition and prolonged immersion. In most natural as well as man-made disasters, teeth may provide the only means of positive identification of an otherwise unrecognizable body. It is imperative that dental evidence should not be destroyed through erroneous handling until appropriate radiographs, photographs, or impressions can be fabricated. Proper methods of physical stabilization of incinerated human dental remains should be followed. The maintenance of integrity of extremely fragile structures is crucial to the successful confirmation of identity. In such situations, the forensic dentist must stabilize these teeth before the fragile remains are transported to the mortuary to ensure preservation of possibly vital identification evidence. Thus, while dealing with any incinerated dental remains, a systematic approach must be followed through each stage of evaluation of incinerated dental remains to prevent the loss of potential dental evidence…

Keywords
Forensic odontology, human identification, incineration, radiographs, scanning electron microscopy, composite resins

Richards, C. S., Rowlinson, C. C., & Hall, M. J. (2013). Effects of storage temperature on the change in size of *Calliphora vicina* larvae during preservation in 80% ethanol. *International Journal of Legal Medicine*, *127*(1), 231-241. https://doi.org/10.1007/s00414-012-0683-9

Abstract/Abstract Excerpt
…This paper investigates the effects of preservation, in 80% ethanol, on the length and weight of first instar, second instar, feeding third instar, and post-feeding third instar *Calliphora vicina* larvae, at three different storage temperatures. For each larval stage, the length of larvae was recorded after 0 h, 3 h, 6 h, 9 h, 12 h, 24 h, 72 h, 7 days, 14 days, 30 days, 91 days, 182 days, 273 days, and 365 days of storage in 80% ethanol, at -25 °C, 6 °C and 24 °C. Storage temperature had no statistically significant effect on the change in larval length and weight for all larval stages, but larval length and weight were significantly affected by the duration of preservation

for first, second, and feeding third instar larvae, but not for post-feeding larvae. Generally, first and second instar larvae reduced in size over time, while feeding third instar larvae increased slightly in size, and post-feeding larvae did not change in size over time. The length of blowfly larvae preserved in 80% ethanol is not affected by constant storage temperatures between -25 °C and +24 °C, but we recommend that forensic entomologists should use the models provided to correct for changes in larval length that do become apparent over time.

Keywords
Calliphora vicina, forensic entomology, postmortem interval, preservation, storage temperature

RTI International. (2016). *Sexual Assault Kit Evidence Tracking: Managing Critical Information*. https://sakittastage.rti.org/resources/docs/SAKI-Evidence-Tracking.pdf

Abstract/Abstract Excerpt
…Evidence tracking systems designed to manage SAK evidence give jurisdictions the ability to manage and track the status of SAKs, including the storage, testing, and transport of the evidence. Some SAK tracking systems also provide investigators the ability to capture additional offender behavioral and modus operandi (MO) data that can assist them in future investigations. In providing basic information on evidence tracking systems, this report aims to facilitate a jurisdiction's efforts in SAK evidence reform. It first explains why such systems are important, including the establishment of evidence tracking, case management, and victim notification mechanisms. The report then explains what such systems do, including collecting/cataloging key information on SAK evidence, tracking/auditing evidence status as cases move through the system, the provision of a written, detailed report to various criminal justice agencies involved in the case, and descriptions of items in each SAK. Since evidence tracking systems can vary in their complexity and capabilities, which affects a system's cost, this report also outlines issues in assessing the selection of a system, including having a single or multi-jurisdictional system, building or buying a system, installing the system, level of ongoing support needed, and costs for both implementation and maintenance…

Keywords
Not indicated by the author(s)

S

Saiz, J., Ferrando, J. L., Atoche, J.-C., Torre, M., & Garcia-Ruiz, C. (2011). Study of losses of volatile compounds from dynamites. Investigation of cross-contamination between dynamites stored in polyethylene bags. *Forensic Science International*, *211*(1-3), 27-33. https://doi.org/10.1016/j.forsciint.2011.04.007

Abstract/Abstract Excerpt
The purpose of this work was to study the appropriateness of polyethylene bags for the preservation of explosive specimens. To this end, specimens of two types of dynamites, Goma-2 EC, containing nitroglycol (EGDN) and dinitrotoluene (DNT), and Goma-2 ECO, containing only EGDN, were placed individually inside bags and introduced into hermetically sealed glass jars, which were stored for a period of time. Losses of volatile compounds were studied by headspace analysis using gas chromatography coupled to mass spectrometry (GC–MS). The cross-contamination between dynamites was studied by using high performance liquid chromatography with mass spectrometry (HPLC–MS) to analyze the extracts obtained after a sequential solvent extraction of these specimens. Polyethylene bags permit the loss of volatile compounds since EGDN and DNT were detected in the headspaces of the jars. Moreover, cross-contamination between dynamites was also demonstrated since DNT content decreased in the dynamite containing this compound and increased in the dynamite that had not contained it.

Keywords
forensic chemistry, dynamite, cross-contamination, evidence container, ethylene glycol dinitrate, dinitrotoluene

Schroth, C., & Phillips, P. (May 9, 2018). *The impact of drug storage temperatures on its efficacy in extreme environments: an evidence-based approach*. CoPMRE Visiting Faculty Day. 0.13140/RG.2.2.28671.92326

Abstract/Abstract Excerpt
This poster explores the available literature/evidence with regards to the most appropriate storage temperatures for emergency care drugs in the pre-hospital setting and how they should be stored to reduce the likelihood of reduced efficacy.

Keywords
Not indicated by the author(s)

Schwarz, L., & Hermanowski, M.-L. (2012). The Effect of Humidity on Long-Term Storage of Evidence Prior to Using Cyanoacrylate Fuming for the Detection of Latent Fingerprints. *Journal of Forensic Identification*, *62*(3), 227-233.

Abstract/Abstract Excerpt
In Germany, cyanoacrylate fuming is the most popular method used for detecting latent fingerprints on nonporous surfaces. Many articles have been written about cyanoacrylate and fingerprint detection, but it is difficult to find information about the influence of relative humidity on the quality of developed prints while storing items until fuming. The influence of humidity (30 percent, 54 percent, and 80 percent) while storing items at room temperature for a period of up to 6 months before fuming was tested. The results indicate that the influence measured is negligible.

Keywords
Not indicated by the author(s)

Sguazzi, G., Lovisolo, F., & Gino, S. (2019). Is Genomic DNA extracted and stored at -20 degrees C for long time useful in forensic field? *Forensic Science International: Genetics Supplement Series*, *7*(1), 629-631. https://doi.org/10.1016/j.fsigss.2019.10.117

Abstract/Abstract Excerpt
…The aim of this study was to understand whether the DNA extracted and stored for a long time at−20 °C could be useful for new analyses in order to identify the perpetrator of unsolved crimes, especially when evidence is no longer available. We selected 120 DNA samples obtained from evidence collected at crime scene between 2001 and 2010: they were quantified again using Realtime PCR and the "Plexor HY System" kit. The results were compared with those obtained in the past. For 37 samples discrepancies were observed (i.e. positive quantification, identification of male material mixed with female ones). Then these samples were amplified with "AmpFISTR Identifiler Plus" and "PowerPlex ESI 17 Fast System" kits. Genetic profiles useful for a comparison were obtained for all the 37 analyzed samples. In 5 samples mixed profiles were highlighted, unlike what was obtained in the past, and in addition, in 28 cases, where no genetic profile was previously typed, a genetic profile was also identified. The study shows how it is possible, even after a considerable time interval, to still obtain genetic profiles useful for a comparison, as well as the possibility of typing new ones…

Keywords
cold case, DNA storage, STR typing, forensic genetics

Shorter, L., & Madland, G. (2019). `Let them have it!' A review of the retention and storage of, and access to, material post-conviction in England and Wales. *Medicine, Science and the Law*, *59*(4), 223-231. https://doi.org/10.1177/0025802419857850

Abstract/Abstract Excerpt
Records kept, physical material seized, samples taken and extracts derived during a criminal investigation are retained post-conviction in case they could assist a subsequent appeal against conviction. Forensic evidence is the application of scientific analysis to the law. Its presentation in court involves not just the material itself but a suitably learned scientist's opinion of its significance, and that opinion may be called into question, scientific understanding being in constant flux. Scientific opinion presented in court today may be superseded tomorrow – a powerful argument for the retention of all material which could be subjected to new tests or interpretation in the light of new information. But are exhibits being retained appropriately? A Freedom of Information request to all police forces in England and Wales was undertaken to ascertain their retention practices. The far-from-uniform results are presented and discussed here, along with policy recommendations.

Keywords
expert witness, forensic DNA, law, legal system, crime scene investigation (CSI)

Silva, J. O. M., Santos, L. F. S., dos Santos, S. M., da Silva, D. P., Santos, V. S., & de Melo, C. M. (2020). Preservation of forensic evidence by nurses in a prehospital emergency care service in Brazil. *Journal of Trauma Nursing*, *27*(1), 58-62. https://doi.org/10.1097/JTN.0000000000000483

Abstract/Abstract Excerpt
…Nurses increasingly must perform forensic procedures with the responsibility to collect, document, preserve, and store evidence that may be used in the investigation of a violent crime. However, few nurses receive education in forensic evidence collection as part of their training. This study aimed to evaluate the relationship between nurses' knowledge and performance of forensic evidence procedures. This is a descriptive survey study of nurses working in a prehospital emergency care service in Aracaju, Brazil. A 32-question survey related to forensic evidence knowledge and procedures was completed by 128 nurses. Descriptive statistics and Kendall's Tau-b were used to describe the sample and evaluate correlations. Results revealed an overall linear relationship between knowledge and performance of forensic evidence procedures (r = .69). The strongest correlation was between knowledge and documentation (r = .71). Weaker correlations were demonstrated between knowledge and evidence collection (r = .47), evidence preservation (r = .47), and overall evidence procedure execution (r = .53). Forensic nursing knowledge is related to forensic evidence procedure performance. Although the study showed that nurses agreed forensic evidence procedures are important

for criminal investigations, most reported they were unprepared to carry out these procedures. The need for additional training and adherence to established institutional protocols are identified as contributing factors.

Keywords
crime scene, forensic evidence, nurses

Sisco, E., Najarro, M., Bridge, C., & Aranda, R. t. (2015). Quantifying the degradation of TNT and RDX in a saline environment with and without UV-exposure. *Forensic Science International*, *251*, 124-131. https://doi.org/10.1016/j.forsciint.2015.04.002

Abstract/Abstract Excerpt
Terrorist attacks in a maritime setting…or the detection of underwater mines, require the development of proper protocols to collect and analyze explosive material from a marine environment. In addition to proper analysis of the explosive material, protocols must also consider the exposure of the material to potentially deleterious elements, such as UV light and salinity, time spent in the environment, and time between storage and analysis. To understand how traditional explosives would be affected by such conditions, saline solutions of explosives were exposed to natural and artificial sunlight. Degradation of the explosives over time was then quantified using negative chemical ionization gas chromatography mass spectrometry (GC/NCI-MS). Two explosives, trinitrotoluene (TNT) and cyclotrimethylenetrinitramine (RDX), were exposed to different aqueous environments and light exposures with salinities ranging from freshwater to twice the salinity of ocean water. Solutions were then aged for up to 6 months to simulate different conditions the explosives may be recovered from. Salinity was found to have a negligible impact on the degradation of both RDX and TNT. RDX was stable in solutions of all salinities while TNT solutions degraded regardless of salinity. Solutions of varying salinities were also exposed to UV light, where accelerated degradation was seen for both explosives…

Keywords
degradation, explosives, mass spectrometry, saltwater

Sisco, E., Najarro, M., Samarov, D., & Lawrence, J. (2017). Quantifying the stability of trace explosives under different environmental conditions using electrospray ionization mass spectrometry. *Talanta*, *165*, 10-17. https://doi.org/10.1016/j.talanta.2016.12.029

Abstract/Abstract Excerpt
This work investigates the stability of trace (tens of nanograms) deposits of six explosives: erythritol tetranitrate (ETN), pentaerythritol tetranitrate (PETN), cyclotrimethylenetrinitramine (RDX), cyclotetramethylenetetranitramine (HMX),

2,4,6-trinitrotoluene (TNT), and 2,4,6-trinitrophenylmethylnitramine (tetryl) to determine environmental stabilities and lifetimes of trace level materials. Explosives were inkjet printed directly onto substrates and exposed to one of seven environmental conditions (Laboratory, -4°C, 30°C, 47°C, 90% relative humidity, UV light, and ozone) up to 42 days. Throughout the study, samples were extracted and quantified using electrospray ionization mass spectrometry (ESI-MS) to determine the stability of the explosive as a function of time and environmental exposure. Statistical models were then fit to the data and used for pairwise comparisons of the environments. Stability was found to be exposure and compound dependent with minimal sample losses observed for HMX, RDX, and PETN while substantial and rapid losses were observed in all conditions except -4°C for ETN and TNT and in all conditions for tetryl. The results of this work highlight the potential fate of explosive traces when exposed to various environments.

Keywords
degradation, environmental stability, mass spectrometry, trace explosives

Smithsonian Museum Conservation Institute. (2009). *Climate and Textile Storage*. https://www.si.edu/mci/english/learn_more/taking_care/geotex.html

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

South Eastern and Eastern Europe Clearinghouse for the Control of Small Arms and Light Weapons. (2007). *Ammunition and Explosives Storage and Safety*. In (5th Edition ed.). https://www.seesac.org/f/docs/Standards-RMDSG/RMDS-05.40-Ammunition-Storage-Edition-4.pdf

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

State of Utah Office of the State Auditor. (2019). *An Audit of Evidence Storage and Management Among Selected Utah District and Juvenile Courts*. https://reporting.auditor.utah.gov/servlet/servlet.FileDownload?file=0151K000003deG8QAI

Abstract/Abstract Excerpt
(from Background) The objective of this review was to determine the extent to which the Court System has established appropriate controls over the handling and storing of evidence, with particular emphasis on money, firearms, and controlled substances. We sampled six district courts and three juvenile courts. We reviewed each court's controls, policies, and procedures for compliance with applicable state statutes and application of industry best practices. A key measure used to determine whether a court has established adequate controls over its evidence function is the number of missing items, which can be determined by conducting an inventory. However, due to the inadequacy of the courts' evidence management practices, we were unable to conduct an inventory.

Keywords
Not indicated by the author(s)

Stevens, B. (2017). *Comprehensive modernization of firearm discharge residue analysis; advanced analytical techniques, complexing agents, and tandem mass spectrometry*. Graduate Theses, Dissertations, and Problem Reports.
https://researchrepository.wvu.edu/etd/6726

Abstract/Abstract Excerpt
…This research investigated three analytical techniques for the detection of FDR; (1) ion mobility spectrometry (IMS), (2) thermal desorption gas chromatography mass spectrometry (TD-GC/MS), and (3) electrospray ionization tandem mass spectrometry (ESI-MSn)… Mass spectral intensities were used to determine the binding selectivities of the metals to the crown ether and in turn the preferential binding of the target metals. Additionally, preliminary molecular modeling provided insight into some experimental observations. Overall, three methods were evaluated in an effort to modernize the analysis of firearm discharge residues and in doing so increase the evidentiary value. IMS and thermal desorption GC/MS proved adequate as screening methods for OGSR and while additional work is required, ESI-MSn proved promising for detecting complexed GSR metals. The advantage of coupling ESI-MSn and complexation is that it allows for the dual detection of OGSR and GSR. While modernizing analysis is key to increasing the evidentiary value it is apparent that coupling the detection of OGSR and GSR is the future of FDR analysis.

Keywords
gunshot residue, firearm discharge residue, ion mobility spectrometry, thermal desorption, ESI, complexing, crown ether

Stoney, D. A., Bowen, A. M., Ausdemore, M., Stoney, P. L., Neumann, C., & Stoney, F. P. (2019). Differential analysis of very small particles (VSP) from the contact surfaces and recessed areas of footwear. *Forensic Science International*, *298*, 106-114. https://doi.org/10.1016/j.forsciint.2019.02.032

Abstract/Abstract Excerpt
…Here we conduct differential analysis of VSP recovered separately from contact and recessed surfaces, following a controlled series of environmental exposures. Work boots and tennis shoes were exposed by walking distances of 250 m, sequentially, in three environmental sites. VSP were harvested separately from contact and recessed surfaces using a moist swabbing procedure. VSP were analyzed by microscopy and the proportions attributable to each site were determined using a newly developed statistical model. The principal findings are (1) contact surfaces of footwear are dominated by VSP attributable to the most recent site of exposure, (2) recessed surfaces of footwear retain VSP from prior exposures, (3) sole type appears to be a source of major differences in the amount of VSP from prior exposures remaining in recessed areas, and (4) when VSP attributable to prior exposures are found, there is no clear trend for dominance between earlier exposures…

Keywords
trace evidence, footwear, very small particles, transfer, differential analysis, particle combination analysis

Strom, K. J., Hickman, M. J., & Ropero-Miller, J. D. (2011). Evidence Retention Policies in U.S. Law Enforcement Agencies: Implications for Unsolved Cases and Postconviction DNA Testing. *Journal of Contemporary Criminal Justice*, *27*(2), 133-148. https://doi.org/10.1177%2F1043986211405835

Abstract/Abstract Excerpt
The use of forensic evidence in the criminal justice system has grown appreciably in the United States. Yet policies that dictate how state and local agencies maintain and store forensic evidence have not kept pace. This study examined the prevalence of evidence retention policies, as well as storage locations and tracking systems, in a nationally representative sample of state and local law enforcement agencies. Less than half of U.S. police departments have a policy for preserving biological evidence from convicted offenders. Among agencies having a policy, the responsibility for retaining evidence was most commonly placed with the investigating law enforcement agency. Implications of these findings and policy directions are discussed.

Keywords
forensic science, law enforcement, forensic evidence, postconviction testing, evidence retention, storage capacity

Scientific Working Group for Shoeprint and Tire Tread Evidence. (2007). Guide for Casting Footwear and Tire Impressions. https://www.nist.gov/system/files/documents/2016/10/26/swgtread_11_guide_for_casting_footwear_and_tire_impression_evidence_200703.pdf

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

Scientific Working Group for Shoeprint and Tire Tread Evidence. (2013). Standard for Terminology Used for Forensic Footwear and Tire Impressions. http://treadforensics.com/index.php/standards/swgtread

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

T

Taudte, R. V., Roux, C., & Beavis, A. (2017). Stability of smokeless powder compounds on collection devices. *Forensic Science International*, *270*, 55-60. https://doi.org/10.1016/j.forsciint.2016.11.027

Abstract/Abstract Excerpt
The current trend towards the implementation of organic gunshot residue (OGSR) analysis into gunshot residue (GSR) investigation protocols typically involves the sequential analysis of inorganic and organic GSR. However, to allow for the consecutive analysis of inorganic and organic GSR, specimens will often be stored for different lengths of time which may result in compounds of interest degrading. In order to optimize storage conditions, it is important to consider compound degradation on collection devices during storage. This study investigated the degradation over time of compounds potentially present in smokeless powders and OGSR on two collection devices, alcohol swabs and GSR stubs. Over a period of 63 days, the highest degree of degradation was found in the first four days. Interestingly, energetic compounds were generally found to be more stable than smokeless powder additives such as stabilizers including diphenylamine and ethyl centralite, which might be problematic considering that these compounds are common targets for OGSR. The findings can provide valuable information to operational forensic laboratories to optimize their storage durations.

Keywords
gunshot residues, GSR stubs, alcohol swabs, storage duration, degradation

Technical Working Group on Fire/Arson Scene Investigation. (2000). *Fire and arson scene evidence: A guide for public safety personnel*. National Institute of Justice, U.S. Department of Justice. https://www.ojp.gov/pdffiles1/nij/181584.pdf

Abstract/Abstract Excerpt
(from the Preface) It is the intention of this Guide to acquaint a broad spectrum of public safety personnel with the fire investigation process, so they may understand their role in this important task and help identify, locate, and preserve evidence in its varied forms, to either assist a specialist investigator when one is needed or to adequately document and collect evidence when no assistance is needed or available. This Guide focuses on the documentation and collection of physical evidence at fire/arson scenes. Other issues of investigation—such as insurance inquiries, background information, fire deaths, the interpretation of fire dynamics and physical evidence, and case analysis and profiling—are not addressed in this document.

Keywords
Not indicated by the author(s)

Topoleski, J. J., & Christensen, A. M. (2019). Use of a Gelatin-based Consolidant to Preserve Thermally-Altered Skeletal Remains. *Journal of Forensic Sciences*, *64*(4), 1135-1138. https://doi.org/10.1111/1556-4029.14019

Abstract/Abstract Excerpt
Thermally altered skeletal remains can be very fragile and fragmented and are typically further fragmented or even destroyed when handled; recovery of such remains from a scene can therefore be extremely challenging. There are few recommendations and no generally accepted practices for preserving burned bone for recovery and transport. Here, we test whether the application of a gelatin-based consolidant at the scene can preserve thermally altered bone in the condition and relative anatomical position in which it was discovered. A solution of Knox® brand gelatin and water was applied to burned pig mandibles using a spray bottle. Qualitative and quantitative analysis indicates that the application of the consolidant significantly decreased fragmentation as compared to untreated controls ($p < 0.05$), with most of the treated mandibles remaining completely intact after recovery and transport to a secondary location. In addition to the effectiveness for preservation, the method is also easy to apply, inexpensive, and reversible.

Keywords
Forensic science, forensic anthropology, fire scene, recovery, burned bone, preservation

Trozzi, T. A., Schwartz, Rebecca, L., & Hollars, M. L. (2000). *Processing Guide for Developing Latent Prints*. U.S. Department of Justice, Federal Bureau of Investigation, Laboratory Division. https://archives.fbi.gov/archives/about-us/lab/forensic-science-communications/fsc/jan2001/lpu.pdf

Abstract/Abstract Excerpt
(Introduction) The identification of latent print evidence is often key in solving a crime. A latent print results from the reproduction of friction ridges found on parts of the fingers, hands, and feet. These prints consist of a combination of different chemicals that originate from natural secretions, blood, and contaminants. Natural secretions mainly derive from the eccrine and sebaceous glands and contain known chemical components. Eccrine gland secretions from the fingers, hands, and feet are both organic and inorganic, but only organic materials are secreted from the sebaceous glands. Other contaminants found in prints result from contact with different materials in the environment. Latent prints can be found on all types of

surfaces. In general, surfaces can be characterized as porous, nonporous, or semiporous. Understanding these characteristics will aid in processing an item for latent prints. The beginning of this manual is a list of processes and procedures for different surface types. Also included are processing sequences that specifically involve prints that are left in blood. Following these lists are details for each process that is currently implemented in the Latent Print Unit (LPU) of the Federal Bureau of Investigation (FBI) Laboratory.

Keywords
Not indicated by the author(s)

Tsanaclis, L., Bagley, K., Bevan, S., & Wicks, J. (2020). The effect of prolonged storage time on the stability of fatty acid ethyl esters in hair samples. *Journal of Analytical Toxicology*, *44*(8, SI), 829-833. https://doi.org/10.1093/jat/bkaa026

Abstract/Abstract Excerpt
… Although stability of drugs and EtG in hair samples is documented to a certain extent, stability of FAEEs in hair samples after collection has not been reported. This study covered hair samples that had been tested for FAEEs on the day of arrival at the laboratory and retested between 4 and 80 months later. The statistical analysis of the data set reveals significant lower FAEEs levels including ethyl palmitate (EtPa) ester levels when samples were retested for the second time after 6 days of storage under ideal conditions. Specifically, the results suggest that when measuring total FAEEs or solely EtPa in hair samples, the elapsed time between sample collection and analysis of the sample needs to be considered when interpreting the results. The recommendation is that whenever hair samples need to be tested for total FAEEs or EtPa, the analytical procedure needs to be performed within 1 week after collection in order to obtain meaningful results. The study results substantiate the case for the use of hair samples solely for the analysis of EtG, in conjunction with other measurements such as full blood count, carbohydrate-deficient transferrin test, liver function test or phosphatidylethanol alongside clinical assessment for a more effective evaluation of alcohol consumption.

Keywords
Not indicated by the author(s)

U

University of Pennsylvania, Environmental Health & Radiation Safety. (2021). *Lithium Battery Safety Program*. https://ehrs.upenn.edu/sites/default/files/2021-02/Lithium%20Battery%20Safety%20Program%202021.pdf

Abstract/Abstract Excerpt
(from Background Information) Lithium-based batteries, especially lithium-ion and lithium-polymer rechargeable batteries, have become highly popular due to their favorable power to weight ratio and the fact that lithium-polymer batteries can be configured in various shapes and sizes. Lithium batteries are quite safe, however if damaged or used without proper care, can overheat, ignite, and burn aggressively. Lithium battery users must be acquainted with their unique vulnerabilities. The most important safety consideration for lithium-ion and lithium-polymer batteries is to treat the battery as if it will ignite at any time. Even though the odds are remote, if each battery is segregated from combustible materials during storage, charging, and in use, in the rare possibility that a fire does occur, the odds are better that it will be limited to the battery itself.

Keywords
Not indicated by the author(s)

V

Van Der Walt, J., & Luke, R. (2011). The storage of forensic evidence at the Forensic Science Laboratory in Pretoria, South Africa. *Journal of Transport and Supply Chain Management*, *5*(1), 202-220. http://dx.doi.org/10.4102/jtscm.v5i1.74

Abstract/Abstract Excerpt
One of the cornerstones of the judicial process is the presentation of evidence in a court of law. The integrity of evidence is vital to reassure the courts that the correct procedures were followed throughout all the processes it was subjected to. In South Africa, the Forensic Science Laboratory (FSL) in Pretoria analyses and stores evidence. The storage facility within the FSL should contribute to the prevention of evidence contamination or degradation thereby also leading to improved service quality and output to its customers. The proper delivery of evidence can lead to the conviction of suspects and to the freedom of the innocent. This study investigates the storage facilities at the FSL to determine whether these are appropriate to ensure the integrity of evidence throughout all the processes it goes through and to recommend actions to continue to add value to the judicial system.

Keywords
Not indicated by the author(s)

Velasquez, C. (2017). Evidence Tracking and Secure Storage. In *Forensic Evidence Management*. Taylor and Francis. ISBN 9781315154916

Abstract/Abstract Excerpt
This chapter reviews the options for tracking evidence, importance of a secure storage location and the need for written policy. These factors impact the integrity of an evidentiary item and the successful prosecution of a court case. An agency must have established policies and procedures for these practices and provide staff with the equipment and training needed to comply. Examples of packaging materials, storage types and documentation methods are discussed in this chapter. Tracking technology and available storage will vary between agencies; however, limitations do not prevent the establishment of standards. An agency's administration needs to stay vigilant to the changes in best practices in order to review and update policies and procedures effectively.

Keywords
Not indicated by the author(s)

Virginia Department of Forensic Science. (2005). Collection and Submission of Meth Lab Materials to DFS. In *Best Practices protocol for use by law enforcement and emergency response agencies regarding the clean-up of abandoned and deactivated methamphetamine production sites and the retention and handling of the byproducts of methamphetamine production.* https://www.dfs.virginia.gov/wp-content/uploads/2013/09/methLabsProtocolExcerpt.pdf

Abstract/Abstract Excerpt
Not indicated by the author(s)

Keywords
Not indicated by the author(s)

Virginia Department of Forensic Science. (2017). *Evidence Handling and Laboratory Capabilities Guide.* https://www.dfs.virginia.gov/documentation-publications/evidence-handling-and-laboratory-capabilities-guide/

Abstract/Abstract Excerpt
(from landing page introduction) This Evidence Handling and Laboratory Capabilities Guide is intended to promote the maximum use of physical evidence and encourage greater utilization of the services of the Virginia Department of Forensic Science (DFS). The objective of this Guide is to provide practical information concerning how the Forensic Laboratory can assist in criminal investigations, and procedures for the collection, preservation, and submission of physical evidence, available to law enforcement personnel. This Guide is intended for use only by those entities served by DFS and listed in the Code of Virginia under § 9.1-1101(A).

Keywords
Not indicated by the author(s)

Virginia Department of Forensic Science. (2020). Evidence Handling & Laboratory Capabilities Guide: Firearms & Tookmarks. In *Evidence Handling and Laboratory Capabilities Guide.* https://www.dfs.virginia.gov/wp-content/uploads/2020/11/Firearms-2020-04.pdf

Abstract/Abstract Excerpt
(from Overview) Examiners in the Firearms and Toolmarks Section examine firearms and ammunition components in an attempt to associate a particular firearm as having fired particular ammunition components, through microscopic comparison. The section also examines tools and tool marks to determine if the submitted tool can be associated with a submitted toolmark.

Keywords
Not indicated by the author(s)

W

White, R. M., Sr., Mitchell, J. M., Hart, E. D., Evans, A., Meaders, M., Norsworthy, S. E., . . . Rogers, K. (2018). Assessment of the stability of DNA in specimens collected under conditions for drug testing-A pilot study. *Forensic Science International*, *283*, 41-46. https://doi.org/10.1016/j.forsciint.2017.11.011

Abstract/Abstract Excerpt
For forensic biological sample collections, the specimen donor is linked solidly to his or her specimen through a chain of custody (CoC) sometimes referenced as a chain of evidence. Rarely, a donor may deny that a urine or oral fluid (OF) specimen is his or her specimen even with a patent CoC. The goal of this pilot study was to determine the potential effects of short-term storage on the quality and quantity of DNA in both types of specimen under conditions that may be encountered with employment-related drug testing specimens. Fresh urine and freshly collected oral fluid all produced complete STR profiles. For the “pad” type OF collectors, acceptable DNA was extractable both from the buffer/preservative and the pad. Although fresh urine and OF produced complete STR profiles, partial profiles were obtained after storage for most samples. An exception was the DNA in the Quantisal OF collector, from which a complete profile was obtained for both freshly collected OF and stored OF.

Keywords
saliva, urine, oralEASE, Intercept i2, Quantisal, STR

Wicklund, D. *Caring for Your Collectible Firearms*. NRA Museums. Retrieved July 22, 2019 from http://www.nramuseum.org/media/1007361/caring%20for%20your%20collectible%20firearms%20by%20doug%20wicklund.pdf

Abstract/Abstract Excerpt
(from document introduction) This short handbook has been designed to give you the best chance to make the most of your collection and keep it in the best possible condition. Any firearm can develop common problems, problems that can directly affect your enjoyment of it as a fine collectible, prime investment or treasured shooting iron. It doesn’t matter what you collect – these general rules of thumb will make the difference in whether you have a collection or not in the long run.

Keywords
Not indicated by the author(s)

Williams, D. W., & Gibson, G. (2016). Individualization of pubic hair bacterial communities and the effects of storage time and temperature. *Forensic Science International: Genetics*, *26*, 12-20. https://doi.org/10.1016/j.fsigen.2016.09.006

Abstract/Abstract Excerpt
A potential application of microbial genetics in forensic science is detection of transfer of the pubic hair microbiome between individuals during sexual intercourse using high-throughput sequencing. In addition to the primary need to show whether the pubic hair microbiome is individualizing, one aspect that must be addressed before using the microbiome in criminal casework involves the impact of storage on the microbiome of samples recovered for forensic testing. To test the effects of short-term storage, pubic hair samples were collected from volunteers and stored at room temperature (~20 °C), refrigerated (4 °C), and frozen (–20 °C) for 1 week, 2 weeks, 4 weeks, and 6 weeks along with a baseline sample… Individual microbial profiles (R2 = 0.69) and gender (R2 = 0.17) were the greatest sources of variation between samples...There was no statistically significant difference attributable to time of sampling or temperature of storage within individuals. Further work on larger sample sets will quantify the temporal consistency of individual profiles and define whether it is plausible to detect transfer between sexual partners. For short-term storage (≤6 weeks), recovery of the microbiome was not affected significantly by either storage time or temperature, suggesting that investigators and crime laboratories can use existing evidence storage methods.

Keywords
bacterial forensics, human microbiome, hair microbiology, microbial ecology, storage

Williams, M. R., & Sigman, M. (2007). Performance testing of commercial containers for collection and storage of fire debris evidence. *Journal of Forensic Sciences*, *52*(3), 579-585. https://doi.org/10.1111/j.1556-4029.2007.00435.x

Abstract/Abstract Excerpt
Fire debris evidence may contain ignitable liquid residues valuable in the investigation of a potential arson scene. The ability to obtain evidence containers that are contaminant-free and vapor-tight is essential to the analysis and storage of fire debris evidence. Commercial containers such as metal “paint” cans, glass mason jars, and polymer bags are often employed as fire debris evidence containers. The purpose of this research was to determine which of these three types of containers provided the most vapor-tight seal for the prevention of ignitable liquid vapor loss and to assess the potential for cross-contamination. Leak rates for each type of container were measured under controlled conditions…Quantitation of the hydrocarbons recovered from activated charcoal was calculated using external

standard calibration curves following analysis by gas chromatography–mass spectrometry. The results demonstrated that glass jars had the fastest leak rate followed by metal paint cans and properly heat-sealed polymer bags with the slowest leak rate. Each container exhibited a different leak mechanism, which resulted in an observable effect on the composition of hydrocarbons lost from the container. Hydrocarbon transfer from one container to another is also demonstrated. This study presents results that reveal the most vapor-tight container to be a properly heat-sealed copolymer bag.

Keywords
forensic science, fire debris, evidence container

Williams, S. R., Taylor, M. K., Mehta, A., & Jeffrey, I. (2014). *RFID Technology in Forensic Evidence Management: An Assessment of Barriers, Benefits, and Costs*. NIST. https://www.nist.gov/publications/rfid-technology-forensic-evidence-management-assessment-barriers-benefits-and-costs

Abstract/Abstract Excerpt
Forensic science laboratories and law enforcement agencies have increasingly used automated identification technology (AIT), such as barcoding and radio frequency identification (RFID), to track and manage forensic evidence, firearms, and personnel. AIT streamlines the capture, collection, and transfer of data to track assets and people. RFID technology provides enhanced capabilities including precise location, environmental measurements, and automatic real-time updates of the position and condition of assets in an inventory. The need for further information on the use of AIT in evidence management was identified by the Technical Working Group on Biological Evidence Preservation. During its deliberations, the working group commissioned a small study to gain a better understanding of the capabilities of advanced technologies to improve tracking and preservation of evidence.

Keywords
automated identification, RFID, forensic, forensic science, evidence, evidence management

Woods, B., Lennard, C., Kirkbride, K. P., & Robertson, J. (2016). Soil examination for a forensic trace evidence laboratory-Part 3: A proposed protocol for the effective triage and management of soil examinations. *Forensic Science International*, *262*, 46-55. https://doi.org/10.1016/j.forsciint.2016.02.034

Abstract/Abstract Excerpt
In the past, forensic soil examination was a routine aspect of forensic trace evidence

examinations. The apparent need for soil examinations then went through a period of decline and with it the capability of many forensic laboratories to carry out soil examinations…We argue the need to reinstate soil examinations as a trace evidence sub-discipline within forensic science laboratories and present a pathway to support this aim. An examination procedure is proposed that includes: (i) appropriate sample collection and storage by qualified crime scene examiners; (ii) exclusionary soil examinations by trace evidence scientists within a forensic science laboratory; (iii) inclusionary soil examinations by trace evidence scientists within a forensic science laboratory; and (iv) higher-level examination of soils by specialist soil scientists and palynologists. Soil examinations conducted by trace evidence scientists will be facilitated if the examinations are conducted using the instrumentation routinely used by these examiners. Hence, the proposed examination protocol incorporates instrumentation in routine use in a forensic trace evidence laboratory. Finally, we report on an Australian soil scene variability study and a blind trial that demonstrate the utility of the proposed protocol for the effective triage and management of soil samples by forensic laboratories.

Keywords
forensic, soils, trace, geology, evidence triage

Wu, F., Marin, S. J., & McMillin, G. A. (2017). Stability of 21 Cocaine, Opioid and Benzodiazepine Drug Analytes in Spiked Meconium at Three Temperatures. *Journal of Analytical Toxicology*, *41*(3), 196-204. https://doi.org/10.1093/jat/bkw113

Abstract/Abstract Excerpt
In this study, the stability of 21 cocaine, opioid and benzodiazepine analytes in spiked meconium was investigated at three storage temperatures: 4°C, room temperature (RT), and 37°C (body temperature). The drugs/metabolites included were hydrocodone, hydromorphone, codeine, morphine, 6-acetylmorphine (6-AM), oxycodone, oxymorphone, cocaine, cocaethylene, benzoylecgonine, m-hydroxybenzoylecgonine, diazepam, oxazepam, temazepam, nordiazepam, chlordiazepoxide, lorazepam, alprazolam, alpha-hydroxyalprazolam, clonazepam, 7-aminoclonazepam, midazolam, alpha-hydroxymidazolam and zolpidem. Drug testing was performed using mass spectrometry methods that were validated for clinical use... After 2 weeks of storage, a substantial loss was observed in the concentrations of 7-aminoclonazepam (48.4% at 4°C and 71.5% at RT), and chlordiazepoxide (59.5% at RT). A slight decrease was observed in the concentrations of alprazolam (20.9% at 4°C), clonazepam (24.5% at 4°C), chlordiazepoxide (23.5% at 4°C), midazolam (20.8% at 4°C), nordiazepam (22.8% at RT), and alpha-hydroxyalprazolam (20.7% at 4°C). At 37°C, the concentrations of chlordiazepoxide, 7-aminoclonazepam, lorazepam, oxazepam, nordiazepam and temazepam decreased by 81.4%, 86.8%, 56.5%, 59.9%, 45.4% and 31.7%, respectively, after 2 weeks. 6-AM was observed to be unstable

regardless of storage temperatures. For morphine, a 33.3% increase at 4°C and a 23.4% increase at RT were observed after 2 weeks, respectively, possibly due to 6-AM degradation, while no changes ≥20% were observed at 37°C...

Keywords
Not indicated by the author(s)

X

No entries.

Y

Yamashita, B., French, M., Bleay, S., Cantu, A., Inlow, V., Ramotowski, R., . . . Wakefield, M. (2011). Latent Print Development. In *Fingerprint Sourcebook*. National Institute of Justice. https://nij.ojp.gov/library/publications/fingerprint-sourcebook

Abstract/Abstract Excerpt
The Fingerprint Sourcebook is the definitive guide to the science of fingerprint identification.

Keywords
Not indicated by the author(s)

Yu, H. A., DeTata, D. A., Lewis, S. W., & Nic Daeid, N. (2017). The stability of TNT, RDX and PETN in simulated post-explosion soils: Implications of sample preparation for analysis. *Talanta*, *164*, 716-726. https://doi.org/10.1016/j.talanta.2016.07.001

Abstract/Abstract Excerpt
Explosives residues in soils may be a useful source of evidence following the detonation of an improvised explosive device (IED)…Soil samples collected from the vicinity of an explosion scene will often be stored for some time prior to analysis, yet explosives residues in soil samples are susceptible to rapid degradation or transformation. Although some research has assessed the use of different storage temperatures with a view to reducing explosives' degradation over time, further research examining the degradation of explosives in soil when stored under a variety of storage conditions is crucial to determine the optimal sample collection and storage procedures for soil containing explosives residues. In this work, three different soils were spiked with solutions of TNT, RDX and PETN and stored either at room temperature, refrigerated or frozen. Samples were extracted over 6 weeks, with additional samples gamma-irradiated or nitrogen purged prior to storage. Experimental results indicate that TNT underwent very rapid degradation at room temperature, attributed to microbial action, whereas PETN and RDX proved to be more stable. Gamma irradiation and nitrogen purging proved of some benefit for mitigating TNT degradation, with lower storage temperatures ultimately proving the most effective method of mitigating degradation.

Keywords
forensic analysis, explosives, soil, degradation, liquid chromatography

Z

Zamboni, C. B., Redigolo, M. M., Miura, V. T., Costa, I., Nagai, M. L. E., Salvador, P. A. V., & Giovanni Nogueira da Silva, D. (2021). Non-destructive analysis in the study of historical photographs by pXRF and ATR-FTIR spectroscopies. *Journal of Forensic Sciences, 66*(3), 1048-1055. https://doi.org/10.1111/1556-4029.14680

Abstract/Abstract Excerpt
…This work presents a suite of portable, non-destructive, and complementary analytical techniques, energy dispersive x-ray fluorescence (EDXRF), Fourier transform infrared (FTIR) spectroscopies, and brightfield microscopy, applied to the analysis of historical photographs depicting São Paulo city architecture, whose registration date and process of fabrication are unknown. The EDXRF analysis emphasizes the use of typical POP (printing-out paper) photograph with baryta (BaSO4) coated paper substrate while the FTIR and microscopy analyses confirm the presence of collodion and a gelatin-based baryta layer. This photographic process was widely employed by professional photographers from 1889 to 1930, when it was gradually abandoned in commercial use…In conclusion, employing complementary techniques (elemental and molecular spectroscopies and image magnification) is essential in identifying the manufacturing materials of cultural heritage material, which is the basis of contemporary authentication procedures. These data provide to curators and historians fundamental information for cataloging, adding subsidies for the correct storage and preservation (“heritage appreciation”). Still, for professional photographers, they present information on the manufacturing processes of historical photographs. The data from the present study also emphasize its perspective of use in graphic arts to aid connoisseurship in identifying forgeries during provenance and authentication studies.

Keywords
art forensics, cultural heritage, non-destructive analytical techniques, provenance

Zecevic, B., Zecevic, N. S., Terzic, J., & Sain, M. (2015). *Researching Influence of climatic environmental parameters on performance of large caliber ammunition during storage*. ICOEST 1st International Conference on Environmental Science and Technology, Sarajevo, Bosnia and Herzegovina.

Abstract/Abstract Excerpt
Influences of environment on ammunition and weapon performance are the subject of continuous research to be able to estimate lifetime of ammunition and establishing quality control. Researching about causes of failure and cancellation of mechanism on some part of ammunition as warhead, cartridge with propellant,

primer, fuses and pyrotechnics components are intensively continuing to implement. Temperature and humidity of environment are the main parameters that influence on performance of ammunition during storage. Available date about climatic environmental influence during storage of ammunition and detection of factors that influence on the lifetime of ammunition are relatively scant. Measurements of temperature and relatively humidity are taken at three geographical locations with different atmospheric parameters on specific warehouses during all four seasons. Temperature and humidity changes are measured outside and inside of warehouse. At the same time, temperature and humidity changes are measured inside of ammunition box and inside of tight fiber container with ammunition. Measurement results are very interesting and require continuous measurements for a longer period. There is necessity to make a model for heat and mass transfer in a complex package of ammunition, which is consisted of inner and outer packaging.

Keywords
ammunition, lifetime, shelf-life, storage, temperature, humidity

Zin, T., Bandhaya, A., & Panvisavas, N. (2019). Tissue storage solution for preservation and transfer of forensic specimen in high ambient-temperature. *Forensic Science International: Genetics Supplement Series*, *7*(1), 182-184. https://doi.org/10.1016/j.fsigss.2019.09.071

Abstract/Abstract Excerpt
Storage of tissue samples in high ambient-temperature can affect the quality of forensic evidence. Experiments were conducted to investigate the potential use of 3 tissue storage solutions for the preservation and transfer of forensic specimen in high ambient temperature conditions, i.e., DMSO, Longmire's buffer, and trehalose solution. Results showed that DNA in tissue was best preserved in DMSO buffer. Samples preserved in Longmire's buffer gave DNA analysis results for temperatures up to 60 °C, however, amplification between replications were not reproducible. For those tissue samples preserved in trehalose solution, DNA markers larger than 300 bp were absent, and irreproducible amplification results were detected at a higher level when the storage temperature increased, and storage time was over 2 weeks. Tissue storage condition at high temperature over 1 week is not recommended. Experimental results here provided an alternative collection and preservation method for tissue samples at ambient temperature (without cold-storage) for subsequent DNA analysis. These can potentially be implemented in forensic biological evidence collection, preservation and transfer in hot climates.

Keywords
high-ambient temperature, tissue storage, DNA analysis

Zörntlein, S. W., Kopp, A., Becker, J., Kaufmann, T. J., Röhrich, J., & Urban, R. (2012). In vitro production of GHB in blood and serum samples under various storage conditions. *Forensic Science International*, *214*(1-3), 113-117. https://doi.org/10.1016/j.forsciint.2011.07.030

Abstract/Abstract Excerpt

The in vitro production of GHB was observed in freshly collected, untreated whole blood samples using glass BD-Vacutainers and polypropylene S-monovettes. GHB concentrations were determined daily over a period of one week and after 3, 6 and 9 weeks again. Furthermore, the GHB concentration in 40 untreated random whole blood samples stored at 4°C for a longer period of time (10 samples 12 month, 10 samples 24 month and 20 samples 36 month) was also determined. For comparison, the in vitro production of GHB in freshly collected and prepared serum samples was observed. GHB serum concentrations were determined three times over a period of one week and once again after six weeks. Sample preparation was performed by means of methanolic extraction following the precipitation of whole blood and serum samples. A methanolic standard calibration was done in a low range of 0.005-0.1 µg/mL (LOD: 0.004, LLOQ: 0.013). For quantification a spiked blood bank serum with a determined GHB concentration of 0.09 µg/mL was used. Corrected calibrations in the range of 0.09-5.09 µg/mL were used (LOD: 0.08 µg/mL, LLOQ: 0.30 µg/mL), recovery: 91.3% (high level: 4.09 µg/mL) 50.5% (low level: 0.19 µg/mL).

Keywords

drug-facilitated sexual assault, gamma-hydroxybutyric acid, GHBIn vitro production, cut off level for exogenous administration of GHB