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### Sleuthing Scientific Evidence Information on the Internet

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# SLEUTHING SCIENTIFIC EVIDENCE INFORMATION ON THE INTERNET

CAROL HENDERSON\* &  
 DIANA BOTLUK\*\*

## TABLE OF CONTENTS

INTRODUCTION.....	60
GENERAL BACKGROUND INFORMATION AND TRAINING IN FORENSIC SCIENCE.....	62
FINDING FORENSIC SCIENCE-RELATED ARTICLES .....	67
FORENSIC SCIENCE ASSOCIATIONS & ORGANIZATIONS.....	69
WEB RESOURCES RELATED TO SPECIFIC FORENSIC SCIENCE TOPICS.....	73
Forensic Pathology.....	73
Forensic Anthropology.....	73
Biometrics .....	74
Forensic Botany .....	75
Toxicology .....	76
Fingerprints .....	77
DNA .....	78
Firearms .....	79
Forensic Odontology.....	80
Questioned Documents .....	81
FINAL THOUGHTS.....	82

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## INTRODUCTION

There is no ignoring the impact of scientific evidence in the legal system today. New developments in science and technology are advancing at a rapid pace. Digital and multimedia sciences, canine scent detection, and touch DNA are just a few of the scientific fields that continue to perplex the justice system as they evolve at an exponential rate. Judges, attorneys, scientists, and law enforcement need to keep abreast of scientific advances. Non-uniformity among forensic laboratory operational and accreditation standards has contributed to the challenge faced by the legal community as a whole. A sturdy framework of interdisciplinary communication and scientific training has become a necessity for the legal and forensic communities to more effectively and reliably use scientific evidence, particularly in criminal prosecutions.

While scientific evidence is a key component of proof in many legal matters, it is not infallible or free from misapprehension. It is the ethical responsibility of judges, attorneys, and expert witnesses to understand and reliably explain this increasingly complex evidence to the jury. The ABA Model Rules of Professional Conduct 1.1 and 1.3 regarding competence and diligence require an attorney to provide reasonably competent representation, which could include seeking expert advice and additional scientific testing.<sup>1</sup> Unrealistic juror expectations of forensic evidence and its accuracy (the so-called “CSI Effect”) has become a prevalent issue among criminal prosecutors and defense attorneys alike.<sup>2</sup> Lawyers need to be aware of the ethical implications of errant experts, and failing to diligently verify the credentials of expert witnesses.<sup>3</sup> Lawyers also need to be prepared to challenge opposing experts in order to test the veracity of an expert witness’ testimony and the scientific principles of his expert opinion.<sup>4</sup> The lawyer who turns a blind eye to these advances and

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<sup>1</sup> MODEL RULES OF PROF’L CONDUCT r. 1.1 and 1.3 (AM. BAR ASS’N 2016); see *Wolfe v. State*, 96 S.W.3d 90 (Mo. 2003) (en banc) (remanding a capital conviction where an attorney was found to be ineffective by failing to test hair sample evidence).

<sup>2</sup> See generally Hon. Donald E. Shelton, Young S. Kim & Gregg Barak, *An Indirect-Effects Model of Mediated Adjudication: The CSI Myth, the Tech Effect, and Metropolitan Jurors’ Expectations for Scientific Evidence*, 12 VAND. J. ENT. & TECH. L. 1 (2009) (explaining the CSI effect and the increasing expectations of jurors regarding scientific evidence).

<sup>3</sup> See MODEL RULES OF PROF’L CONDUCT r. 3.3 cmts. 5–9 (AM. BAR ASS’N 2016) (stating that a lawyer could violate the duty of candor toward the tribunal by offering expert testimony that the lawyer knows or should know is false).

<sup>4</sup> See *Locating, Evaluating & Selecting Expert Witnesses*, NAT’L CLEARINGHOUSE SCI., TECH. & L., <http://leic.tennessee.edu/expertwitness> (last visited May 23, 2016). See generally Carol Henderson & Kurt Lentz, *Expert Witness: Qualifications and Testimony*, in

expectations does so at her own peril and to the detriment of her client and the justice system as a whole.

Congress recognized the importance of scientific evidence to the legal system and called for the creation of an independent forensic science committee at the National Academy of Sciences (NAS) to identify the needs of the forensic science community, including assessing present and future resource needs of labs, medical examiner, and coroner offices; identifying potential scientific advances that will assist law enforcement in using forensic technologies; and determining how to disseminate best practices and guidelines to ensure quality and consistency in the use of technologies and techniques.<sup>5</sup> This effort resulted in the report *Strengthening Forensic Science in the United States: A Path Forward* (NAS Report).<sup>6</sup>

The NAS Report noted that “[l]awyers and judges often have insufficient training and background in scientific methods, and they often fail to fully comprehend the approaches employed by different forensic science disciplines and the strengths and vulnerabilities of forensic science evidence offered during trials.”<sup>7</sup> Additionally, the NAS Report stated:

The fruits of any advances in the forensic science disciplines should be transferred directly to legal scholars and practitioners, . . . members of the judiciary, and [other members of the justice system] . . . so that appropriate adjustments can be made in criminal and civil laws and procedures, model jury instructions, law enforcement practices, litigation, strategies, and judicial decision making.<sup>8</sup>

Further, “judges need to be better educated in forensic science methodologies and practices.”<sup>9</sup>

Two government entities were established to address the NAS Report’s recommendations: the National Commission on Forensic Science (NCFS),<sup>10</sup> whose mission is to develop policy, and the Organization of

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SCIENTIFIC EVIDENCE REVIEW: MONOGRAPH NO. 9 (Sci. & Tech. Law Section, Am. Bar Ass’n, Cynthia H. Cwik, Jules Epstein & Carol Henderson eds., 2013). See also *Digging Up Dirt on Experts*, NAT’L CLEARINGHOUSE SCI., TECH. & L., <http://www.ncstl.org/education/Digging%20Up%20Dirt%20on%20Expert%20Witnesses> (last visited May 23, 2016).

<sup>5</sup> See NAT’L RES. COUNCIL, NAT’L ACADEMIES, *STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD* (2009) <https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf> [hereinafter NAS REPORT]; NAT’L COMM. ON FORENSIC SCI., <https://www.justice.gov/ncfs> (last visited May 23, 2016).

<sup>6</sup> See generally NAS REPORT, *supra* note 5.

<sup>7</sup> *Id.* at 238.

<sup>8</sup> *Id.* at 27.

<sup>9</sup> *Id.*

<sup>10</sup> *National Commission on Forensic Science*, NAT’L INST. OF STANDARDS & TECH.,

Scientific Area Committees (OSAC), whose mission is to develop discipline-specific practice standards and guidelines.<sup>11</sup> OSAC has a Forensic Resource Committee and NCFS has a Training on Science and Law Subcommittee, providing insight into how scientific developments and regulations will ultimately impact the law of admissibility, and how the educational requirements of lawyers and judges must be adapted to meet the needs of modern forensic sciences.<sup>12</sup>

What follows is an overview of some of the valuable resources on scientific evidence that the legal profession needs and the criminal and civil justice systems require for justice to be served in today's science and technology-driven climate. These resources range from general information on scientific disciplines to professional organizations and discipline-specific research databases. Those who research scientific evidence topics often use the internet in their quest for information and resources. It may be helpful to begin researching more generalized databases and websites that offer encyclopedic information on different scientific disciplines. This guide provides some of the essential online resources for scientific evidence that can be accessed by judges, attorneys, and scientists to keep abreast of trends and issues in science.

#### GENERAL BACKGROUND INFORMATION AND TRAINING IN FORENSIC SCIENCE

The *National Clearinghouse for Science, Technology, and the Law* (NCSTL) at Stetson University College of Law was created to address the justice system's escalating need for information on science, technology, and the law.<sup>13</sup> It provides a website that gathers a wide variety of forensic-related information in one place, freely available to public users. Its forensic database of bibliographic information includes books, scientific and legal journal articles, newspaper and magazine articles, multimedia, seminars and

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<https://www.nist.gov/topics/forensic-science/national-commission-forensic-science> (last visited May 23, 2016).

<sup>11</sup> *Organization of Scientific Area (OSAC) Subcommittees*, NAT'L INST. OF STANDARDS & TECH., <https://www.nist.gov/topics/forensic-science/osac-subcommittees> (last visited May 23, 2016).

<sup>12</sup> *Organization of Scientific Area (OSAC) Roles and Responsibilities*, NAT'L INST. OF STANDARDS & TECH., <https://www.nist.gov/forensics/osac-roles-and-responsibilities#LR> (last visited Sept. 1, 2016); *National Commission on Forensic Science, Training on Science and Law Subcommittee*, U.S. DEP'T OF JUST., <https://www.justice.gov/ncfs/training-science-and-law> (last visited Sept. 1, 2016).

<sup>13</sup> *About Us*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., <http://www.ncstl.org/about/Accomplishments%20Archive> (last visited June 28, 2016).

conference sessions, dissertations, and organizations.<sup>14</sup> Books and articles indexed in NCSTL's database are available through interlibrary loan from the Stetson Law Library.<sup>15</sup> The website's "Resources" section provides a directory of hundreds of scientific and law-related links that are useful for forensic researchers.<sup>16</sup>

NCSTL's educational programming has provided a wide variety of classes for lawyers, judges, scientists, and others.<sup>17</sup> The Education and Training section of the website provides handouts created for professional development presentations by NCSTL staff, as well as transcripts, podcasts, and webcasts of lectures on forensic science and technology.<sup>18</sup> It includes modules such as:

The *Law 101: Legal Guide for the Forensic Expert* module provides thirteen educational modules for non-lawyers regarding policies, procedures, and protocols that exist when serving as an expert witness.<sup>19</sup> Some of these modules include:

- *DNA for the Defense*: The NCSTL, National Institute of Justice (NIJ), and an expert advisory group produced *DNA for the Defense*, which provides training to defense counsel regarding the uses of DNA evidence in judicial proceedings, as well as how this evidence is used throughout case assessment, discovery, and trial.<sup>20</sup>
- *Forensic Science for Capital Litigators 2009–2012*: NCSTL presented a series of in-person *Forensic Science for Capital Litigators* courses from 2009 to 2012. Course materials and both audio and video are available on NCSTL's website.<sup>21</sup>

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<sup>14</sup> *Resources*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., <http://www.ncstl.org/resources> (last visited June 28, 2016).

<sup>15</sup> *See id.*

<sup>16</sup> *Id.*

<sup>17</sup> *Education and Training*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., <http://www.ncstl.org/education> (last visited June 28, 2016).

<sup>18</sup> *Id.*

<sup>19</sup> *Law 101: Legal Guide for the Forensic Expert*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., <http://www.ncstl.org/education/Law%20101> (last visited June 28, 2016); *see also* *NIJ-Sponsored Course or Event: Law 101: Legal Guide for the Forensic Expert*, NAT'L INST. OF JUST., <http://nij.gov/training/pages/training-detail.aspx?itemid=64> (last visited June 28, 2016).

<sup>20</sup> *DNA for the Defense*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., <http://www.ncstl.org/education/DNA%20for%20the%20Defense> (last visited June 28, 2016).

<sup>21</sup> *Capital Litigation*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., <http://www.ncstl.org/education/Capital%20Litigation%20Training%20—%202009-2012> (last visited June 28,

- *Forensic Science for Capital Litigators Online Course*: In 2014, NCSTL produced an online course that provides educational information in over fourteen major forensic topic areas, including DNA, forensic anthropology, digital and multimedia sciences, and toxicology.<sup>22</sup> The course focuses on information useful to lawyers preparing capital cases.<sup>23</sup> Lawyers can earn continuing legal education credit for this course.<sup>24</sup>
- *SANE-SART Training*: A collaborative effort between NCSTL and SANE-SART Resource Services provides both in-person and online training for various types of forensic examinations by nurses.<sup>25</sup>

In 2015, NCSTL received a Bureau of Justice Assistance grant to develop courses under the *Capital Litigation Initiative: Crime Scene to Courtroom Forensics Training* program.<sup>26</sup> NCSTL is producing eight webinars and two live symposia for prosecutors and defense attorneys who litigate capital cases.<sup>27</sup> The first two webinars, *Crime Scene Essentials* and *Crime Lab Essentials*, are available in the Education and Training section of NCSTL's website.<sup>28</sup> Bibliographic resources for the webinars and symposia are also available.<sup>29</sup>

The NIJ's *Forensic Sciences* webpages provide the full text of many

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2016).

<sup>22</sup> *Forensic Science Course for Capital Litigators*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., <http://www.ncstl.org/education/Forensic-Science-for-Capital-Litigators-Course-Introduction>—2014 (last visited June 28, 2016).

<sup>23</sup> *Id.*

<sup>24</sup> *Id.*

<sup>25</sup> *It's Evident*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., (Summer 2013), <http://www.ncstl.org/evident> (last visited June 28, 2016).

<sup>26</sup> *Capital Litigation Initiative: Crime Scene to Courtroom Forensics Training Webinars*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., <http://www.ncstl.org/education/Crime%20Scene%20to%20Courtroom%20Forensics%20Webinars> (last visited June 28, 2016); see *Forensic Science Training for Capital Litigators*, STETSON UNIV., <https://stetsonuniversitycollegeo.regfox.com/capital-litigant-training-eastern-conference-application> (last visited Sept. 9, 2016).

<sup>27</sup> Education, *Capital Litigation Initiative: Crime Scene to Courtroom Forensics Training Webinars*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., <http://www.ncstl.org/education/Crime%20Scene%20to%20Courtroom%20Forensics%20Webinars> (last visited Sept. 9, 2016).

<sup>28</sup> *Id.*; *Webinar 1: Crime Scene Essentials*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., (March 2, 2016), <http://www.ncstl.org/education/Capital-Litigation-2015-Webinar-1-Crime%20Scene-Essentials-2015>; *Webinar 2: Crime Laboratory Essentials*, NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., (May 25, 2016), <http://www.ncstl.org/education/Capital-Litigation-2016-Webinar-2-Crime-Lab-Essentials>.

<sup>29</sup> *Id.*

NIJ publications related to forensic sciences, as well as descriptions of related NIJ programs and funding sources.<sup>30</sup> One of the essential works for forensics is the Federal Bureau of Investigation's (FBI) Handbook of Forensic Services, the text of which can be found online at the FBI website.<sup>31</sup> This online version is divided into four major sections: Introduction, Submitting Evidence, Evidence Examinations, and Crime Scene Safety.<sup>32</sup>

A database of books from both *FORENSICnetBASE* and *LawENFORCEMENTnetBASE* provides the texts of dozens of forensic science and criminal justice books, which are available in full text.<sup>33</sup> Forensic topics include general forensics, forensic pathology, computer crime investigation, and arson and fire investigation.<sup>34</sup> It is available from CRCnetBASE for an annual subscription fee.<sup>35</sup>

Several useful forensic-related websites provide either research pathfinders or a categorized directory of web links, or both. *Gelman Library's Forensic Sciences Pathfinder* is an excellent resource.<sup>36</sup> Provided by George Washington University, this site provides information about forensic-related resources in both print and online formats.<sup>37</sup> Additionally, *Science and Technology Resources on the Internet* by Cynthia Holt describes and links to the best forensic resources on the Internet.<sup>38</sup> The 2006 book, *Guide to Information Sources in the Forensic Sciences*, updates Holt's article.<sup>39</sup>

*Zeno's Forensic Site* is a web directory of hundreds of forensic-related sites.<sup>40</sup> An interesting feature of the site is that users can rate the links, thus providing useful feedback. It provides the opportunity to be informed by e-

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<sup>30</sup> *Forensic Sciences*, NAT'L INST. OF JUST., <http://www.nij.gov/topics/forensics/Pages/welcome.aspx> (last visited June 28, 2016).

<sup>31</sup> See generally U.S. DEP'T OF JUST., HANDBOOK OF FORENSIC SERVICES (2013), <https://www.fbi.gov/file-repository/handbook-of-forensic-services-pdf.pdf/view>.

<sup>32</sup> *Id.*

<sup>33</sup> *FORENSICnetBASE*, CRCNETBASE, [http://www.crcnetbase.com/page/forensic\\_ebooks](http://www.crcnetbase.com/page/forensic_ebooks) (last visited June 28, 2016).

<sup>34</sup> *Id.*

<sup>35</sup> *How to Subscribe*, CRCNETBASE, [http://www.crcnetbase.com/page/how\\_to\\_subscribe](http://www.crcnetbase.com/page/how_to_subscribe) (last visited June 28, 2016).

<sup>36</sup> *Forensic Sciences: Getting Started*, GW LIBR., <http://libguides.gwu.edu/c.php?g=258679&p=1727900> (last visited June 28, 2016).

<sup>37</sup> *Id.*

<sup>38</sup> Cynthia Holt, SCIENCE AND TECHNOLOGY RESOURCES ON THE INTERNET, <http://www.istl.org/03-spring/internet.html> (last visited June 28, 2016).

<sup>39</sup> See CYNTHIA HOLT, GUIDE TO INFORMATION SOURCES IN THE FORENSIC SCIENCES (Libraries Unlimited, 2006).

<sup>40</sup> ZENO'S FORENSIC SITE, <http://forensic.to> (last visited June 28, 2016).



mail when new links are added.<sup>41</sup> Forensic researchers can also use *Reddy's Forensic Page*, which is a topically organized directory of dozens of links related to forensic science and law.<sup>42</sup>

Some unique forensic-related sites can be found online. These include *Crime and Clues: The Art and Science of Criminal Investigation*, a site that pulls together articles about various aspects of criminal investigation.<sup>43</sup> It includes information about different types of scientific evidence, crime scene and death investigation, and testimony and ethics.<sup>44</sup>

Oxford Reference offers Suzanne Bell's *A Dictionary of Forensic Science*, which is available for a fee and contains over 1,300 terms and concepts.<sup>45</sup> A smaller, but free, forensic glossary can be found at *Forensics: Examining the Evidence* by choosing "Glossary" from the "Reference Center" drop down box.<sup>46</sup>

Keeping up to date in any discipline can be a challenge. The *Crime Lab Project Forum* is a blog that reports on the latest news about crime labs and other forensic-related stories.<sup>47</sup> Readers who wish to follow the frequent updates can opt to have them delivered to their e-mail addresses by means of a Yahoo! group.<sup>48</sup> Additionally, *Daubert Tracker* is a subscription-based service that tracks United States federal and state court decisions and supporting documents about "evidentiary gatekeeping."<sup>49</sup> It provides a database of all reported decisions and many unreported decisions dating back to 1993.<sup>50</sup> It also supplies information regarding the expert's name, discipline, area of expertise challenged, and results of the challenge.<sup>51</sup>

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<sup>41</sup> *Email Updates*, ZENO'S FORENSIC SITE, <http://www.forensic.to/links/cgi-bin/subscribe.cgi> (last visited June 28, 2016).

<sup>42</sup> Reddy P. Chamakura, *Reddy's Forensic Page*, <http://www.forensicpage.com> (last visited June 28, 2016).

<sup>43</sup> *Crime & Clues: The Art and Science of Criminal Investigation*, CRIME & CLUES, <http://www.crimeandclues.com> (last visited June 28, 2016).

<sup>44</sup> *See id.*

<sup>45</sup> Suzanne Bell, *A Dictionary of Forensic Science*, OXFORD REFERENCE, <http://www.oxfordreference.com/view/10.1093/acref/9780199594009.001.0001/acref-9780199594009> (last visited June 28, 2016).

<sup>46</sup> FORENSICS: EXAMINING THE EVIDENCE, <http://www.forensicbasics.org> (last visited June 28, 2016).

<sup>47</sup> THE CRIME LAB PROJECT, <http://crimelabproject.wordpress.com> (last visited June 28, 2016).

<sup>48</sup> *Id.*

<sup>49</sup> *See* DAUBERT TRACKER, <http://www.dauberttracker.com> (last visited June 28, 2016).

<sup>50</sup> *Product Demonstration*, DAUBERT TRACKER, [http://www.dauberttracker.com/demo/demo\\_swf.html](http://www.dauberttracker.com/demo/demo_swf.html) (last visited Sept. 9, 2016).

<sup>51</sup> *Id.*

## FINDING FORENSIC SCIENCE-RELATED ARTICLES

*Forensic Science Abstracts* makes it easy to locate articles related to forensic science.<sup>52</sup> This index can be found in hard copies in many libraries, but is also part of the online collection of fee-based EMBASE, a biomedical and pharmacological database available from Elsevier.<sup>53</sup>

*PubMed* is a free service from the National Library of Medicine, National Institutes of Health.<sup>54</sup> It includes over twenty-six million citations to life science and biomedical articles dating back to 1946.<sup>55</sup> There are also links to online sources of the full text of indexed articles, and informs where to find the articles in a library.<sup>56</sup>

When searching for dissertations, researchers can use *ProQuest Digital Dissertations*, which indexes and abstracts dissertations and theses in all disciplines.<sup>57</sup> Guests can search the database and order individual copies of dissertations for a fee, while full subscribers can access the entire database of over 3 million graduate works, including approximately 1.7 million full texts available.<sup>58</sup>

The *National Criminal Justice Reference Service* (NCJRS) is sponsored by several offices within the United States Department of Justice (DOJ) and Executive Office of the President.<sup>59</sup> NCJRS provides the NCJRS Abstracts Database.<sup>60</sup> The NCJRS collection contains more than 222,000 publications, reports, articles, and audiovisual products from the United States and around the world.<sup>61</sup> These resources include statistics, research findings, program descriptions, Congressional hearing transcripts,

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<sup>52</sup> *Forensic Science Abstracts*, ELSEVIER, <https://www.elsevier.com/journals/forensic-science-abstracts-section-49-embase/0303-8459> (last visited June 28, 2016).

<sup>53</sup> *Embase*, ELSEVIER, <http://www.elsevier.com/online-tools/embase> (last visited June 28, 2016).

<sup>54</sup> *PubMed*, NAT'L CTR. FOR BIOTECH. INFO., <http://www.ncbi.nlm.nih.gov/pubmed> (last visited June 28, 2016).

<sup>55</sup> *Fact Sheet PubMed: MEDLINE Retrieval on the World Wide Web*, NAT'L LIBR. OF MED., <https://www.nlm.nih.gov/pubs/factsheets/pubmed.html> (last updated Aug. 27, 2014).

<sup>56</sup> *Id.*

<sup>57</sup> *Dissertation and Theses Dissemination and Ordering*, PROQUEST, <http://www.proquest.com/products-services/dissertations> (last visited June 28, 2016).

<sup>58</sup> *ProQuest Dissertations & Theses Global*, PROQUEST, <http://www.proquest.com/products-services/pqdtglobal.html> (last visited June 28, 2016).

<sup>59</sup> *About NCJRS*, NAT'L CRIM. JUST. REFERENCE SERV., <https://www.ncjrs.gov/whatsncjrs.html> (last visited June 28, 2016).

<sup>60</sup> *Virtual Library*, NAT'L CRIM. JUST. REFERENCE SERV., <https://www.ncjrs.gov/Library.html> (last visited June 28, 2016).

<sup>61</sup> *Id.*

and training materials.<sup>62</sup> The collection dates back to the 1970s.<sup>63</sup> The NCJRS Abstracts Database is available online for free and links to the full text of documents whenever available.<sup>64</sup>

The multidisciplinary database at *NCSTL* indexes forensic-related articles that focus on science, technology, law, or criminal justice.<sup>65</sup> The database is free and links to full texts or abstracts and purchase information.<sup>66</sup>

Most journal articles can be accessed online for a fee, but some journals offer full text for free. Some of these journals are:

- *American Journal of Pathology* (from the American Society for Investigative Pathology)<sup>67</sup>
- *Archives of Pathology & Laboratory Medicine* (from the College of American Pathologists)<sup>68</sup>
- *Crime Lab Minute* (from the American Society of Crime Laboratory Directors)<sup>69</sup>
- *Forensic Magazine*<sup>70</sup>
- *Forensic Science Communications*<sup>71</sup>
- Chartered Society of Forensic Sciences (see their newsletter *INTERfaces*)<sup>72</sup>
- *Journal of Clinical Pathology*<sup>73</sup>
- *Laboratory Investigation* (from the United States and

<sup>62</sup> *Id.*

<sup>63</sup> *Id.*

<sup>64</sup> *Id.*

<sup>65</sup> NAT'L CLEARINGHOUSE FOR SCI., TECH. & L., <http://ncstl.org> (last visited June 28, 2016).

<sup>66</sup> *Id.*

<sup>67</sup> *American Journal of Pathology*, AM. SOC'Y FOR INVESTIGATIVE PATHOLOGY, <http://ajp.amjpathol.org> (last visited June 28, 2016).

<sup>68</sup> College of American Pathologists, *Archives of Pathology and Laboratory Medicine*, <http://www.archivesofpathology.org> (last visited June 28, 2016).

<sup>69</sup> *Crime Lab Minute*, AM. SOC'Y OF CRIME LAB. DIRS., <http://www.asclcd.org/resource-library/the-crime-lab-minute> (last visited June 28, 2016).

<sup>70</sup> FORENSIC MAG., <http://www.forensicmag.com> (last visited June 28, 2016).

<sup>71</sup> Laboratory Services, *Forensic Science Communications*, FED. BUREAU OF INVESTIGATION, <http://www.fbi.gov/about-us/lab/forensic-science-communications> (last visited June 28, 2016).

<sup>72</sup> *Publications*, CHARTERED SOC'Y OF FORENSIC SCIS., <http://www.forensic-science-society.org.uk/Publications/Interfaces> (last visited June 28, 2016).

<sup>73</sup> Association of Clinical Pathologists, *Journal of Clinical Pathology*, BMJ, <http://jcp.bmj.com> (last visited June 28, 2016).

Canadian Academy of Pathology)<sup>74</sup>

- *Microgram Journal*<sup>75</sup>
- *NIJ Journal*<sup>76</sup>
- *Science & Technology Review*<sup>77</sup>
- *TechBeat*<sup>78</sup>

#### FORENSIC SCIENCE ASSOCIATIONS & ORGANIZATIONS

Most forensic associations and societies provide information about their organizations and membership on their websites. These websites can be used as a tool to locate both educational resources and scientific experts in specific disciplines. The American Academy of Forensic Sciences (AAFS) is a “professional society dedicated to the application of science to the law, and is committed to the promotion of education and the elevation of accuracy, precision, and specificity in the forensic sciences.”<sup>79</sup> AAFS was founded in 1948 and has over 7,000 members, including physicians, attorneys, dentists, toxicologists, physical anthropologists, digital evidence experts, document examiners, psychiatrists, physicists, engineers, criminalists, educators, and others.<sup>80</sup> AAFS publishes the *Journal of Forensic Sciences*.<sup>81</sup> The AAFS website also provides a wealth of information about education and career planning for forensic scientists and links to other valuable forensic science resources.<sup>82</sup>

The American Society of Crime Laboratory Directors is a nonprofit

<sup>74</sup> *Laboratory Investigation*, U.S. ACAD. OF PATHOLOGY, <http://www.nature.com/labinvest/index.html> (last visited June 28, 2016).

<sup>75</sup> *Microgram Journal*, U.S. DEP’T. OF JUST., DRUG ENF’T ADMIN., [http://www.dea.gov/pr/microgram\\_journals.shtml](http://www.dea.gov/pr/microgram_journals.shtml) (last visited June 28, 2016).

<sup>76</sup> *National Institute of Justice Journal*, OFFICE OF JUST. PROGRAMS, <http://www.nij.gov/journals/Pages/welcome.aspx> (last visited June 28, 2016).

<sup>77</sup> *Science & Technology Review*, LAWRENCE LIVERMORE NAT’L LAB., <https://str.llnl.gov> (last visited June 28, 2016).

<sup>78</sup> *TechBeat*, JUST. TECH. INFO. CTR., <https://www.justnet.org/InteractiveTechBeat> (last visited June 28, 2016).

<sup>79</sup> *About AAFS*, AM. ACAD. OF FORENSIC SCI., <http://www.aafs.org/about-aafs/#aafs-history> (last visited June 28, 2016).

<sup>80</sup> *Id.* Current abstracts are available to the public at [http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1556-4029](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1556-4029), while abstracts for volumes seventeen through fifty can be found online at [http://www.astm.org/DIGITAL\\_LIBRARY/JOURNALS/FORENSIC/jofs\\_issues.html](http://www.astm.org/DIGITAL_LIBRARY/JOURNALS/FORENSIC/jofs_issues.html).

<sup>81</sup> *Id.* Current abstracts are available to the public at [http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1556-4029](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1556-4029), while abstracts for volumes seventeen through fifty can be found online at [http://www.astm.org/DIGITAL\\_LIBRARY/JOURNALS/FORENSIC/jofs\\_issues.html](http://www.astm.org/DIGITAL_LIBRARY/JOURNALS/FORENSIC/jofs_issues.html).

<sup>82</sup> *Id.*

professional society of crime laboratory directors and forensic science managers.<sup>83</sup> It is “dedicated to providing excellence in forensic science through leadership and innovation.”<sup>84</sup> The website offers information about forensic science education and careers, as well as the society’s official newsletter, the *Crime Lab Minute*, and links to other online articles focusing on forensic science in the news.<sup>85</sup>

The Canadian Society of Forensic Science is a nonprofit organization of professionals open to an international membership, incorporated to maintain professional standards and to promote the study and enhance the stature of forensic science.<sup>86</sup> The website includes a link to abstracts of the *Canadian Society of Forensic Science Journal*, a link to the Centre of Forensic Services, and information about forensic science education and careers.<sup>87</sup>

The Australian and New Zealand Forensic Science Society gathers forensic professionals from Australia and New Zealand, divided into nine geographical branches under one umbrella.<sup>88</sup> The website provides association articles, rules, and membership information.<sup>89</sup>

Formed in 1915, the International Association for Identification is the oldest and largest forensic science / forensic identification organization in the world.<sup>90</sup> Its website provides information about the association and its many divisions, publications, and professional opportunities.<sup>91</sup>

Some such websites of other forensic-related associations or societies are:

- The American Chemical Society<sup>92</sup>
- American Society of Forensic Odontology<sup>93</sup>
- The American Society of Questioned Document Examiners<sup>94</sup>

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<sup>83</sup> AM. SOC’Y OF CRIME LAB. DIRS., [www.asclld.org](http://www.asclld.org) (last visited June 28, 2016).

<sup>84</sup> *Id.*

<sup>85</sup> *Id.*

<sup>86</sup> CANADIAN SOC’Y OF FORENSIC SCI., <http://www.csfs.ca/index.html> (last visited June 28, 2016).

<sup>87</sup> *Id.* at *Centre of Forensic Sciences*, <http://www.csfs.ca/centre-of-forensic-sciences.html> (last visited June 28, 2016).

<sup>88</sup> AUSTL. & N.Z. FORENSIC SCI., <http://anzfss.org> (last visited June 28, 2016).

<sup>89</sup> *Id.*

<sup>90</sup> *About the IAI*, INT’L ASS’N FOR IDENTIFICATION, <http://www.theiai.org/about/index.php> (last visited June 28, 2016).

<sup>91</sup> *Id.*

<sup>92</sup> AM. CHEM. SOC’Y, [www.acs.org](http://www.acs.org) (last visited June 28, 2016).

<sup>93</sup> AM. SOC’Y OF FORENSIC ODONTOLOGY, <http://www.asfo.org> (last visited June 28, 2016).

<sup>94</sup> AM. SOC’Y OF QUESTIONED DOCUMENT EXAM’RS., [www.asqde.org](http://www.asqde.org) (last visited June 28, 2016).

- The Association for Crime Scene Reconstruction<sup>95</sup>
- The Association of Firearm and Tool Mark Examiners<sup>96</sup>
- Association of Forensic DNA Analysts and Administrators<sup>97</sup>
- Entomological Society of America<sup>98</sup>
- Evidence Photographers International Council<sup>99</sup>
- The Chartered Society of Forensic Sciences<sup>100</sup>
- The International Association of Bloodstain Pattern Analysts<sup>101</sup>
- The International Association of Crime Analysts<sup>102</sup>
- The International Association of Forensic Toxicologists<sup>103</sup>
- The International Board of Forensic Engineering Sciences<sup>104</sup>
- Microscopy Society of America<sup>105</sup>
- The National Association of Medical Examiners<sup>106</sup>
- The Society of Forensic Toxicologists<sup>107</sup>

The Organization of Scientific Area Committees is part of an initiative by the National Institute of Standards and Technology and the NIJ to strengthen forensic science in the United States by developing standards and guidelines and ensure that a sufficient scientific basis exists for each

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28, 2016).

<sup>95</sup> *Crime Scene Reconstruction*, ASS'N FOR CRIME SCENE RECONSTRUCTION, <http://www.acsr.org> (last visited June 28, 2016).

<sup>96</sup> ASS'N OF FIREARM AND TOOL MARK EXAM'RS., <http://www.afte.org> (last visited June 28, 2016).

<sup>97</sup> ASS'N OF FORENSIC DNA ANALYSTS AND ADM'RS., <http://www.afdaa.org> (last visited June 28, 2016).

<sup>98</sup> *About ESA*, ENTOMOLOGICAL SOC'Y OF AM., <http://www.entsoc.org> (last visited June 28, 2016).

<sup>99</sup> EVIDENCE PHOTOGRAPHERS INT'L COUNCIL, <http://www.evidencephotographers.com> (last visited June 28, 2016).

<sup>100</sup> CHARTERED SOC'Y OF FORENSIC SCIS., <http://www.forensic-science-society.org.uk> (last visited June 28, 2016).

<sup>101</sup> INT'L ASS'N OF BLOODSTAIN PATTERN ANALYSTS, [www.iabpa.org](http://www.iabpa.org) (last visited June 28, 2016).

<sup>102</sup> *Welcome to IACA.net*, INT'L ASS'N OF CRIME ANALYSTS, <http://www.iaca.net> (last visited June 28, 2016).

<sup>103</sup> INT'L ASS'N OF FORENSIC TOXICOLOGISTS, <http://www.tiaft.org> (last visited June 28, 2016).

<sup>104</sup> INT'L BD. OF FORENSIC ENG'G SCI., <http://www.iifes.org> (last visited June 28, 2016).

<sup>105</sup> MICROSCOPY SOC'Y OF AM., <http://www.microscopy.org> (last visited June 28, 2016).

<sup>106</sup> NAT'L ASS'N OF MED. EXAM'RS., <http://www.thename.org> (last visited June 28, 2016).

<sup>107</sup> SOC'Y OF FORENSIC TOXICOLOGISTS, <http://www.soft-tox.org> (last visited June 28, 2016).

discipline.<sup>108</sup> Its mission is to develop discipline-specific practice standards and guidelines.<sup>109</sup> NIST and NIJ have convened multidisciplinary groups to examine specific challenges to the forensic science community.<sup>110</sup> The Technical Working Group on Biological Evidence Preservation provides guidance to help ensure the integrity of biological evidence,<sup>111</sup> the Latent Print AFIS Interoperability Working Group helps improve AFIS interoperability,<sup>112</sup> and the Expert Working Group on Human Factors in Latent Print Analysis examines the human factors involved in fingerprint analysis and published *Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach*.<sup>113</sup> The *OSAC Catalog of Standards and Guidelines* contains standards and best practices that apply to forensic fields.<sup>114</sup>

DOJ and NIST also established the NCFS in 2013 to improve the reliability of forensic science.<sup>115</sup> The Commission is comprised of forensic science service providers, research scientists, academics, law enforcement officials, attorneys, and judges.<sup>116</sup> The NCFS exists to provide recommendations and advice to strengthen the validity of forensic sciences; enhance quality assurance and control in laboratories; recommend guidance and protocols for evidence collection, testing, analysis, and reporting; and assess other forensic science needs.<sup>117</sup> NCFS's documents are available on its website.<sup>118</sup>

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<sup>108</sup> *Organization of Scientific Area Committees (OSAC)*, NAT'L INST. OF STANDARDS AND TECH., <http://www.nist.gov/forensics/osac/index.cfm> (last visited June 28, 2016).

<sup>109</sup> *Id.*

<sup>110</sup> *Id.*

<sup>111</sup> *NIST/NIJ Technical Working Group on Biological Evidence Preservation*, NAT'L INST. OF STANDARDS AND TECH., <http://www.nist.gov/forensics/bio-ev-wg.cfm> (last visited June 28, 2016).

<sup>112</sup> *Latent Print AFIS Interoperability Working Group*, NAT'L INST. OF STANDARDS AND TECH., [http://www.nist.gov/oles/afis\\_interoperability.cfm](http://www.nist.gov/oles/afis_interoperability.cfm) (last visited June 28, 2016).

<sup>113</sup> *Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach*, NAT'L INST. OF STANDARDS AND TECH., [http://www.nist.gov/manuscript-publication-search.cfm?pub\\_id=910745](http://www.nist.gov/manuscript-publication-search.cfm?pub_id=910745) (last visited June 28, 2016).

<sup>114</sup> *OSAC Catalog of Standards and Guidelines*, NAT'L INST. OF STANDARDS AND TECH., <http://www.nist.gov/forensics/osac/standards-guidelines-catalog.cfm> (last visited June 28, 2016).

<sup>115</sup> *National Commission on Forensic Science*, U.S. DEP'T. OF JUST., <https://www.justice.gov/ncfs> (last visited July 29, 2016).

<sup>116</sup> *Id.*

<sup>117</sup> *Id.*

<sup>118</sup> *Id.*

## WEB RESOURCES RELATED TO SPECIFIC FORENSIC SCIENCE TOPICS

## FORENSIC PATHOLOGY

*Visible Proofs: Forensic Views of the Body* is an exhibition at the National Library of Medicine, National Institutes of Health, with a complementary online exhibit.<sup>119</sup> The website features information about the history of forensic medicine, galleries of famous forensic cases throughout history, libraries of images and videos, and other educational resources.<sup>120</sup>

Forensic pathology is a medical subspecialty of pathology that "... deals primarily with the investigation of violent, sudden, suspicious, unexplained, unexpected, and medically unattended deaths for the purpose of determining the cause and manner of death."<sup>121</sup> Forensic Pathology continues to evolve, making resources such as *Visible Proofs: Forensic Views of the Body* invaluable to lawyers and judges attempting to explain this information in the courtroom.<sup>122</sup>

## FORENSIC ANTHROPOLOGY

Forensic Anthropology refers to the study of skeletal remains to determine identity of the deceased and circumstances of death. Bones are particularly useful in the legal context because they can: (1) resist decay; (2) reflect the deceased's unique characteristics like sex, height, ancestry, and age; (3) preserve signs of injury such as knife marks; (4) contain preserved DNA material; and (5) provide the basis for facial reconstruction.<sup>123</sup>

The International Association for Craniofacial Identification (IACI), comprised primarily of medical and scientific professionals from throughout the world, focuses on craniofacial identification.<sup>124</sup> The organization offers educational opportunities that include classes ranging from "How to Be a Forensic Artist" and "Understanding the Human Face"

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<sup>119</sup> *Visible Proofs: Forensic Views of the Body*, NAT'L LIBR. OF MED., <http://www.nlm.nih.gov/visibleproofs> (last visited June 28, 2016). The exhibition at the National Library of Medicine closed on February 25, 2008. *Id.*

<sup>120</sup> *Id.*

<sup>121</sup> CYRIL H. WECHT, MICHAEL A. GRAHAM & RANDY L. HANZLICK, *FORENSIC PATHOLOGY IN CIVIL AND CRIMINAL CASES* 4 (4th ed. 2016).

<sup>122</sup> *Visible Proofs: Forensic Views of the Body*, NAT'L LIBR. OF MED., <http://www.nlm.nih.gov/visibleproofs> (last visited June 28, 2016).

<sup>123</sup> *Database Topics Defined, Topic 23: Forensic Anthropology*, NAT'L CLEARINGHOUSE SCI., TECH. & L., <http://www.ncstl.org/database/Database%20Topics%20Defined> (last visited Aug. 27, 2016).

<sup>124</sup> INT'L ASSOC. FOR CRANIOFACIAL IDENTIFICATION, <http://www.forensicartist.com/IACI/index.html> (last visited June 28, 2016).



to both basic and advanced classes such as "Facial Reconstruction Sculpture."<sup>125</sup> The site includes links to selected historical exhumation projects, as well as nearly thirty related craniofacial identification sites and publications.<sup>126</sup> IACI member and forensic artist, Wesley Neville maintains *Forensic Art World*, which describes the various facets of forensic art and links to additional resources.<sup>127</sup>

The American Association of Physical Anthropology (AAPA) website provides information such as funding opportunities, the location of graduate programs, position statements by the organization, job postings, and access to its official journal, the *American Journal of Physical Anthropology*.<sup>128</sup> Other pages include information about careers in physical anthropology, the organization's annual meeting, and links to other related scientific associations.<sup>129</sup>

The Forensic Anthropology Center at the University of Tennessee at Knoxville is well known for its outdoor anthropological research facility, essential for providing education and training in forensic anthropology.<sup>130</sup> The Center runs a Forensic Anthropology Data Bank containing 3,400 forensic anthropology case analyses.<sup>131</sup> These case analyses are available to researchers by request after filling out a form on the website.<sup>132</sup>

## BIOMETRICS

Biometrics refers to the automated identification of an individual based on their behavioral or physiological characteristics. The Retinal Scan sub-topic contains resources related to retinas and irises. In particular, biometric sensors detect visual characteristics that are less susceptible to alteration such as furrows, rings, freckles, and the corona. The recognition process essentially involves three steps: (1) a sensor takes an observation of the behavioral or physiological characteristic (2) the observation is mathematically described as a biometric "signature," and (3) a computer

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<sup>125</sup> *Id.*

<sup>126</sup> *Id.*

<sup>127</sup> Wesley Neville, *Forensic Art World*, <http://www.forensicartist.com> (last visited June 28, 2016).

<sup>128</sup> AM. ASSOC. OF PHYSICAL ANTHROPOLOGISTS, <http://www.physanth.org> (last visited June 28, 2016).

<sup>129</sup> *Id.*

<sup>130</sup> *Forensic Anthropology Center*, UNIV. OF TENN. KNOXVILLE, <https://fac.utk.edu> (last visited June 28, 2016).

<sup>131</sup> *Id.*

<sup>132</sup> *Id.*

system inputs the signature into an algorithm and compares it against other biometric signatures stored in its database.<sup>133</sup>

*Biometrics.gov* is the authoritative source for all biometrics-related activities within the Federal Government and is divided into three main areas.<sup>134</sup> First, the “Biometrics Reference Room” tab leads to general information about biometrics technology, and provides a synopsis of biometrics programs hosted by various federal agencies.<sup>135</sup> It offers *Privacy & Biometrics: Building a Conceptual Foundation*, a publication that presents the government’s perspective on biometrics privacy.<sup>136</sup> Next, the site provides information on the National Science & Technology Council’s (NSTC) Subcommittee on Biometrics, including presentations, publications, and additional technical information.<sup>137</sup> The “Standards” page offers the *NSTC Policy for Enabling the Development, Adoption and Use of Biometric Standards* as well as the *Registry of USG Recommended Standards*.<sup>138</sup>

#### FORENSIC BOTANY

Forensic botany is the use of plant remains to help solve crimes or other legal problems.<sup>139</sup> Plants or parts of plants can provide significant supporting, sometimes, crucial evidence in solving crimes. The reasons for this are several: 1) plant remains can be found almost everywhere; 2) they offer multiple sources of evidence, both macroscopic and microscopic, such as pieces of wood, (even as charcoal), seeds, fruits, leaves, twigs, plant hairs, microscopic air-borne pollen and spores, or in aquatic environments, algal cells; 3) their morphological diversity allows us to identify them and from the identification gather other useful information such as the season or geographical location in which a crime took place, whether a body has been moved following a murder; if a body is buried, how long it has been buried, and whether a suspect was present at the crime scene. Pollen and spores, in

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<sup>133</sup> *Database Topics Defined, Topic 6: Biometrics: Retinal Scans*, NAT’L CLEARINGHOUSE SCI., TECH. & L., <http://www.ncstl.org/database/Database%20Topics%20Defined> (last visited June 29, 2016).

<sup>134</sup> BIOMETRICS.GOV, <http://www.biometrics.gov> (last visited June 28, 2016).

<sup>135</sup> *Biometrics Reference Room*, BIOMETRICS.GOV, <http://www.biometrics.gov/ReferenceRoom/Default.aspx> (last visited June 28, 2016).

<sup>136</sup> *Id.*

<sup>137</sup> *NSTC Subcommittee on Biometrics and Identity Management Room*, BIOMETRICS.GOV, <http://www.biometrics.gov/nstc/Default.aspx> (last visited June 28, 2016).

<sup>138</sup> *Standards*, BIOMETRICS.GOV, <http://www.biometrics.gov/Standards/default.aspx> (last visited June 28, 2016).

<sup>139</sup> *BSA’s Classroom Plant Talking Points*, BOTANICAL SOC’Y OF AM. <http://botany.org/PlantTalkingPoints/Crime.php> (last visited June 29, 2016).

particular, have all the useful characters just mentioned. Being widespread in nature in the air and on most surfaces, we breathe them into our lungs and they stick to our clothes.<sup>140</sup>

The *Internet Directory of Botany* is an extensive, award-winning alphabetical index of links to online botanical information, including links to specific databases, articles, and other resources.<sup>141</sup>

## TOXICOLOGY

Toxicology refers to the study and examination of drugs and their metabolites as found in biological tissues and fluids. Experts in this field provide services in three main areas: (1) human performance cases wherein persons are suspected of acting under the influence of alcohol/drugs, (2) postmortem cases wherein toxicology test results aid death investigations, and (3) workplace testing wherein job-related testing for alcohol/drugs is mandated. Other related issues include poisoning, drug-facilitated sexual assaults, possession and use of illegal substances, medical malpractice, and product tampering.<sup>142</sup>

*TIAFT.org* is the official website of The International Association of Forensic Toxicologists (TIAFT), and it offers direct links to additional resources from both public and members-only areas.<sup>143</sup> For example, the public section maintains a user-contributed collection of reference analytical data to assist in the identification of unknown toxic substances, an observatory section comprised of links, a large directory of all genres of toxicology-related websites arranged by forensic specialty, and a “powersearch” area to search for and access various scientific and medical literature and technological information.<sup>144</sup> Membership allows access to the organization’s therapeutic and toxic drug concentrations list developed by colleagues, medical specialists, and from information obtained through the field’s literature, the pharmaceutical industries, and by comparison with established drug data lists.<sup>145</sup> Members may also access the complete text of the organization’s quarterly journal, retrieve previously published journal *Case Notes*, read online reviews of various articles focused on state-of-the-art forensic and analytical toxicology topics, and tap into a collection of

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<sup>140</sup> *Id.*

<sup>141</sup> INTERNET DIRECTORY OF BOTANY, <http://www.people.fas.harvard.edu/~brach/IDB/botany.html> (last visited June 28, 2016).

<sup>142</sup> *Id.*

<sup>143</sup> INT’L ASS’N OF FORENSIC TOXICOLOGISTS, <http://www.tiaft.org> (last visited June 28, 2016).

<sup>144</sup> *Id.*

<sup>145</sup> *See id.*

nearly 1,500 papers presented at TIAFT meetings spanning three decades.<sup>146</sup>

*Soft-tox.org* is the website of the Society of Forensic Toxicologists (SOFT), an organization of practicing forensic toxicologists and others that share an interest in the discipline.<sup>147</sup> The site provides brief and general information introducing forensic toxicology and allows public users to download guidelines for the practice of forensic toxicology in the two defined areas of postmortem forensic toxicology and human performance forensic toxicology.<sup>148</sup> Additional downloads include the organization's Drug Facilitated Sexual Assault Survey and Drug Facilitated Sexual Assault Drug List and Cutoffs, and the new American Academy of Forensic Sciences Toxicology Section Mass Spectrometry Database, a comprehensive drug library of the spectra for several hundred substances including a mini-library of the mass spectra of newer drugs, metabolites, and some breakdown products.<sup>149</sup>

## FINGERPRINTS

In general, print analysis is the examination of impressions left by ridged skin from human palms, fingers and foot soles. Fingerprints refer specifically to impressions left by human fingers. The significance of such impressions comes from their individuality and permanence. Print comparisons can be used to identify individuals, deceased or living. They can establish that someone was present in a particular location, or that someone handled a certain object. The condition and location of prints may also assist in the reconstruction of crime and/or accident scenes. Additionally, fingerprints have been used in the security context as passwords.<sup>150</sup>

The FBI maintains a webpage from which users may access general and historical information on fingerprint identification, become familiar with the automated fingerprint identification system (IAFIS), learn the proper method for taking legible fingerprints, and discover training opportunities.<sup>151</sup>

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<sup>146</sup> See *id.*

<sup>147</sup> SOC'Y OF FORENSIC TOXICOLOGISTS, <http://www.soft-tox.org> (last visited June 28, 2016).

<sup>148</sup> See *id.*

<sup>149</sup> See *id.*

<sup>150</sup> See *Database Topics Defined, Topic 18: Fingerprints*, NAT'L CLEARINGHOUSE SCI., TECH. & L., <http://www.ncstl.org/database/Database%20Topics%20Defined> (last visited June 29, 2016).

<sup>151</sup> FED. BUREAU OF INVESTIGATION, [http://www.fbi.gov/about-us/cjis/fingerprints\\_bio](http://www.fbi.gov/about-us/cjis/fingerprints_bio)

*The Fingerprint Sourcebook*, prepared by the NIJ, funded the West Virginia University Forensic Science Initiative with participation by the Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST), which is a comprehensive resource on the science of fingerprint identification. It is available for free at the NIJ website.<sup>152</sup>

*Latent Print Examination: Fingerprints, Palmprints and Footprints* is an online resource dedicated to latent print examination and is useful for both the novice and expert.<sup>153</sup> The website, maintained by Ed German, is an extensive repository of latent fingerprint, handprint, and footprint technology, history, news, caselaw, and links.<sup>154</sup> Topics from challenges to fingerprint evidence reliability to the latest technologies for crime scene processing and evidence collection are explored in depth.<sup>155</sup> Online discussion forums and opportunities to “ask an expert” are available.<sup>156</sup>

*CLPEX.com*, the website for “Complete Latent Print Examination,” allows latent print examiners to locate the information they need.<sup>157</sup> It provides links to other fingerprint websites, as well as links to reference articles on print examination.<sup>158</sup> There are lists of fingerprint consultants, training opportunities, and books about fingerprint examination.<sup>159</sup> It provides a weekly newsletter / blog called the Weekly Detail, with an area to discuss the issues contained in the newsletter, as well as other topics of importance to fingerprint examiners.<sup>160</sup>

## DNA

Deoxyribonucleic acid (DNA) is the basic genetic material of most organisms. The DNA structure is a double helix wherein two chains of nucleotides are held together by hydrogen bonds to form a sequence of base pairs. The uniqueness of this sequence allows for identification of the DNA donor. DNA is particularly useful in the forensic context because nearly all

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metrics/biometric-center-of-excellence/modalities/fingerprint (last visited June 28, 2016).

<sup>152</sup> *Fingerprint Sourcebook*, NAT'L INST. OF JUST., <http://www.nij.gov/publications/pages/publication-detail.aspx?ncjnumber=225320> (last visited Aug. 27, 2016).

<sup>153</sup> *Latent Print Examination: Fingerprints, Palmprints and Footprints*, ONLN.COM, <http://www.onin.com/fp/index.htm> (last visited June 28, 2016).

<sup>154</sup> *See id.*

<sup>155</sup> *See id.*

<sup>156</sup> *See id.*

<sup>157</sup> COMPLETE LATENT PRINT EXAMINATION (CLPEX.COM), <http://www.clpex.com> (last visited June 28, 2016).

<sup>158</sup> *See id.*

<sup>159</sup> *See id.*

<sup>160</sup> *See id.*

human cells contain DNA, and thus it can be extracted from materials such as bodily fluids, body tissue, hair root sheaths, bone marrow, and tooth pulp. Additionally, the testing process requires only a small sample and is considered highly accurate. Also DNA is very stable and resists degradation.<sup>161</sup>

*Forensic Bioinformatics* provides articles about DNA and other informational pieces.<sup>162</sup> There is a small selection of scholarly articles, videos about DNA, information about DNA testing, and even a sample discovery motion.

*MITOMAP: A Human Mitochondrial Genome Database* offers a comprehensive “compendium of polymorphisms and mutations of the human mitochondrial DNA.”<sup>163</sup> The database can be searched by gene, disease, or enzyme. Alternatively, the researcher may use subsections divided into areas including “MtDNA Polymorphisms” and “MtDNA Mutations with Reports of Disease-Associations,” and organized by mtDNA location or phenotype. The website is supplemented by several illustrations and tables, a “Mitomap Quick Reference” section that includes an extensive bibliography of mitochondrial references, and links to additional databases and related sites.

*DNA•VIEW* presents a comprehensive look at forensic DNA analysis, particularly as it relates to mathematics.<sup>164</sup> The site provides topical news, articles, archived discussions on DNA identification (including recent identifications after mass disasters) information on DNA identification software, and data tables organized by subject (for example, “Allele Frequencies for US Populations” provided by Cellmark Diagnostics). Topic areas such as “discussions” are enhanced with photos, slide presentations, news, and other articles provided by the participants.

## FIREARMS

Firearms analysis refers to the examination of weapons that use propellants to fire projectiles (usually bullets) at a very high velocity.<sup>165</sup>

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<sup>161</sup> See *Database Topics Defined, Topic 11: DNA*, NAT’L CLEARINGHOUSE SCI., TECH. & L., <http://www.ncstl.org/database/Database%20Topics%20Defined> (last visited June 29, 2016).

<sup>162</sup> FORENSIC BIOINFORMATICS, <http://www.bioforensics.com> (last visited June 28, 2016).

<sup>163</sup> *MITOMAP: A Human Mitochondrial Genome Database*, FOSWIKI, <http://www.mitomap.org> (last visited June 28, 2016).

<sup>164</sup> *Forensic Mathematics, DNA•VIEW*, <http://dna-view.com> (last updated Aug. 10, 2016).

<sup>165</sup> See *Database Topics Defined, Topic 19: Firearms (General)*, NAT’L

Firearms are most frequently utilized for sport, self-defense, warfare, and criminal purposes. Experts in this field obtain critical information about these weapons by reviewing impact patterns, gunpowder residue, projectile paths, and bullet markings. Such information includes: identity of a specific weapon, identity of the shooter, angle and speed of shots, and event sequences. Though most frequently associated with criminal contexts, firearms can also play an important role in the reconstruction of accidents. Other legal issues involve the manufacture, regulation and possession of these weapons.<sup>166</sup>

*FirearmsID* provides extensive educational and investigative information including firearm safety, topical articles, expert testimony, firearms testing, and an introduction to firearms and ballistics, and arranged by categories like the History of Firearm ID and Case Profiles.<sup>167</sup> The website offers a discussion area, Forensic Forum, and a Resource Area provides such subtopics as Ballistics Picture Book and Virtual Comparison Microscope, while another area leads the user to databases containing rifling data and a bullet and Shotgun Component Search.

*Firearm Identification in the Forensic Science Laboratory* is a booklet put out by the National District Attorneys Association.<sup>168</sup> It describes the science of firearm identification, the production of firearm toolmarks on fired cartridges, the examination process, and trial preparation.<sup>169</sup>

#### FORENSIC ODONTOLOGY

Forensic Odontology refers to the study of dental evidence for identification purposes. Most often the identity of the biter is the issue. Bite mark identification rests on the theory that each person has a unique and distinguishable bite pattern. Whether an expert can identify the biter rests largely on the uniqueness of an individual's dental characteristics and the quality of the bite mark itself. The uniqueness of an individual's dental characteristics is determined by the condition and arrangement of their teeth, and can be preserved in dental impressions. The quality of the bite mark is determined by the manner in which the mark was inflicted,

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CLEARINGHOUSE SCI., TECH. & L., <http://www.ncstl.org/database/Database%20Topics%20Defined> (last visited June 29, 2016).

<sup>166</sup> See *id.*

<sup>167</sup> FIREARMSID.COM., <http://www.firearmsid.com> (last visited June 28, 2016).

<sup>168</sup> Nat'l Dist. Attorneys Ass'n, *Firearm Identification in the Forensic Science Laboratory*, [http://www.ndaa.org/pdf/Firearms\\_identity\\_NDAAsm.pdf](http://www.ndaa.org/pdf/Firearms_identity_NDAAsm.pdf) (last visited June 28, 2016).

<sup>169</sup> See *id.*

preserved, collected, photographed, and analyzed.<sup>170</sup> Forensic Odontology evidence is primarily associated with criminal law, especially child abuse and physical assault cases. Forensic odontology also refers to identification of persons who die anonymously. This usually involves a comparison of dental records with the decedent's teeth.<sup>171</sup>

*Issues in Human and Animal Bite Mark (Bitemark) Analysis* provides an extensive overview of bitemarks, supplemented by links to several case studies (for example, serial killer Ted Bundy and the crash of Alaska Airlines Flight 261 in 2000), photos of bitemark evidence, journal articles, and links to similar websites.<sup>172</sup>

*Forensic Dentistry Online*,<sup>173</sup> provides information about bitemarks and bitemark identification, including new resources using DNA from teeth and saliva, as well as information covering the legal aspects of bitemark evidence admissibility.<sup>174</sup> It includes sections posting news items and commentaries from users, book reviews, and links to continuing education courses and odontologists.<sup>175</sup>

#### QUESTIONED DOCUMENTS

Questioned Documents refers to the study of handwritten or electronically produced documentation. Examiners in this field use light sources, optical instrumentation, digital enhancement, and known samples to determine authenticity and authorship of challenged documentation. For example, examiners may conclude that a specific person wrote a specific letter; or they may establish that two letters were written by the same person.<sup>176</sup>

Questioned document examiner Emily J. Will offers an overview of questioned documents through areas exploring the theories and applications of questioned document examination, the external tools used in

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<sup>170</sup> See *id.*

<sup>171</sup> See *Database Topics Defined, Topic 26: Forensic Odontology*, NAT'L CLEARINGHOUSE SCI., TECH. & L., <http://www.ncstl.org/database/Database%20Topics%20Defined> (last visited June 29, 2016).

<sup>172</sup> Mike Bowers & Raymond Johansen, *Issues in Human and Animal Bite Mark (Bitemark) Analysis*, <http://www.forensic.to/webhome/bitemarks> (last visited June 28, 2016).

<sup>173</sup> FORENSIC DENTISTRY ONLINE, <http://forensidentistryonline.org> (last visited June 28, 2016).

<sup>174</sup> *Id.*

<sup>175</sup> *Id.*

<sup>176</sup> *Database Topics Defined, Topic 35: Questioned Documents*, NAT'L CLEARINGHOUSE SCI., TECH. & L., <http://www.ncstl.org/database/Database%20Topics%20Defined> (last visited June 29, 2016).



examination, and a presentation of famous cases.<sup>177</sup> *Identifont* provides the largest independent directory of online typefaces to search for type and picture or symbol fonts by font appearance, name, or similarity.<sup>178</sup> Users can also download a wide selection of fonts for free.<sup>179</sup> Similarly, *Omniglot* provides details of alphabets and writing systems, both current and ancient.<sup>180</sup> Each writing system is illustrated, with information provided about its origin, usage, notable features, and the languages written with it.<sup>181</sup>

#### FINAL THOUGHTS

Mounting challenges to scientific evidence require attorneys to avail themselves of all scientific evidence research avenues, especially online resources. New developments in scientific evidence are increasing rapidly. For example, Attorney General Loretta Lynch recently issued a memorandum to DOJ prosecutors and laboratory personnel regarding a Code of Professional Responsibility for the practice of forensic science, as well as other significant changes, ranging from how forensic scientist should present their findings and work in court to the promotion of “greater transparency and access to forensic laboratory quality assurance documents.”<sup>182</sup> Also, in September 2016, the President’s Council of Advisors on Science and Technology issued its report *Forensic Sciences in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods*.<sup>183</sup> A lawyer who does not utilize scientific evidence Internet resources like the ones described in this article, risks falling behind in this rapidly developing field. Such failure could be to the detriment of one’s clients.

This article is based in part on the Authors’ former work, *Scientific Evidence Resources on the Web*, as published in the ABA Judicial Division Quarterly, Vol. 54 No. 3 Judges’ J. 35 (2015).

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<sup>177</sup> Emily J. Will, *Home*, <http://www.qdewill.com> (last visited June 28, 2016).

<sup>178</sup> IDENTIFONT, <http://www.identifont.com/index.html> (last visited June 28, 2016).

<sup>179</sup> *Id.*

<sup>180</sup> OMNIGLOT, <http://www.omniglot.com> (last visited June 28, 2016).

<sup>181</sup> *Id.*

<sup>182</sup> Press Release, U.S. Dep’t of Justice, Justice Department Announces New Steps to Advance and Strengthen Forensic Science (September 12, 2016), <https://www.justice.gov/opa/pr/justice-department-announces-new-steps-advance-and-strengthen-forensic-science> (announcing the implementation of “a number of steps that will promote professional responsibility among forensics practitioners, institute best practices and advance the relationship between the academic research of forensic science and implementation in the field”).

<sup>183</sup> See generally President’s Council of Advisors on Sci. & Tech., Exec. Office of the President, Report to the President, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods* (2016).