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Twenty-First Century Forensic Science Challenges for Trial Judges in Criminal Cases: Where the "Polybutadiene" Meets the "Bitumen"

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TWENTY-FIRST CENTURY FORENSIC SCIENCE CHALLENGES FOR TRIAL JUDGES IN CRIMINAL CASES: WHERE THE "POLYBUTADIENE" MEETS THE "BITUMEN"

Hon. Donald E. Shelton

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* For over 19 years, Donald E. Shelton has been a Circuit Judge in an Ann Arbor, Michigan trial court where, as he puts it, the forensic evidence rubber ("polybutadiene") meets the road ("bitumen"). He has a Masters degree in Criminology, in addition to his J.D. from the University of Michigan Law School, and is an adjunct faculty member at Eastern Michigan University in the Criminology and Political Science departments. Judge Shelton has authored numerous texts and articles and one of his primary interests is the impact of technology in the law. Judge Shelton is very appreciative of the assistance of attorney Kelly Roberts in the research and preparation of this article.
I. INTRODUCTION

The seemingly rapid development of emerging scientific methods, especially the increased understanding of deoxyribonucleic acid ("DNA"), has had, and will undoubtedly continue to have, an almost stunning impact on our justice system, particularly at the trial level. The forensic applications of these new scientific discoveries have been most dramatically seen in the criminal trial court. Although a few "sciences," such as fingerprinting and blood typing, have been utilized for a long time in criminal prosecutions, the last twenty-five years have brought us many new forms of forensic science criminal evidence, from the now ubiquitous use of DNA, to hair and fiber analysis, to new methods of tool mark and ballistics analysis, to thermal imaging, to supposedly scientific analysis of bite marks or handwriting, and many others.

Which of these new forms of scientific forensic evidence have sufficient validity to be used in a criminal proceeding that could take away a person's liberty or even their life? Who answers that question and how? The Supreme Court of the United States has decided that it is the trial judge who must decide these issues and be the "gatekeeper" who will determine which forms of scientific forensic evidence "get in" to the jury's consideration. The first part of this article defines and explores that expanded gatekeeper role, as it continues to be a task of increasing onus to trial judges, and examines the current status of various forms of scientific evidence as we subject them to our screening function.

This advanced technology also presents a new variety of pretrial issues for the trial judge, especially as they relate to DNA, and the second part of this article addresses some of those issues. What constitutional questions for trial judges are potentially posed by the development of extremely large DNA databases? Are there Fourth or Fifth Amendment search or incrimination issues that are presented by how these databases are collected? To what extent will these databases lead to the adoption or application of new
statutes of limitation? How will the use of "John Doe" warrants affect motions to suppress searches or seizures based on those warrants? As the defense responds to new government technology in criminal cases, how does that change the nature of pretrial discovery motions and requests for expert assistance, particularly for indigent defendants?

The challenges posed to trial judges from these new forms of evidence go beyond questions of admissibility. Managing a jury trial in this new technological age is no mean feat because jurors know about, or at least they think they know about, much of this new technology. The third part of this article describes how juror expectations and demands for scientific evidence have changed and how the pressure of that "tech effect" (or "CSI effect" as the media calls it) can alter criminal trials. As I noted with my coauthors in an earlier article:

These developments in science and information are contemporaneous and feed off of one another. Advancements in science are fostered by the ability to exchange and transfer information among scientists. At the same time, scientific developments almost immediately become available not only to scientists but to the entire world. The information technology system uses its media to grab scientific discoveries and quickly makes them part of our popular culture. The dissemination is fast and widespread through the media online, on television fiction and non-fiction, on film (now video transmission of course), and even on traditional "news" sources. DNA, for example, has gone from an abstract concept known only to the small biochemical community to a term that even children recognize and use. Ordinary people know, or at least think they know, more about science and technology from what they have learned in the media than they ever learned in school.

It is those ordinary people who constitute the jury system. Every week, this new scientific and information age comes marching through the courtroom door via the psyche of almost every juror that claims a seat in the box.¹

¹ Donald E. Shelton, Young S. Kim & Gregg Barak, *A Study of Juror Expectations and Demands Concerning Scientific Evidence: Does the "CSI*
the proffered conclusions. Justice Blackmun specifically addressed any concern that Daubert would lead to a wholesale admission of questionably reliable scientific evidence:

Respondent expresses apprehension that abandonment of "general acceptance" as the exclusive requirement for admission will result in a "free-for-all" in which befuddled juries are confounded by absurd and irrational pseudoscientific assertions. In this regard respondent seems to us to be overly pessimistic about the capabilities of the jury and of the adversary system generally. Vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence. Additionally, in the event the trial court concludes that the scintilla of evidence presented supporting a position is insufficient to allow a reasonable juror to conclude that the position more likely than not is true, the court remains free to direct a judgment and likewise to grant summary judgment. These conventional devices, rather than wholesale exclusion under an uncompromising "general acceptance" test, are the appropriate safeguards where the basis of scientific testimony meets the standards of Rule 702.

... We recognize that, in practice, a gatekeeping role for the judge, no matter how flexible, inevitably on occasion will prevent the jury from learning of authentic insights and innovations. That, nevertheless, is the balance that is struck by Rules of Evidence designed not for the exhaustive search for cosmic understanding but for the particularized resolution of legal disputes.

Subsequently, however, Justice Rehnquist seemed to muddy the waters of the trial judge's standards. In Joiner, the trial judge rejected the testimony of plaintiff's proffered experts that linked his cancer to polychlorinated biphenyls ("PCBs") manufactured by the defendants and granted summary judgment. The trial judge held that the scientific studies upon which the evidence was based did

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11 Daubert, 509 U.S. at 595.
12 Id. at 595-97 (citations omitted).
not justify the expert's conclusions about the cause of the plaintiff's
injuries. The plaintiff claimed that the judge had focused on the
experts' conclusions, rather than on their methodology, contrary to
the clear admonitions of Daubert. The Court disagreed and
upheld the trial judge's decision:

   Respondent points to Daubert's language that the "focus, of
course, must be solely on principles and methodology, not on
the conclusions that they generate." . . . He claims that because
the District Court's disagreement was with the conclusion that
the experts drew from the studies, the District Court committed
legal error and was properly reversed by the Court of Appeals.
But conclusions and methodology are not entirely distinct from
one another. Trained experts commonly extrapolate from
existing data. But nothing in either Daubert or the Federal
Rules of Evidence requires a district court to admit opinion
evidence that is connected to existing data only by the ipse dixit
of the expert. A court may conclude that there is simply too
great an analytical gap between the data and the opinion
proffered.

Thus, Joiner clearly indicates that the trial judge gatekeeper has
the discretion to totally reject and disallow an expert's opinion,
even if based on an accepted methodology, if the judge finds that
the expert's conclusion is not reliably based on that methodology—
so much for the Daubert emphasis on methodology rather than
conclusion.

In Kumho, the Court expanded its Daubert ruling and again
indicated that significant deference was to be given to trial judges
in the exercise of their gatekeeping role. In this defective tire case,
the trial court granted summary judgment for defendants after
finding that the opinions of the plaintiff's expert engineer were not
based on a method that the judge found to be "sufficiently
reliable." In its opinion, the Court first upheld the gatekeeping
role as applied to an engineering witness and made it clear that the
Daubert analysis was to be applied to evidence proffered by all

15 Id. at 146.
16 Id. (emphasis added) (citations omitted).
experts, not only by scientists. Second, the Court reinforced the Joiner holding that trial judges are permitted to examine whether an expert's conclusions are sufficiently reliable, even if based on a proper and accepted methodology. The Court upheld the trial court's conclusion that the expert's testimony about the cause of the failure of the particular tire in the case at issue was not reliable enough to be presented to the jury.

The Daubert trilogy has imposed what some regard as a very difficult task on trial judges in criminal cases, especially as it has morphed into an obligation to decide the reliability of expert evidence:

The adoption of the reliability standard for expert evidence in federal courts and many state courts has created a daunting task for trial judges who must grapple with any number of complex, scientific, and technical forms of evidence.... Because the Supreme Court, many state courts, and the Federal Rules of Evidence have extended proof of reliability to all forms of expert testimony, courts must grapple with questions concerning forensic expert evidence that is a part of many criminal prosecutions. Make no mistake—this is a challenging task, and many judges wrestle with the proper application of reliability standards to this type of evidence.

To fulfill this difficult gatekeeper role, Justice Breyer suggested in his concurring opinion in Joiner that trial judges may use their inherent power to appoint independent experts for advice. Most

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18 Kumho Tire Co., 526 U.S. at 141.
19 Id. at 152-53.
22 Gen. Elec. Co. v. Joiner, 522 U.S. 136, 149-50 (1997) (Breyer, J., concurring). The suggestion has been taken to heart by some judges and has led the American Association for the Advancement of Science to create the Court
trial judges in criminal cases, especially state judges lacking the public resources to afford such outside expert assistance,\textsuperscript{23} must become arbiters of science, at least in a particular case, regardless of our qualifications to do so. Unfortunately, \textit{Daubert}'s application in criminal cases has raised serious issues about whether the courts apply the standards as rigorously when prosecutors introduce forensic evidence to prove guilt as when plaintiffs in civil cases use it to prove civil liability. And there may be some demonstrable validity to the charge.\textsuperscript{24} The National Academy of Sciences recently completed a congressionally authorized study of the use of

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forensic science in the criminal justice system. After examining the current use of forensic evidence in criminal prosecutions and the Daubert reliance on the adversarial process for determining the admissibility of such evidence, the researchers were extremely critical of the current system and stated:

The report finds that the existing legal regime—including the rules governing the admissibility of forensic evidence, the applicable standards governing appellate review of trial court decisions, the limitations of the adversary process, and judges and lawyers who often lack the scientific expertise necessary to comprehend and evaluate forensic science—is inadequate to the task of curing the documented ills of the forensic science disciplines.

Adequate or not, Daubert is nevertheless the process that most criminal court trial judges must use, at least for the time being.

While some feel that judges do not take their gatekeeping role seriously, the challenge to trial judges is to fulfill the role visited upon them and to evaluate and control the evidence that is presented to the jury as worthy of their consideration and relevant to their fact finding. In the preface to the 2008 edition of Modern Scientific Evidence: The Law and Science of Expert Testimony, David L. Faigman aptly described the situation:

Judges and lawyers are not generally known for expertise in science and mathematics. Nor is science a subject given significant attention in American law schools. . . .

Ever so slowly, however, there are signs that a "third culture" is emerging in the law. This third culture is one that integrates a sophisticated understanding of science into legal

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26 Id. at 3-1.
27 "The single most important observation about judicial gatekeeping of forensic science is that most judges under most circumstances admit most forensic science. There is almost no expert testimony so threadbare that it will not be admitted if it comes to a criminal proceeding under the banner of forensic science." Moriarty & Saks, supra note 21, at 28.
decisionmaking. Perhaps the most visible sign of this emerging integration is the [Daubert case]. The Daubert Court held that under the Federal Rules of Evidence trial court judges must act as "gatekeepers," and evaluate the validity of the basis for proffered scientific expertise before permitting the expert to testify.

Application of the Daubert standard requires an understanding of scientific research. This revolution is one of perspective, and it affects profoundly not only the judges who guard the gate, but also the lawyers who seek to enter through it.

. . . Daubert calls upon judges to assess the merits of the scientific research supporting an expert's opinion. . . . The Daubert perspective immediately raised the prospect, as Chief Justice Rehnquist decried it, of judges assuming the role of "amateur scientists." The gatekeeping role, he feared, was one most judges were ill-suited to fill.

. . .

Daubert, perhaps, represents nothing more, or less, than that the legal culture must assimilate the scientific culture. . . . We can confidently say, however, that science has become, and will forever more be, a tool upon which the law must sometimes rely to do justice.28

The following is a review of just some of the ways in which judges have dealt with their new gatekeeping role as new science and technology have emerged.

28 1 FAIGMAN ET AL., supra note 22, at vii-ix (citations omitted) (footnote omitted); see Erin Murphy, The New Forensics: Criminal Justice, False Certainty, and the Second Generation of Scientific Evidence, 95 CAL. L. REV. 721, 793-94 (2007) (arguing that because of "the government's domination of forensic science," "rather than simply selecting and advocating for the theory that suits it best, the government should bear a burden of presenting evidence and disclosing results derived from all legitimate, competing theories").
B. DNA Evidence

DNA is the molecular structure in all living things that contains genetic information. DNA evidence is very durable and can be extracted from the smallest of remains many years after a crime. Equally significant is its "polymorphism," meaning that, depending on the method used for its extraction, it is unique among humans and can identify the donor of the specimen with overwhelming accuracy. DNA testing can be extremely precise and can often demonstrate that only one person in billions could have been the source of the specimen evidence.

DNA profiling started "as a method of determining paternity." The first use of DNA in a successful U.S. criminal prosecution was in Andrews v. State, when police matched DNA samples from semen to the defendant's blood in a rape case. The admission of DNA evidence in a criminal case was first approved by a state supreme court in State v. Woodall. Subsequently, properly collected and analyzed DNA evidence has been routinely admitted. DNA test results are now admissible in virtually every

31 Id. at 93.
32 For descriptions of the development of DNA testing and its use in the criminal justice system, see 4 FAIGMAN ET AL., supra note 22, §§ 32:1-32:53, at 276-374; Imwinkelried, supra note 30, at 91-101; and Moriarty & Saks, supra note 21, at 19, 24-25.
35 Andrews, 533 So. 2d at 843.
jurisdiction. DNA matching has almost totally replaced blood typing for identification purposes and is probably the most important forensic science development in the twentieth century. Thirteen states have even adopted statutes "authorizing admission of DNA evidence."

While the National Academy of Sciences report was critical of the basis for some other types of forensic evidence, there is no remaining doubt about the reliability of properly performed DNA analysis:

... Among existing forensic methods, only nuclear DNA analysis has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between an evidentiary sample and a specific individual or source. Indeed, DNA testing has been used to exonerate persons who were convicted as a result of the misapplication of other forensic science evidence.

Although some courts initially refused to admit the results of DNA testing because of perceived flaws, DNA evidence is now universally admitted by courts in the United States. When 2 profiles are found to "match" in a search of the Federal Bureau of Investigation's (FBI's) Combined DNA Index System (CODIS) database using 13 short tandem repeat (STR) loci, the likelihood that the profiles came from different people is extremely small. In other words, assuming the samples were properly collected and analyzed, an observer may state with a high degree of confidence that the two profiles likely came from the same person.

Although the forensic use of nuclear DNA is barely 20 years old, DNA typing is now universally recognized as the standard against which many other forensic individualization techniques are judged. DNA enjoys this preeminent position because of its reliability and the fact that, absent fraud or an

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38 Cormier, Calandro & Reeder, supra note 33, at 13-14.
39 See Murphy, supra note 28, at 724.
40 KREEGER & WEISS, supra note 29, at 19.
error in labeling or handling, the probabilities of a false positive are quantifiable and often miniscule.41

Other than issues of laboratory procedures and safeguards which present themselves in all forensic science cases, the admissibility questions concerning DNA which remain for trial judges today arise mainly from the development and discovery of new methods of DNA analysis. We are in what has been described as the "fifth phase" of the judicial evaluation of DNA admissibility.42 Nuclear DNA ("nDNA") testing is the most discriminating test, while mitochondrial DNA ("mtDNA") testing is less so.43 DNA testing does not really produce a match between two samples, but instead describes the statistical likelihood that the evidence sample came from someone other than the defendant.44 "Three methods are . . . used to generate DNA profiles": RFLP ("restriction fragmentation length polymorphism"), PCR ("polymerase chain reaction"), and STR ("short tandem repeats test").45

Results obtained through PCR-based DNA methods are being offered regularly, and the only remaining question for trial judges is whether those methods have a solid scientific foundation or are generally accepted in the scientific community. Current opinions are almost unanimous that PCR-based laboratory procedures satisfy standards of admissibility under Frye or Daubert evaluations.46 Courts in more than thirty-five states have specifically admitted evidence based on the PCR method of amplifying DNA.47 Use of the now common "product rule" for testing the frequency of genotypes in the population in PCR-based

41 NAT'L RESEARCH COUNCIL OF THE NAT'L ACADS., supra note 25, at 3-12, 5-3.
43 Moriarty & Saks, supra note 21, at 19.
44 See BROUN ET AL., supra note 42, § 205, at 316.
45 Moriarty & Saks, supra note 21, at 19. For a detailed description of the chemistry and mechanics of each method, see KREEGER & WEISS, supra note 29, at 7-9.
46 KREEGER & WEISS, supra note 29, at 19.
47 Id.
tests is widely recognized as both scientifically sound and generally accepted. More than twenty-five states have admitted evidence of accompanying population frequency statistics.

The value of DNA evidence goes beyond proving identity. DNA evidence may be used by the prosecutor to prove or corroborate many elements of the charged crime. Prosecutors have been urged to use DNA evidence "just as any other form or type of evidence—to corroborate, validate and/or impeach evidence or testimony." The location of a tested specimen of blood or other evidence may corroborate a complainant's description of where the offense occurred or could be used to refute a defense claim of alibi. The location of DNA tested samples may show single sources or mixed DNA from both the complainant and the defendant and may demonstrate a sequence of events. DNA evidence may even be offered by the prosecutor to show purpose or intent. DNA evidence may also be offered as impeachment of a defendant's testimony or earlier statements or to enhance the credibility of a complainant.

Although DNA profiling is clearly scientifically superior to other forensic identification evidence, it is not—contrary to earlier pronouncements—infallible. DNA evidence and its underlying methodology are, of course, subject to human error. False positive DNA results have occurred and will undoubtedly continue to be

\[\text{KREEGER \& WEISS, supra note 29, at 14-15.}\]  
\[\text{Id. at 19.}\]  
\[\text{Id. at 18.}\]  
\[\text{Id. at 17.}\]  
\[\text{Id.}\]  
\[\text{Id. at 18.}\]  
\[\text{KREEGER \& WEISS, supra note 29, at 18.}\]  
\[\text{See generally Johnathan J. Koehler, Error and Exaggeration in the Presentation of DNA Evidence at Trial, 34 JURIMETRICS J. 21 (1993) (discussing how experts and attorneys may misrepresent and misinterpret estimates, resulting in overstated statements regarding the strength and implications of DNA evidence); William C. Thompson, Guide to Forensic DNA Evidence, in EXPERT EVIDENCE: A PRACTITIONER'S GUIDE TO LAW, SCIENCE, AND THE FJC MANUAL 195, 231-36 (Bert Black & Patrick W. Lee eds., 1997).}\]
part of the DNA testing landscape. Proffered evidence may still, as with other forensic science evidence, be the result of mistakes or contamination in its collection, testing, or interpretation. As the technology and methodology of DNA testing has progressed, it is the human errors that may present the biggest evidentiary challenges for trial judges.

DNA evidence has been recently challenged on a variety of factors, including poor laboratory proficiency testing, contamination, lack of proper laboratory protocols or accreditation, improper techniques, lack of quality control, and broken chains of custody. Laboratory temperature variances are a source of challenge because DNA is very sensitive to environmental conditions and can "start to degrade depending on the sample's exposure to extreme temperatures, oxygen, water, sweat, and breath." If the sample evidence is contaminated before PCR amplification, the identity of the donor may be masked by over-amplification. Before and at the laboratory, DNA testing errors result from sample mislabeling, or otherwise switching samples, or from cross-contamination between samples in the same or different cases.

Currently, the immense demand for DNA testing by police and prosecutors may inadvertently pose the most serious threat to its use in criminal trials. The overwhelming demand may be

57 See Joel D. Lieberman et al., Gold Versus Platinum: Do Jurors Recognize the Superiority and Limitations of DNA Evidence Compared to Other Types of Forensic Evidence?, 14 PSYCHOL. PUB. POLY & L. 27, 31 (2008).
58 Id.
59 Id. (citing Carl W. Gilmore, Challenging DNA in Paternity Cases: Finding Weaknesses in an Evidentiary Goliath, 90 ILL. B.J. 472, 474 (2002)).
resulting in poor laboratory practices by inexperienced or overworked technicians to the degree that confidence in DNA test results is being affected. There were "whistleblower" allegations of pro-prosecution bias and even fraud at the Federal Bureau of Investigation's crime laboratory that required significant reforms, but nevertheless more allegations of improper testing and false testimony later surfaced. Recently even the Department of Justice Inspector General officially reported that the FBI laboratory still "was riddled with flawed scientific practices that had potentially tainted dozens of criminal cases, including the bombings of the Federal Building in Oklahoma City and the World Trade Center in New York." Suspected and documented cases of poor practices and false reports by forensic scientists at various state and local crime laboratories have been equally rampant. The Supreme Court of West Virginia ultimately conducted a series of

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The reality is that there are few accepted standards for the performance and practices of forensic science laboratories, either public or private. The National Academy of Sciences report recommends significant strengthening of the oversight of crime laboratories in light of the current vacuum:

Several commentators appearing before the committee noted that nearly anyone with a garage and some capital theoretically could open a forensics laboratory and start offering services. Although this might be a bit hyperbolic, the fact is that there are no requirements, except in a few states (New York, Oklahoma, and Texas), for forensics laboratories to meet specific standards for quality assurance or for practitioners to be certified according to an agreed set of standards. Well-publicized problems in large crime laboratories have uncovered systematic deficiencies in quality control. . . . Problems included poor documentation, serious analytical and interpretive errors, the absence of quality assurance programs, inadequately trained personnel, erroneous reporting, the use of inaccurate and misleading statistics, and even "drylabbing" (the falsification of scientific results).

Despite important movement in recent years toward developing and implementing quality control measures in the forensic science disciplines, a lack of uniform and mandatory quality assurance procedures, combined with some highly publicized problems involving large crime laboratories, has led to heightened attention to efforts to remedy uneven quality among laboratories through the imposition of standards and best practices. . . .\footnote{NAT'L RESEARCH COUNCIL OF THE NAT'L ACADS., supra note 25, at 7-1 (citations omitted).}
Trial judges will necessarily find themselves as the primary guardians of the integrity of scientific evidence that is sought to be introduced to prove guilt. When it comes to DNA evidence, the gatekeeper role assigned to trial judges may find its most important function not in an evaluation of the reliability or general acceptance of new scientific theory, but rather in the very traditional functions of insuring that proffered evidence meets basic standards of authenticity, relevance, and reliability in the particular application of a scientific theory.

Deficiencies in a particular application may be found to go more to weight than admissibility. In United States v. Gipson, the Court of Appeals for the Eighth Circuit differentiated the court's role in evaluating theory, as opposed to application, when it came to the use of particular DNA testing kits which were challenged:

In applying the reliability requirement of Daubert, this court has drawn a distinction between, on the one hand, challenges to a scientific methodology, and, on the other hand, challenges to the application of that scientific methodology. In United States v. Beasley, . . . the district court admitted DNA evidence based upon the polymerase chain reaction (PCR) method of DNA typing, derived by using the DQ<<alpha>> Amplitype and Polymarker test kits. . . . As our court's Beasley opinion explains, the rule in this circuit is that, when the application of a scientific methodology is challenged as unreliable under Daubert and the methodology itself is otherwise sufficiently reliable, outright exclusion of the evidence in question is warranted only if the methodology "was so altered [by a deficient application] as to skew the methodology itself."68

Nevertheless, when it comes to human error, particularly of the types recently reported, the application may indeed be "so altered" as to skew the results beyond the limits of admissibility. It would be a mistake for trial judges to assume, as the public is wont

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68 United States v. Gipson, 383 F.3d 689, 696-97 (8th Cir. 2004) (alteration in original) (citing and quoting United States v. Beasley, 102 F.3d 1440, 1445-48 (8th Cir. 1996)). The Supreme Court of Colorado reached a similar result as to the use of other DNA testing kits. People v. Shreck, 22 P.3d 68, 82-83 (Colo. 2001) (en banc).
to do, that all proffered DNA evidence is genuine, reliable, and admissible. As Professor Simon Cole admonished:

Recent history demonstrates that DNA evidence, like other types of forensic evidence, is subject to laboratory error, prosecution bias, and overstatement of the scientific certainty of conclusions. Precautions should be taken to ensure that forensic DNA evidence receives ongoing scrutiny from the courts, the defense bar, and the scientific community and is not turned into a black box whose conclusions are treated as unassailable, error-free gospel.

In performing our gatekeeper role, trial judges will need to demand more than "mere testimony of a genetic match" and not disregard the apparently distinct possibility of human error.

C. Non-DNA Forensic Scientific Evidence Generally

While the emergence of forensic DNA evidence has proven to be a dramatically positive aspect of new breakthroughs in science and technology, one perhaps unanticipated effect is that those same new scientific analyses have cast doubt on some of the more traditional types of forensic scientific evidence that trial judges have long treated as reliable and generally accepted. New scientific methods have caused some to reassess the validity of such things as serology testing, comparative bullet lead analysis, bite mark identification, handwriting analysis, hair and fiber analysis, and

69 "More than 8 in 10 Americans (85%) think DNA evidence is either completely (27%) or very (58%) reliable. A majority considered it reliable when Gallup first asked the question in 2000; the percentage backing the reliability of DNA has increased since then." Darren K. Carlson, Americans Conclusive About DNA Evidence, GALLUP, Nov. 15, 2005, http://www.gallup.com/poll/19915/Americans-Conclusive-About-DNA-Evidence.aspx.


tool mark and ballistics testimony. Even more disturbing has been new scientific evidence that fingerprint comparisons may not be entitled to the weight that courts and jurors have long ascribed to it. Postconviction DNA testing itself has resulted in proof of wrongful convictions that were based on seemingly reliable non-DNA forensic scientific evidence. For example, twenty-two percent of the first two hundred postconviction DNA exonerations had been based on false hair or fiber comparisons, and almost forty percent had been based on serology evidence.

The so-called "soft sciences" have both developed and been called into serious question by modern scientific examination. On the one hand, eyewitness testimony, long considered by jurors to be the most important evidence they hear, is itself being challenged as unreliable and courts are being asked to admit expert testimony as to its fallibility. On the other, scientists are challenging the lack of a scientific foundation for such behavioral science claims of "battered woman syndrome" or "rape trauma syndrome." There is an underlying question of whether Daubert, or even Frye, applies to the behavioral sciences at all. It is an interesting conundrum for many behavioral scientists. Many have fought the stigma of the sobriquet "soft" sciences for many years and insisted that behavioral science is based upon the same demanding standards reflected in the scientific method used by the physical sciences. Now, however, some behavioral scientists are fighting equally hard to escape the gatekeeping standards of Frye or Daubert by arguing that the same principles of general acceptance or scientific validity and reliability should not apply to them.

74 See id. at 125.
77 See id. at 968.
They insist that behavioral sciences are "different" and should be treated differently by the courts.\textsuperscript{78} One commentator stated the problem thus:

Most expert testimony is based on the scientific method. Increasingly, however, experts trained in social science are being used in American courtrooms, and these witnesses do not uniformly rely upon the scientific method as the basis for their testimony. A curious problem arises, then, when expert testimony is not grounded in the scientific method. The problem arises out of the fact that both the \textit{Frye} and \textit{Daubert} approaches to expert testimony are based upon scientific method principles, principles that are not always compatible with social science.\textsuperscript{79}

This conflict arises directly in criminal cases when trial judges are confronted by prosecutors with a proffer of expert testimony in such areas as sexual abuse "syndromes" or when the defense wants to introduce expert evidence about the fallibility of eye witness identification. The legal status of those particular types of forensic evidence are discussed later in this article, but first some comments are in order about the whether the court even has a \textit{Frye} or \textit{Daubert} gatekeeping role when it comes to behavioral science evidence.

After \textit{Daubert}, there was some dispute about whether its gatekeeping requirements applied to what the Court of Appeals for the Eleventh Circuit, for example, characterized as "non-scientific," technical expert testimony.\textsuperscript{80} In \textit{Carmichael v. Samyang Tire, Inc.}, that court held that \textit{Daubert} should not apply to expert testimony based on experience, as opposed to scientific theory.\textsuperscript{81} The Supreme Court of the United States rejected the notion and reversed the Eleventh Circuit in that case in \textit{Kumho Tire Co. v.}

\footnotesize
\begin{itemize}
\item \textsuperscript{78} Steele, \textit{supra} note 76, at 968 (citing Hadden v. State, 690 So. 2d 573, 579-80 (Fla. 1997)).
\item \textsuperscript{79} \textit{Id.} at 954 (footnotes omitted).
\item \textsuperscript{81} \textit{Id.}
\end{itemize}
Similar distinctions used by other federal courts were also presumably invalidated by the broader requirements of *Kumho*.\(^8\)

Obviously neither *Daubert* nor *Kumho* are controlling in the state courts where most criminal cases are tried. Some states that still use the *Frye* type test have held that it simply does not apply to testimony from behavioral science experts. In *People v. Beckley*,\(^8^4\) the Supreme Court of Michigan dealt with the issue of whether the testimony of an expert in the "child sexual abuse syndrome" was properly admitted.\(^8^5\) The court held that the Michigan version of *Frye*, known as *Davis/Frye*, simply did not apply to behavioral science testimony:

"Psychologists, when called as experts, do not talk about things or objects; they talk about people. They do not dehumanize people with whom they deal by treating them as objects composed of interacting biological systems. Rather, they speak of the whole person." Thus, it is difficult to fit the behavioral professions within the application and definition of *Davis/Frye*.

The ultimate testimony received on syndrome evidence is really only an opinion of the expert based on collective clinical observations of a class of victims. Further, the issues and the testimony solicited from experts is not so complicated that jurors will not be able to understand the "technical" details. The experts in each case are merely outlining probable responses to a traumatic event. It is clearly within the realm of all human experience to expect that a person would react to a traumatic event and that such reactions would not be consistent or predictable in all persons. Finally, there is a fundamental

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83 Some of the earlier distinctions were made in *United States v. Bighead*, 128 F.3d 1329, 1330 (9th Cir. 1997); *United States v. Cordoba*, 104 F.3d 225, 230 (9th Cir. 1997); and *Berry v. City of Detroit*, 25 F.3d 1342, 1349 (6th Cir. 1994).


85 Id. at 402-03.
difference between techniques and procedures based on chemical, biological, or other physical sciences as contrasted with theories and assumptions that are based on the behavioral sciences.

We would hold that so long as the purpose of the evidence is merely to offer an explanation for certain behavior, the Davis/Frye test is inapplicable.\(^{86}\)

It must be noted that Michigan more recently became a Daubert state,\(^{87}\) and it remains to be seen if the Supreme Court of Michigan will exempt the behavioral sciences from its requirements as well.\(^{88}\)

Predictably, behavioral science experts have not fared as well in states that have applied Daubert or Frye to them.\(^{89}\) Sound scientific theory is testable if its rate of error can be calculated and subjected to peer review and the test of general acceptance. Human behavior, on the other hand, is more difficult to duplicate and is often incapable of appropriate testing and review. Several states have applied Frye and Daubert to behavioral science testimony and found it wanting.\(^{90}\)

\(^{86}\) Beckley, 456 N.W.2d at 404 (quoting Dirk Lorenzen, The Admissibility of Expert Psychological Testimony in Cases Involving the Sexual Misuse of a Child, 42 U. MIAMI L. REV. 1033, 1035 (1988)). The Supreme Court of Michigan later affirmed its Beckley position, but modified the purposes for which such evidence could be introduced in People v. Peterson, 537 N.W. 2d 857, 866 (Mich. 1995).


\(^{88}\) The state also amended its rules of evidence to correspond with Daubert, and it may therefore be more difficult to carve out such an exemption. MICH. R. EVID. 702.

\(^{89}\) "Not surprisingly, when social science-based testimony is subjected to the Frye test or to the Daubert factors, that testimony fails either standard." Steele, supra note 76, at 956.

\(^{90}\) Newkirk v. Commonwealth, 937 S.W.2d 690, 695 (Ky. 1996) (holding that child sexual abuse syndrome evidence offered for any use would fail to meet the standards set forth in either Frye or Daubert); State v. Foret, 628 So. 2d 1116, 1127 (La. 1993) (holding that child sexual abuse accommodation syndrome fails Daubert because it is not scientifically reliable); Commonwealth v. Dunkle, 602 A.2d 830, 832 (Pa. 1992) (holding that syndrome evidence does not meet Frye standards); Fowler v. State, 958 S.W.2d 853, 864 (Tex. App. 1997) (holding that testimony regarding domestic violence might satisfy state
D. Fingerprints

Fingerprint comparisons have been accepted as evidence in criminal prosecutions for over one hundred years. Courts have accepted the proposition that each person's fingerprint is unique and that fingerprint comparison is almost infallible as a means of forensic identification. Fingerprint experts often declare a positive identification, rather than a probability of identity. Recently, that assumption of infallibility has been seriously undermined by new scientific analysis.

States that still use the Frye analysis will have little difficulty with new fingerprinting information because fingerprint identification is certainly generally accepted and has been for a long time. Most of the claims made by fingerprint examiners enjoy widespread belief among members of both the public and the bar. In a sense, this points out the significant limitation of the Frye test in that the criminal justice systems using that test take a very long time to react to changes in science, which often can take place in a short period of time.

The challenge of Daubert, however, is significant if it is to be applied to fingerprinting. On the one hand, most, if not all, of the claims made by, or on behalf of, fingerprint examiners enjoy widespread and unquestioning belief among the lay public, including the bench and the bar. On the other hand, little conventional science exists to support the generally accepted claims regarding fingerprint identification. Although there is debate about the number of points of similarity in fingerprints that are sufficient to declare a match, there is no generally accepted scientific or court-recognized minimum standard. Proficiency testing simply does not support the zero error rate claimed by fingerprint examiners. In fact, a majority of the most basic tenets

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91 For a description of the evolution and history of fingerprint identification, see Cole, supra note 70, at 65-75.
92 See 4 David L. Faigman et al., supra note 22, § 34:2, at 278-79.
93 See id. § 34:1, at 276.
94 The details of fingerprinting and fingerprinting comparison, as well as some of its limitations, are described in 4 Faigman et al., supra note 22, §§ 34:21-34:53, at 339-371.
of fingerprint identification have never been subjected to empirical analysis. Most modern researchers who have looked into fingerprinting comparison have concluded that the broad claims of fingerprint identification accuracy cannot be substantiated. As one commentator put it, the "gold standard" of fingerprinting identification may be more akin to "fool's gold."

Nevertheless, the few courts that have reexamined fingerprint identification under Daubert either have held that it passed Daubert muster or have just continued to give it a superficial review and approval. Very few have rejected or limited fingerprint examiner testimony after a Daubert review. In United


96 Malcom, supra note 71, at 328.


States v. Llera Plaza\(^{100}\)—vacated and superseded on reconsideration\(^{101}\)—the federal district judge did an interesting about-face in his *Daubert* analysis of fingerprint evidence.\(^{102}\) However, in view of the mounting scholarly evidence that fingerprinting lacks scientific validation, some courts have allowed the defense to admit evidence about the unreliability of fingerprint comparisons.\(^{103}\)

The rather blind acceptance of fingerprint evidence that is borne of years of assumptions about its validity is likely to erode slowly. The federal courts and those state courts that have adopted *Daubert* will eventually face the necessity to reevaluate the scientific basis for fingerprinting's assumptions about uniqueness and to reexamine the question of whether fingerprint comparison, without scientific standards of point similarity, is perhaps more art than science. States still using the *Frye* analysis will take longer to reassess fingerprint evidence. By definition, the "general acceptance" of fingerprinting will only erode as even more scientists begin to doubt its validity and as more *Daubert* courts begin to doubt its admissibility.

**E. Firearms, Toolmarks, and Bullet Lead Comparison**

Weapons used in the commission of crimes are a prime source of evidence, as investigators seek to identify a particular gun or other weapon as the unique source of bullets or other ammunition components or to identify whether a particular tool, or even knife, was used to commit the crime. Marks made by tools in the manufacture of guns or ammunition may result in particular corresponding marks on bullets, cartridge cases, and shot shells as they process through the firing mechanism.\(^{104}\)

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\(^{103}\) See Epstein, *supra* note 95, at 650.

\(^{104}\) See 4 *FAIGMAN ET AL.*, *supra* note 22, § 34:3, at 580.
The proffered basis for expert firearm or toolmark testimony is that each set of markings is unique.\textsuperscript{105} Although such testimony has been almost universally accepted,\textsuperscript{106} it may be susceptible to a viable Daubert challenge. The National Academy of Sciences report is very critical of the scientific basis for the type of toolmark and ballistics evidence that has been routinely accepted by the courts:

Because not enough is known about the variabilities among individual tools and guns, we are not able to specify how many points of similarity are necessary for a given level of confidence in the result. Sufficient studies have not been done to understand the reliability and repeatability of the methods...

A fundamental problem with toolmark and firearms analysis is the lack of a precisely defined process...

Although some studies have been performed on the degree of similarity that can be found between marks made by different tools and the variability in marks made by an individual tool, the scientific knowledge base for toolmark and firearms analysis is fairly limited.\textsuperscript{107}

Recent Daubert hearings have not resulted in a successful attack on classic ballistics expert testimony.\textsuperscript{108} Of course, such

\textsuperscript{105}4 FAIGMAN ET AL., supra note 22, § 34:4, at 582-83.
\textsuperscript{106}See id. § 34:4, at 583-87; Moriarty & Saks, supra note 21, at 20. However, in United States v. Green, the judge allowed toolmark evidence in spite of his reservation that "[t]he more courts admit this type of toolmark evidence without requiring documentation, proficiency testing, or evidence of reliability, the more sloppy practices will endure; we should require more." United States v. Green, 405 F. Supp. 2d 104, 107 (D. Mass. 2005).
\textsuperscript{107}NAT'L RESEARCH COUNCIL OF THE NAT'L ACADS., supra note 25, at 5-21.
\textsuperscript{108}Commonwealth v. Meeks is a good example of a thorough Daubert hearing that even included a tour of the laboratory by the judge, after which he found that

[b]oth the hearing testimony and the hearing exhibits ... not only establish that the methodology employed in firearms examinations is generally accepted by firearms examiners, but also support the underlying premise, that
testimony remains subject to attacks upon the propriety and reliability of the laboratory procedures utilized or the qualifications of a proposed expert witness in a particular case and may require the trial judge to hold preliminary hearings into those matters to determine if they pose admissibility questions or only go to the weight of the government's evidence.\(^{109}\)

On the other hand, bullet lead comparison is of questionable validity. Analysis of bullet lead for identification purposes is premised on the theory that batches of lead in bullets have unique combinations of arsenic, antimony, tin, copper, bismuth, silver, and cadmium.\(^{110}\) The conclusion is that when two bullets have the same ratios of these elements, they came from the same source.\(^{111}\) However, one batch of lead in the bullet making process produces a large number of bullets, and those bullets may in turn go to a variety of distribution routes.\(^{112}\)

While some courts initially admitted bullet lead analysis comparison testimony for identification, metallurgists and statisticians eventually demonstrated that it is not reliable. An early Daubert evaluation in United States v. Mikos\(^{113}\) found that source conclusions based on bullet lead analysis were based on faulty science and were inadmissible.\(^{114}\) The National Academy of Sciences conducted a study and found that, while the methods for


\(^{111}\) See 4 Faigman et al., supra note 22, § 35:2, at 638.

\(^{112}\) For a general description of the theory of bullet lead analysis, see 4 Faigman et al., supra note 22, § 35:5, at 644 (quoting Robert D. Koons & JoAnn Buscaglia, Forensic Significance of Bullet Lead Comparisons, 50 J. Forensic Sci. 1, 10 (2005)); Moriarty & Saks, supra note 21, at 22.


\(^{114}\) See id. at *6.
identifying and measuring the elements were sound, the assumptions based on those measurements were simply unsupportable.\textsuperscript{115} Shortly thereafter, the FBI ceased to use bullet lead comparison in its investigations.\textsuperscript{116} And even Frye courts have since rejected bullet lead comparisons.\textsuperscript{117}

\textit{F. Eyewitness Identification Experts}

Unlike much of the forensic science evidence discussed herein, eyewitness identification experts are typically proffered by the defense in criminal cases to raise a reasonable doubt about the reliability of a government witness claiming to identify the defendant as a perpetrator. The defense may seek to present expert testimony based on scientific research that eyewitness testimony in general is not very reliable and may also want to elicit testimony that the particular conditions present at the particular identification in the case is scientifically suspect. The necessity for such testimony from the defense perspective is strong. Jurors appear to give great weight to the testimony of eyewitnesses, even at the expense of forensic scientific evidence in the case.\textsuperscript{118}

There is a significant body of scientific research to support the defense position. Studies going back over twenty-five years have demonstrated the unreliability of eyewitness testimony

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\textsuperscript{117} See, e.g., Clemons v. State, 896 A.2d 1059, 1077-79 (Md. 2006).

\textsuperscript{118} In our study of the so-called CSI Effect, we found that jurors had high expectations that the prosecutor would produce scientific evidence, but they were nevertheless willing to find a defendant guilty without any scientific evidence if the government had eyewitness testimony. Shelton, Kim & Barak, supra note 1, at 354. The demand for scientific evidence as a prerequisite for a guilty verdict was prominent only in rape cases or where the government was relying on circumstantial evidence. Id.; Donald Shelton, The "CSI Effect": Does It Really Exist?, NAT'L INST. JUST. J., Mar. 2008, at 1, 5 (2008), available at http://www.ncjrs.gov/pdffiles1/nij/221501.pdf.
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generally.\textsuperscript{119} These psychological studies have shown that humans are just not very good (some less than sixty percent) at identifying people they saw briefly during a traumatic incident.\textsuperscript{120} They also indicate that identifications of persons of a different race than the witness are especially unreliable.\textsuperscript{121} In the wake of DNA exonerations of persons convicted on the basis of eyewitness testimony, the Department of Justice convened a working group that studied the issue of eyewitness identifications.\textsuperscript{122} The Attorney General's preface to the report of that group said:

Recent cases in which DNA evidence has been used to exonerate individuals convicted primarily on the basis of eyewitness testimony have shown us that eyewitness evidence is not infallible. Even the most honest and objective people can make mistakes in recalling and interpreting a witnessed event; it is the nature of human memory. This issue has been at the heart of a growing body of research in the field of eyewitness identification over the past decade.\textsuperscript{123}

Notwithstanding this research, some courts have been very reluctant to admit expert testimony about eyewitness identification. A few jurisdictions even have adopted a per se rule excluding it, most notably the Court of Appeals for the Eleventh Circuit in United States v. Holloway.\textsuperscript{124} A few states have also employed a per se exclusion.\textsuperscript{125} The Eleventh Circuit revisited its per se


\textsuperscript{120} Cutler \& Penrod, supra note 119, at 8.

\textsuperscript{121} 2 Moriarty, supra note 4, § 13:54, at 13-71 to -72.


\textsuperscript{123} Id. at iii.

\textsuperscript{124} United States v. Holloway, 971 F.2d 675, 679 (11th Cir. 1992).

exclusion after *Daubert* in *United States v. Smith* but did not change its position and relied on the trial judge's finding that such testimony would not assist the jury.\(^{126}\) The Eleventh Circuit appears to be the only federal circuit to have a rule that such testimony is not admissible per se.

More generally, however, courts have held that the admissibility of expert testimony about eyewitness identification is to be decided by the same factors used in evaluating other proffered scientific testimony, whether under *Frye, Daubert*, or general relevancy considerations. Courts have always focused on whether the accuracy of eyewitness identifications is a matter in which jurors need assistance. Even before *Daubert*, trial judges were required to consider many traditional admissibility factors in deciding the admissibility of such testimony, including how it might "fit" the facts of a particular case. In 1973 the Court of Appeals for the Ninth Circuit in *United States v. Amaral*, for example, described a four-part test for admissibility that is still used by many courts: (1) is the expert qualified; (2) is the expert's testimony a proper subject in the particular case; (3) is it based in a generally accepted theory; (4) is its probative value outweighed by its prejudicial effect?\(^{127}\) Several courts held that, contrary to the Eleventh Circuit position, the failure to make such an analysis and the blanket exclusion of eyewitness identification expert testimony was error.\(^{128}\)

Using these parameters, many courts, however, still exclude expert testimony about eyewitness identification in particular cases on the grounds that it is not a proper subject because it will not assist the jury. The rationale is that jurors are able to evaluate the

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\(^{126}\) *United States v. Smith*, 122 F.3d 1355, 1358 (11th Cir. 1997) (quoting the district court).

\(^{127}\) *United States v. Amaral*, 488 F.2d 1148, 1153 (9th Cir. 1973).

credibility of an eyewitness using their common knowledge and experience after hearing competent cross examination and that expert testimony is simply not useful in making the credibility decision.\textsuperscript{129} Other courts, especially in more recent cases, reject this "common knowledge" approach in favor of scientific research casting doubt on such "myths."\textsuperscript{130} In \textit{United States v. Smithers}, the Court of Appeals for the Sixth Circuit specifically applied \textit{Daubert} and required the trial court to make an assessment of the relevance and the scientific basis for eyewitness identification testimony, especially when such an identification is the only evidence offered to prove guilt.\textsuperscript{131} After \textit{Daubert}, the Court of Appeals for the Ninth Circuit held in \textit{United States v. Rincon},\textsuperscript{132} and later reinforced in \textit{United States v. Hicks}, that "the admissibility of expert testimony concerning eyewitness identification should be based on an individualized inquiry, rather than strict application of the past rule that summarily excluded such testimony."\textsuperscript{133}

While some judges still insist that jurors are fully capable of understanding the dangers of eyewitness identification without the necessity of expert assistance, the trend appears to be the opposite direction. The spate of recent exonerations after postconviction DNA testing has some lessons that appear not to be lost on judges when considering whether to admit expert testimony about eyewitness identification. The Innocence Project analysis of such

\textsuperscript{129} See, e.g., \textit{United States v. Martin}, 391 F.3d 949, 953-54 (8th Cir. 2004); \textit{United States v. Hicks}, 103 F.3d 837, 847 (9th Cir. 1996); \textit{United States v. Kime}, 99 F.3d 870, 884 (8th Cir. 1996); \textit{United States v. Larkin}, 978 F.2d 964, 971 (7th Cir. 1992); \textit{State v. Higgins}, 898 So. 2d 1219, 1240 (La. 2005).

\textsuperscript{130} \textit{United States v. Moore}, 786 F.2d 1308, 1312 (5th Cir. 1986); \textit{see also} \textit{United States v. Mathis}, 264 F.3d 321, 335-42 (3d Cir. 2001) (providing a detailed analysis of whether an expert's testimony should have been admitted), \textit{cert. denied}, 535 U.S. 908 (2002); \textit{United States v. Langan}, 263 F.3d 613, 624 (6th Cir. 2001) (allowing the jury to weigh eyewitness testimony without the aid of any expert); \textit{People v. Lee}, 750 N.E.2d 63, 66-67 (N.Y. 2001) (holding the inclusion of eyewitness expert testimony was not an abuse of discretion); \textit{People v. Radcliffe}, 764 N.Y.S.2d 773, 775 (Sup. Ct. 2003) (identifying the traditional safeguards of eyewitness testimony).

\textsuperscript{131} \textit{United States v. Smithers}, 212 F.3d 306, 313-16, 318 (6th Cir. 2000).


\textsuperscript{133} \textit{United States v. Hicks}, 103 F.3d 837, 847 (9th Cir. 1996) (citing \textit{Rincon}, 28 F.3d at 926).
cases led them to conclude that mistaken eyewitness identifications "contributed to over 75% of the more than 220 wrongful convictions in the United States overturned by post-conviction DNA evidence." When eyewitness identification is a principal part of the government's prosecution in a particular case, courts are increasingly recognizing the need to allow expert testimony about the limitations of human perception and recall and how situational factors affect the accuracy of such an identification.

G. Handwriting Comparison

Comparison of handwriting samples is one of the oldest types of forensic evidence. The science is based on "the asserted ability to determine the authorship vel non of a piece of handwriting by examining the way in which the letters are inscribed, shaped and joined, and comparing it to exemplars of a putative author's concededly authentic handwriting." Handwriting examiners claim that no two people write alike and that no one person writes the same way twice. They argue, therefore, that no two writings are ever identical.

Although it was offered in courts even before the twentieth century, it was not widely accepted as scientific evidence until it became part of the cornerstone of the prosecution case in State v. Hauptmann, the Lindbergh kidnapping case. After that, it appears to have been almost unanimously accepted as reliable and admissible. As with several other such routinely accepted types of forensic scientific evidence, Daubert has led scientists and the

136 Risinger, supra note 135, § 33:12, at 496.
137 Id. § 33:12, at 496-97.
courts to reexamine questions of the reliability and admissibility of handwriting comparison expert testimony.

_Daubert_ started a reevaluation of handwriting testimony which led to even more inquiries after _Kumho_. On the science side, for example, one 2002 empirical study found that the ability to determine the writer with a high degree of confidence was established using computer algorithms for extracting features from samples from 1500 representative individuals.\textsuperscript{140} Some courts are not so sure. In _United States v. Fujii_, an American court excluded handwriting analysis testimony for the first time since the Lindbergh case,\textsuperscript{141} and it was followed in _United States v. Saelee_.\textsuperscript{142} While other courts have begun to express some reservations, they have not excluded handwriting analysis testimony altogether.\textsuperscript{143}

\textbf{H. Hair Analysis}

Traditionally, forensic evidence comparing human hair was based on a microscopic comparison of the evidentiary sample with a known sample from the defendant.\textsuperscript{144} Although used by investigative agencies, including the FBI,\textsuperscript{145} the most that it can show is that a hair is consistent with having originated from a

\textsuperscript{140} Sargur N. Srihari, Sung-Hyuk Cha, Hina Arora & Sangjik Lee, _Individuality of Handwriting_, 47 J. FORENSIC SCI. 856, 871 (2002). Indeed, there is a growing field of computerized handwriting analysis as opposed to individual examiner analysis. See Risinger, _supra_ note 135, § 33:40, at 569-71.

\textsuperscript{141} _United States v. Fujii_, 152 F. Supp. 2d 939, 942 (N.D. Ill. 2000).


\textsuperscript{143} See, e.g., _United States v. Hines_, 55 F. Supp. 2d 62, 67-68 (D. Mass. 1999) (holding that expert testimony about general similarities and differences between the evidentiary sample and defendant's exemplar was admissible but that the expert could not testify to the conclusion that the defendant was the author because it lacked empirical validation).


particular person but would also be consistent with many others. Prosecutorial and expert claims of a "match" based on hair analysis are clearly overstatements of the capabilities of microscopic hair analysis. And it is clear that substantial errors have occurred using microscopic hair analysis.

The advent of DNA, and particularly the mtDNA method, changed the field of forensic hair analysis completely. The mtDNA method is not nearly as discriminating as the usual nuclear DNA, since it is based on mitochondria in human cells, which are shared by maternal relatives. Thus siblings will be indistinguishable based on mtDNA comparison. In spite of that limitation, its value lies in the fact that mitochondria are found outside the nuclei of human cells and exist in shafts of hair that have no roots attached. If the evidence sample has a root, typical and much

146 "It is recognized that hair comparisons do not constitute a basis for absolute personal identification." Id.; see 4 FAIGMAN ET AL., supra note 22, § 29:37, at 48; ANDRE A. MOENSSSENS, CAROL E. HENDERSON & SHARON G. PORTWOOD, SCIENTIFIC EVIDENCE IN CIVIL AND CRIMINAL CASES § 11.13, at 732-34 (5th ed. 2007); NAT'L RESEARCH COUNCIL OF THE NAT'L ACADS., supra note 25, at 5-26; Richard E. Bisbing, The Forensic Identification and Association of Human Hair, in 1 FORENSIC SCIENCE HANDBOOK 420-21 (Richard Saferstien ed., 2d ed. 2002).

147 See, e.g., People v. Moore, 662 N.E.2d 1215, 1227 (Ill. 1996); People v. Linscott, 566 N.E.2d 1355, 1358-60 (Ill. 1991).

148 At least one court has found that Daubert required the exclusion of microscopic hair analysis evidence and overturned a conviction based on it. Williamson v. Reynolds, 904 F. Supp. 1529, 1557-58, 1562 (E.D. Okla. 1995), aff'd sub nom. Williamson v. Ward, 110 F.3d 1508, 1523 (10th Cir. 1997); see Moriarty & Saks, supra note 21, at 32 n.38 ("Of the first seventy-one convictions that were reversed on the basis of DNA testing, twenty-one involved erroneous microscopic identification of hair samples."). See generally Clive A. Stafford Smith & Patrick D. Goodman, Forensic Hair Comparison Analysis: Nineteenth Century Science or Twentieth Century Snake Oil?, 27 COLUM. HUM. RTS. L. REV. 227 (1996) (questioning the scientific foundation of microscopic hair analysis).


150 See id. at 106.

151 See id. at 100.
more definitive nuclear DNA can, of course, be used. But where there is no root, as is often the case, mtDNA is very effectively used to supplant, or at least support, a microscopic hair analysis. With the limitations on the accuracy of microscopic comparisons, mtDNA analysis can give the court a much more substantial basis for admitting hair analysis as a significant part of a prosecution.

In State v. Pappas, the Supreme Court of Connecticut conducted an exhaustive review of the status of mtDNA sequencing for hair analysis comparison. In language that would satisfy either Frye or Daubert, the court concluded:

[W]e agree with the trial court's conclusion that the procedures used to extract and chart the chemical bases of mtDNA—extraction, PCR amplification, capillary electrophoresis, and the use of an automated sequencing machine to generate a chromatograph—are scientifically valid and generally accepted in the scientific community.

The use of mtDNA sequencing evidence, for hair and other sample analysis, is becoming widespread and has been accepted by many courts. The trend is clearly that mtDNA evidence has become

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154 One study found that nearly twelve percent of declared microscopic hair identifications were found to be erroneous after mtDNA testing. Max M. Houck & Bruce Budowle, Correlation of Microscopic and Mitochondrial DNA Hair Comparison, 47 J. FORENSIC SCI. 964, 966 (2002).

155 Pappas, 776 A.2d at 1100-1113 (Conn. 2001).

156 Id. at 1108.

157 See id.; see also United States v. Beverly, 369 F.3d 516, 528-31 (6th Cir. 2004); United States v. Coleman, 202 F. Supp. 2d 962, 970 (E.D. Mo.
the standard for hair analysis testimony and that microscopic analysis alone may no longer be sufficiently reliable for admission.

I. Bite Mark Analysis

Bite mark testimony seeks to identify a perpetrator by comparing a cast or image of teeth from a bite mark left at a crime scene with a sample of the defendant’s teeth. A forensic odontologist offers testimony in which the bite marks are analyzed and compared. The basic premise underlying bite mark forensic evidence is that human dentition is unique and that, when compared within a reasonable time, an expert opinion identifying the person who made both impressions can be made.158 This basic concept of dental uniqueness has been accepted by many courts.159 Indeed, bite mark evidence in general has received widespread acceptance. In State v. Timmendequas,160 when admitting bite mark evidence, the Supreme Court of New Jersey stated that "[j]udicial opinion from other jurisdictions establish that bite-mark analysis has gained general acceptance and therefore is reliable... Over thirty states considering such evidence have found it admissible and no state has rejected bite-mark evidence as unreliable."161 Nevertheless, significant questions remain for trial judges.

First, despite its acceptance in various cases, there is significant disagreement among odontologists and other scientists even about the basic premise of dental uniqueness. The American Society of Forensic Odontology asserts that the uniqueness

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158 For general information about bite mark comparisons, see generally BITEMARK EVIDENCE (Robert B.J. Dorion ed., 2005).


161 Id. at 114 (citations omitted).
premise has been well established. However, some claim that the premise simply remains unproven:

There is effectively no valid documented scientific data to support the hypothesis that bite marks are demonstrably unique. Additionally, there is no documented scientific data to support the hypothesis that a latent bite mark, like a latent fingerprint, is a true and accurate reflection of this uniqueness. To the contrary, what little scientific evidence that does exist clearly supports the conclusion that crime-related bite marks are grossly distorted, inaccurate, and therefore unreliable as a method of identification.

Second, a number of factors in a particular case may affect the accuracy of bite mark identification. These include such things as the "freshness" of the bite mark impression and its changes over time, temperature or contamination effects at the crime scene, damage to soft tissue around the bite mark, and dental similarities among individuals. A primary concern is often that the impression includes only a limited number of teeth. When experts rely, as they often do, on photographic images of bite marks made at the scene or during an autopsy, the quality of the photography and the enhancement techniques used for comparison can clearly affect the reliability of the odontologist's conclusions. Guidelines have been suggested by the American Board of Forensic Odontology that specifically address many of these factors.

164 See Wilkinson & Gerughty, supra note 163, at 535-37, 550-52.
165 See Giannelli, supra note 163, at 932.
166 See Wilkinson & Gerughty, supra note 163, at 557-59.
167 Am. Bd. of Forensic Odontology, Inc., Guidelines For Bite Mark Analysis, 112 J. AM. DENTAL ASS'N. 383, 384-86 (1986); see also Michelle McClure, Odontology: Bite Marks as Evidence in Criminal Trials, 11 SANTA
Third, in spite of its general admissibility, expert testimony has varied to such a degree that some courts have excluded the testimony altogether. The conclusions that an expert can draw from the evaluation are necessarily limited by the number and quality of the points in the evidentiary sample. Odontology experts have expressed opinions from stating that the bite mark was consistent with the defendant's teeth, to stating that the defendant's teeth probably made the bite mark, to conclusively claiming that the match was a positive identification for the defendant.\textsuperscript{168}

In \textit{Ege v. Yukins},\textsuperscript{169} for example, the District Court for the Eastern District of Michigan found constitutional error in a state court case where testimony about bite marks was a critical factor in the conviction.\textsuperscript{170} The court found that testimony of the government's bite mark expert comparing a photograph of a disputed bite mark on the victim's cheek with a mold of the defendant's teeth made some nine years prior was unreliable, grossly misleading, and "so extremely unfair that its admission violates fundamental concepts of justice."\textsuperscript{171} Specifically, the court used the expert's testimony to point out that out of the 3.5 million people residing in the Detroit metropolitan area, the defendant was the only one whose dentition could match the individual who left the possible bite mark on the victim's cheek "was unreliable and not worthy of consideration by a jury."\textsuperscript{172} As the court noted:

The flaw in Dr. Warnick's statistical opinion should have been obvious and its admissibility readily assailable. The opinion apparently was based on the mathematical product theory, a proposition that long has been condemned and was discredited over thirty-five years ago by the California

\textsuperscript{168}{}For a review of various reported cases using these qualifiers, see generally Paul C. Giannelli, \textit{Forensic Science}, 33 J.L. MED. & ETHICS 535 (2005) (analyzing the use and admissibility of forensic science by courts) [hereinafter Giannelli, \textit{Forensic Science}].
\textsuperscript{170}{}Id. at 880.
\textsuperscript{171}{}Id. at 880 (quoting Dowling v. United States, 493 U.S. 342, 352 (1990)).
\textsuperscript{172}{}Id. at 871.
Supreme Court in the case of People v. Collins, 68 [Cal. 2d] 319, 66 Cal.Rptr. 497, 438 P.2d 33 (1968), a case that has become a classic for law students in basic evidence classes. Other bite mark experts have also been the subject of blistering reviews by the courts.

As with other types of long accepted forensic scientific evidence, postconviction DNA exonerations have called the science into question. In a case that received a great deal of publicity, bite mark evidence from two experts convicted a defendant of capital murder, who was later exonerated by DNA while on death row. Publicity surrounding other murder case DNA exonerations based on bite mark evidence has led to serious public and professional doubts about its validity. The extent to which bite mark evidence will survive Daubert scrutiny, especially in light of both these significant and public reversals and the lack of empirical studies on the subject, remains to be seen.

J. Battered Woman, Rape Trauma, and Child Sexual Abuse Syndromes

Over the last twenty years, prosecutors have sought to present expert testimony concerning various syndromes of symptoms or
characteristics that the government claims are typical of, or at least consistent with, the behavior of victims of certain crimes. Various syndromes have been offered, including child sexual abuse accommodation syndrome, battered child syndrome, battered woman syndrome, battering parent syndrome, separation trauma, and rape trauma syndrome. The testimony is usually offered to corroborate the testimony of the complainant or to rebut certain claims of the defendant. Some preliminary legal issues that arise in these cases are common to the behavioral concept of a syndrome. Initially, as noted earlier, some courts have held that the Frye or Daubert admissibility analysis may not be applicable at all to testimony from experts in the behavioral sciences, and many of those cases arose in the context of proffered syndrome testimony.

The current American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders offers a general definition of syndrome as "[a] grouping of signs and symptoms, based on their frequent co-occurrence, that may suggest a common underlying pathogenesis, course, familial pattern, or treatment selection." A "syndrome" is not necessarily a medical diagnosis, but rather "a collection of related symptoms." A diagnosis depends on whether the pattern of symptoms is the result of an underlying pathological process which is recognized as a "disorder."

In People v. Beckley, the Supreme Court of Michigan more bluntly described it in legal terms: "'Syndrome type' testimony is behavioral characteristics collectively associated with the syndrome which would suggest that the victim was diagnosed as

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180 Lorenzen, supra note 86, at 1046-48 (citing J. CHAPLIN, DICTIONARY OF PSYCHOLOGY 529 (1975)).
181 See id. at 1048; Steele, supra note 76, at 942-46.
182 Beckley, 456 N.W.2d at 391.
possessing the syndrome. The net result of syndrome type testimony is an opinion that abuse in fact occurred. That definition prejudges limitations on its admissibility as substantive evidence. Almost all courts agree that syndrome evidence is not necessarily probative of whether the act occurred, and those courts which allow it to be introduced restrict its use to rebuttal or rehabilitative evidence. The only apparent deviation is in rape trauma cases, where it has been held to be affirmatively admissible as to the complainant's credibility. Even so, it is not admissible to directly prove that the act occurred, and where courts have allowed syndrome evidence, it is admissible only to rehabilitate the victim's testimony. The balance is in not usurping the jury function as finder of fact, on the one hand, while allowing expert testimony concerning syndrome evidence to explain behavioral signs that may confuse a jury so that it believes that the victim's behavior is inconsistent with that of an ordinary victim.

The "battered woman syndrome" is a psychological and behavioral phenomenon that describes characteristics of women living in battering relationships. Although expert testimony on the syndrome originated in self-defense cases, it has been proffered by prosecutors for a variety of reasons and by defendants claiming duress short of self-defense. The syndrome has been recognized for over thirty years and was originally described by its main proponent, Lenore Walker. It is regarded as a subcategory of

183 Beckley, 456 N.W.2d at 396 n.11.
185 See People v. Bowker, 249 Cal. Rptr. 886, 890-91 (Ct. App. 1988); Beckley, 456 N.W.2d at 409-10; State v. Hall, 406 N.W.2d 503, 504-05 (Minn. 1987).
188 See WALKER, BATTERED WOMAN, supra note 186, at 31-35; WALKER, BATTERED WOMAN SYNDROME, supra note 186, at 7-8; LENORE E. WALKER,
posttraumatic stress disorder and has four principle elements: "(1) the woman believes that the violence was her fault; (2) the woman has an inability to place the responsibility for the violence elsewhere; (3) the woman fears for her life and/or her children's lives; and (4) the woman has an irrational belief that the abuser is omnipresent and omniscient."\(^{189}\)

Prosecutors often offer evidence of the syndrome in prosecutions of alleged batterers to explain to the jury why the complainant may have changed her testimony to favor the defendant.\(^{190}\) Yet, prosecutorial use of the syndrome raises substantial questions, and some courts have held that it is impermissible character or "bad acts" evidence.\(^{191}\)

The battered woman syndrome has received more attention from, and greater acceptance by, courts than perhaps any other area of psychological research.\(^{192}\) Courts applying Frye have admitted it.\(^{193}\) Nevertheless, its underlying scientific basis has been the subject of criticism that neither the legal nor empirical bases for

\(^{189}\) WALKER, TERRIFYING LOVE, supra note 188, at 48-49; Michael McGrath, Psychological Aspects of Victimology, in FORENSIC VICTIMOLOGY: EXAMINING VIOLENT CRIME VICTIMS IN INVESTIGATIVE AND LEGAL CONTEXTS 229, 241 (Brent E. Turvey & Wayne Petherick eds., 2009) (explaining that the four general characteristics of battered woman syndrome are often attributed to Walker's BATTERED WOMAN SYNDROME but that no such characteristics are in fact found in that text); see WALKER, BATTERED WOMAN SYNDROME, supra note 186, at 95-97.


the syndrome are sound. At least one court has reviewed battered woman syndrome under a *Daubert*-type standard and found that it was not based on a valid underlying scientific theory.

"Rape trauma syndrome" is "used to describe common responses to a sexual assault." The term "was coined by Burgess and Holmstrom to describe" two stages of recovery from rape. Rape trauma syndrome evidence is usually offered to prove lack of consent. As with other syndrome evidence, it is not probative that a rape occurred and cannot be used simply to bolster the credibility of the alleged witness that the rape occurred. The most accepted use of rape trauma syndrome is as evidence when the defense is consent and the prosecutor wishes to show that the complainant's behavior is consistent with that of rape victims. It usually speaks to postrape behavior.
"Child sexual abuse syndrome" is the phrase often used to describe the profile of characteristics experienced by children after being sexually abused.\textsuperscript{202} Originally, it was described as the "child sexual abuse accommodation syndrome" by Dr. Roland Summit.\textsuperscript{203} His theory described five coping mechanisms commonly observed in sexually abused children: 

1. Secrecy; 
2. Helplessness; 
3. Entrapment and accommodation; 
4. Delayed, conflicted, and unconvincing disclosure; and 
5. Retraction.\textsuperscript{204}

The shorter phrase "child sexual abuse syndrome" is a broader term than Dr. Summit's original theory and includes a longer list of observed characteristics.\textsuperscript{205} The American Medical Association has many more characteristics on its list, including: overt or subtle and indirect disclosures to "a relative, friend, or teacher"; highly sexualized play; withdrawal and excessive daydreaming; low self-esteem and "feelings of shame or guilt"; falling grades; pseudomature personality development; sexual promiscuity; poor peer relationships; attempted suicide; positive relations exhibited toward the offender; and frightened or phobic reactions, especially toward adults.\textsuperscript{206}

Many courts have admitted expert testimony regarding child sexual abuse syndrome in light of the significant problems associated with the testimony of children in general and especially the testimony of children relating to sexual abuse. The challenges presented by such testimony were well summarized by one commentator:

\begin{itemize}
  \item 21 & n.8 (Or. 1983); State v. Jensen, 432 N.W.2d 913, 914-21 (Wis. 1988); and Chapman v. State, 18 P.3d 1164, 1169-74 (Wyo. 2001).
  \item \textsuperscript{202} Steele, supra note 76, at 944.
  \item \textsuperscript{203} Roland C. Summit, The Child Sexual Abuse Accommodation Syndrome, 7 CHILD ABUSE & NEGLECT 177, 181 (1983).
  \item \textsuperscript{204} Id.
  \item \textsuperscript{205} For an excellent description of the history and judicial reactions to the child sexual abuse syndrome, see generally Steele, supra note 76, at 933-73.
  \item \textsuperscript{206} Council on Scientific Affairs, AMA Diagnostic and Treatment Guidelines Concerning Child Abuse and Neglect, 254 J. AM. MED. ASSN 796, 798 (1985); see also People v. Peterson, 537 N.W.2d 857, 863 & n.7 (Mich. 1995) (citing with approval the behavioral signs in the American Medical Association's guidelines); J.Q., 617 A.2d at 1201-02 (same).
\end{itemize}
The difficulty, however, in prosecuting cases of child sexual abuse goes beyond problems of delayed reporting, inconsistent recollection, or recantation. Even in the absence of these issues, the defense may use the mere fact of the child's age or immaturity to portray the child as intrinsically less trustworthy than the adult defendant. Even when a child is capable of testifying in court, she will rarely be a good witness by traditional standards. Both "developmentally and psychologically," a child is, at best, a less than ideal witness: she is frequently "unable to give consistent, spontaneous, and detailed reports of her sexual abuse." In addition, the victim is likely to develop a "fear [for her] safety, fear of future sexual abuse, feelings of depression or anxiety, embarrassment at peers' knowledge of happenings, and a negative view of sex," all of which can handicap her "ability to give clear and consistent testimony." The combination of these factors can result in a witness who appears frightened, anxious, and unwilling to testify. The jury, in turn, may be less likely to find such a child credible.

In light of these difficulties, expert testimony has been allowed for a variety of purposes. In State v. Kim, the Supreme Court of Hawaii adopted a very liberal approach to admissibility and even allowed the expert to testify that he found the specific complainant in that case to be "believable." Much more common among the courts that allow child sexual abuse syndrome testimony is the approach taken by the Supreme Court of Michigan in People v. Beckley and reaffirmed in People v. Peterson:

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207 Steele, supra note 76, at 940 (alteration in original) (footnotes omitted).
209 State v. Kim, 645 P.2d 1330 (Haw. 1982).
211 People v. Beckley, 456 N.W.2d 391 (Mich. 1990); see Steele, supra note 76, at 933-37 (providing an excellent discussion of Beckley).
The question that arises in such cases is how a trial court must limit the testimony of experts while crafting a fair and equitable solution to the credibility contests that inevitably arise. As a threshold matter, we reaffirm our holding in Beckley that (1) an expert may not testify that the sexual abuse occurred, (2) an expert may not vouch for the veracity of a victim, and (3) an expert may not testify whether the defendant is guilty. However, we clarify our decision in Beckley and now hold that (1) an expert may testify in the prosecution's case in chief regarding typical and relevant symptoms of child sexual abuse for the sole purpose of explaining a victim's specific behavior that might be incorrectly construed by the jury as inconsistent with that of an actual abuse victim, and (2) an expert may testify with regard to the consistencies between the behavior of the particular victim and other victims of child sexual abuse to rebut an attack on the victim's credibility.212

On the other hand, a few courts have taken a very rigid stand against any child sexual abuse syndrome testimony and found that it does not meet the scientific requirements of Frye or Daubert.213

III. PRETRIAL ISSUES

A. DNA Databases

The DNA Identification Act of 1994214 mandated the creation of the FBI's Combined DNA Index System ("CODIS") forensic DNA database. CODIS is a "computer software program that operates local, State, and national databases of DNA profiles from convicted offenders, unsolved crime scene evidence, and missing

213 Newkirk v. Commonwealth, 937 S.W.2d 690, 690-96 (Ky. 1996) (finding that child sexual abuse syndrome offered for any use would fail to meet the standards set forth in either Frye or Daubert; State v. Foret, 628 So. 2d 1116, 1121-27 (La. 1993) (finding that child sexual abuse accommodation syndrome fails Daubert because it is not scientifically reliable); Commonwealth v. Dunkle, 602 A.2d 830, 832-36 (Pa. 1992) (finding that syndrome evidence does not meet Frye standards).
persons. All fifty states mandate DNA databases of some sort, although the types of crimes that require inclusion in a DNA database vary from state to state. In 2004, the Justice for All Act significantly increased funding for the use of DNA in the criminal justice system, including an expansion of CODIS to allow state crime laboratories to include even more persons in the database. This created significant expansions of previous police databases, which had primarily focused on fingerprints. CODIS now includes what has been estimated to be over five million DNA samples.

CODIS DNA databases are searched for matches based on specimens collected at a crime scene to identify a potential perpetrator. While these searches are often used in serious cases of murder, rape, or robbery, it has been suggested that they should be used to solve multiple minor crimes. These databases are also often used in "cold case" investigations where specimens from cases that were processed before DNA was collected now undergo DNA analysis and the results are sorted against the multitude of stored DNA in the CODIS database. A "hit" then prompts an investigation of the person identified by that CODIS sample.

There is a debate about the scope and use of these DNA databases. The debate focuses on which crimes should prompt a DNA sample collection and the stage in the criminal process at which DNA samples should be taken from defendants. On the one
hand, some suggest that the largest possible database is an important tool in law enforcement and that a government DNA database should be collected and maintained on the entire population:

In principle, it is not at all clear why the obligation to provide personally identifying DNA data should be restricted to those individuals who are swept into or punished by the criminal justice system. In practice, settling for a DNA identification database restricted to convicts, or to convicts and arrestees, is sure to aggravate racial polarization in society, undermine the legitimacy of law and law enforcement, and further compromise public safety by halting far short of the deterrent and investigative capability that a population-wide database would afford. Like the double helix of the DNA molecule, privacy and equality are intertwined in complex ways. When they are untangled and evaluated, the case for a population-wide DNA database is strong. 221

There is no universal DNA database system but clearly the trend is to expand the breadth of genetic criminal identification databases, from violent felons, to felons, to misdemeanants. Other questions about DNA sampling include: (1) at what stage in the process they are DNA samples taken (arrest, indictment, or conviction); and (2) what should happen to DNA the samples after acquittal or dismissal? 222

However, many people are concerned about the threat of eugenics posed by continuing to enlarge the scope of DNA databases. Their concern is that genes contain information about the racial and ethnic heritage, disease and mental illness

221 D.H. Kaye & Michael E. Smith, DNA Databases for Law Enforcement: The Coverage Question and the Case for a Population-Wide Database, in DNA AND THE CRIMINAL JUSTICE SYSTEM, supra note 30, at 247, 272. There are also concerns that the police and laboratories may maintain DNA samples that are not authorized by statute, such as acquitted defendants or misdemeanants. Jonathan Saltzman, State Hits Crime Lab on DNA Cache: Some Files Improperly Kept, IG Says, BOSTON GLOBE, Feb. 4, 2009, at B1.

222 For a discussion of some of these issues, see Cole, supra note 70, at 80-84. Thirteen states have enacted statutes requiring DNA sampling at felony arrests. DNA Research Report, Domestic DNA Legislation, http://www.dnaresource.com/domestic.html (last visited Mar. 31, 2009).
susceptibility, and even behavioral tendencies, of every person in the database. In this respect, they point out that DNA databases are inherently different than the fingerprint databases that law enforcement has maintained for many years and which are useful only for identification purposes.\textsuperscript{223}

George Annas, one of the principal opponents of expanding DNA databases, has described the special problem presented by the "genetic exceptionalism" of DNA sequencing:

The DNA molecule itself . . . is a source of medical information, and like a personal medical record, it can be stored and accessed without the need to return to the person from whom the DNA was collected for authorization. But DNA sequence information contains information beyond an individual's medical history and current health status. DNA also contains information about the individual's future health risks, and in this sense is analogous to a probabilistic, coded "future diary." As the code is broken, DNA reveals information about an individual's probable risks of suffering from specific medical conditions in the future. . . .

At some point, however, [we as] scientists are going to be better able to read our DNA and tell us something about the types of diseases that we are at risk to encountering as we age. There is nothing else quite like this type of DNA sequence information.\textsuperscript{224}

The danger opponents see is that this personal, private health data will be used for a variety of discriminatory and currently unlawful purposes. This debate poses is what many see as a conflict between public safety and individual privacy. Some

\textsuperscript{223} Cole, supra note 70, at 75 (quoting Barry Steinhardt, Privacy and Forensic DNA Data Banks, in DNA AND THE CRIMINAL JUSTICE SYSTEM, supra note 30, at 173 ("Drawing a DNA sample is simply not the same as taking a fingerprint. Fingerprints are two-dimensional representations of the physical attributes of our fingertips. They are useful only as a form of identification.")).

\textsuperscript{224} George J. Annas, Genetic Privacy, in DNA AND THE CRIMINAL JUSTICE SYSTEM, supra note 30, at 135, 136-37; see also Steinhardt, supra note 218, at 173-74; Tania Simoncelli, Dangerous Excursions: The Case Against Expanding Forensic DNA Databases to Innocent Persons, 34 J.L. MED. & ETHICS 390, 392 (2006).
maintain that balancing these conflicting interests is ultimately a political issue and that privacy interests are best protected through regulatory control over the law enforcement agencies that have access to the DNA databases.\textsuperscript{225}

Trial judges may seek solace in the belief that issues regarding DNA databases will be determined by the legislatures and not in individual cases. The future, however, as with most of the issues in forensic science, may involve us in questions about these databases. Genetic information and its supposed "probabilistic" tendencies gleaned for the analysis of large quantities of DNA samples have already been offered as evidence in criminal trials.\textsuperscript{226} Contrary to the fears about police misuse of the data, defendants have sought to introduce expert testimony regarding their biological predispositions, or the lack thereof. Some have offered testimony regarding a biological predisposition for alcohol or drug addiction to claim that their criminal act was involuntary. In \textit{State v. Boushack},\textsuperscript{227} for example, the court heard but rejected the defendant's claim that his alcoholism was involuntary due to the result of his genetic makeup.\textsuperscript{228} Genetic evidence has also been offered to support a defendant's insanity claim in criminal cases.\textsuperscript{229} The use of genetic evidence in other aspects of criminal cases awaits us in the future.

\textsuperscript{225} See Amitai Etzioni, \textit{A Communitarian Approach: A Viewpoint on the Study of the Legal, Ethical and Policy Considerations Raised by DNA Tests and Databases}, 34 J.L. MED. \\& ETHICS 214, 219-20 (2006) (arguing that DNA databases are akin to security cameras and concerns can be addressed by stronger monitoring of the police).

\textsuperscript{226} See Nita A. Farahany \\& William Bernet, \textit{Behavioural Genetics in Criminal Cases: Past, Present and Future}, 2 GEONOMICSSOC'Y \\& POLY, 72, 72-73, 76 (2006) (predicting that the use of human behavioral genetics research will become more prevalent).


\textsuperscript{228} \textit{Id.} at \#2.

B. Search Issues

DNA database issues may most often present themselves to trial judges in pretrial motions alleging violations of the Fourth Amendment. Generally, such motions have failed. The federal courts have consistently ruled that the federal statute and various state statutes mandating the taking of DNA samples for law enforcement databases are not constitutionally infirm.230 In United States v. Kincade,231 the United States Court of Appeals for the Ninth Circuit, en banc, held that the federal statutory requirement that federal parolees and probationers submit to compulsory DNA profiling was reasonable and did not violate the Fourth Amendment.232 In Jones v. Murray,233 the United States Court of Appeals for the Fourth Circuit held that a Virginia statute requiring all convicted felons and all arrestees to give DNA samples, without probable cause, was not an unlawful search because there was no reasonable expectation of privacy.234 In Roe v. Marcotte,235 the United States Court of Appeals for the Second Circuit upheld a Connecticut statute requiring convicted sex offenders to submit DNA samples and held that it violated neither the Fourth Amendment nor the Equal Protection Clause.236 The United States Court of Appeals for the Tenth Circuit rejected a state prisoner's claims that an Oklahoma statute requiring DNA samples from all prisoners was a violation of the Fourth Amendment, the First Amendment Free Exercise Clause, or the Ex Post Facto Clause, in Shaffer v. Saffle.237 The United States Court of Appeals for the Tenth Circuit later upheld the expansion of the DNA database required by the DNA Analysis Backlog Elimination Act of 2000238 against a Fourth Amendment challenge in United

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231 United States v. Kincade, 345 F.3d 1095 (9th Cir. 2003), rev'd en banc, 379 F.3d 813 (9th Cir. 2004).
232 Id. at 1113.
234 Id. at 306-07.
235 Roe v. Marcotte, 193 F.3d 72 (2d Cir. 1999).
236 Id. at 80, 82.
237 Shaffer v. Saffle, 148 F.3d 1180, 1181-82 (10th Cir. 1998).
States v. Kimler.\textsuperscript{239} A Texas statute compelling prisoners to submit DNA samples was upheld against claims of Fourth Amendment and due process violations in Velasquez v. Woods.\textsuperscript{240}

The gathering of a specimen from a suspect for DNA testing is, of course, governed by the same Fourth Amendment constraints that apply to any seizure, and the DNA purpose of that seizure does not change that analysis. For example, in State v. Reed,\textsuperscript{241} police collected a cigarette butt that a suspect had flicked into a pile of trash on his patio.\textsuperscript{242} One of the detectives kicked the butt into an adjoining grass common area and later retrieved it for DNA testing.\textsuperscript{243} The North Carolina Court of Appeals found that the defendant had a reasonable expectation of privacy in the patio and suppressed the warrantless seizure as a violation of the Fourth Amendment.\textsuperscript{244}

\textbf{C. Statutes of Limitations and "John Doe Warrants"}

One of the side effects of the use of newly developing DNA techniques and ever-expanding DNA databases in "cold" cases is an often lengthy delay in charging a defendant whose identity is finally revealed by that DNA comparison. Applicable statutes of limitation may well have expired in the interim. In response, federal and state legislatures have begun to revise the statutory limitation periods.\textsuperscript{245}

\textsuperscript{239} United States v. Kimler, 335 F.3d 1132, 1146 (10th Cir. 2003).
\textsuperscript{240} Velasquez v. Woods, 329 F.3d 420, 421-22 (5th Cir. 2003).
\textsuperscript{241} State v. Reed, 641 S.E.2d 320 (N.C. Ct. App. 2007). In an interesting sidelight, the court noted that after the defendant had smoked a cigarette earlier in the interview, he shredded the butt and placed the remains in his pocket, commenting that he was a frequent watcher of CSI. Id. at 321.
\textsuperscript{242} Id.
\textsuperscript{243} Id.
\textsuperscript{244} Id. at 323.
\textsuperscript{245} See generally Imwinkelried, supra note 30, at 94-95 (providing a general description of statute of limitation issues relating to DNA); Jonathan W. Diehl, Note, Drafting a Fair DNA Exception to the Statute of Limitations in Sexual Assault Cases, 39 JURIMETRICS J. 431 (1999) (providing analysis of statute of limitation issues relating to DNA and sexual assault crimes); Amy Dunn, Note, Criminal Law—Statutes of Limitation on Sexual Assault Crimes: Has the Availability of DNA Evidence Rendered Them Obsolete?, 23 U. ARK. LITTLE ROCK L. REV. 839 (2001) (same).
The Justice for All Act of 2004\textsuperscript{246} that expanded the CODIS database also extended the federal statute of limitations in cases which DNA testing implicates a perpetrator until the time that the actual identity of the perpetrator is discovered. The statute states:

In a case in which DNA testimony implicates an identified person in the commission of a felony, except for a felony offense under chapter 109A, no statute of limitations that would otherwise preclude prosecution of the offense shall preclude such prosecution until a period of time following the implication of the person by DNA testing has elapsed that is equal to the otherwise applicable limitations period.\textsuperscript{247}

Several states have similarly extended some periods of limitations, including "Colorado, Florida, Indiana, Michigan, Nevada, New Jersey, and New York."\textsuperscript{248} Many states have created special statutory limitation extensions applicable to sexual assault cases.\textsuperscript{249} A myriad of additional extensions and modifications of state limitations periods are currently under consideration.\textsuperscript{250} The proposals range, for example, from eliminating the limitations period entirely for certain offenses\textsuperscript{251} to extending the statute when DNA evidence is recovered at a crime scene but the evidence does not currently match anyone in the DNA database.\textsuperscript{252}

\textsuperscript{247} § 204 (codified as amended at 18 U.S.C. § 3297 (2006)).
\textsuperscript{248} Imwinkelried, supra note 30, at 94, 103 n.26.
\textsuperscript{251} Id.
\textsuperscript{252} Id.
Additionally, prosecutors in several states have tried to toll the statute of limitations by filing a criminal complaint and warrant naming "John Doe" as the defendant and identifying him by the DNA profile obtained from a crime scene specimen. For example, the complaint might read, "'John Doe,' unknown male with matching DNA at genetic locations ###, ###, ###." Prosecuting attorney organizations and the Justice Department are encouraging the filing of such "John Doe" warrants. These warrants were first originated in Wisconsin in 1999 but are now being used by prosecutors in many other jurisdictions. Both federal and state Federal statutes and some state statutes have specifically authorized the use of such warrants.

The issue for judges is whether such warrants or indictments sufficiently identify the defendant so as to toll the statute of limitations. The Fourth Amendment requires that warrants particularly describe the person to be seized. The Federal Rules of Criminal Procedure require that an arrest warrant "contain the name defendant's name or, if it is unknown, a name of the defendant, or if the defendant's name is unknown, any name or description by which the defendant can be identified with reasonable certainty." Most states have similar requirements.

"John Doe" warrants—without further identifying information—are clearly constitutionally insufficient, even when they contain some physical description such as race, height, or
weight. Prosecutors contend, however, that including the DNA profile not only meets but exceeds the reasonable certainty requirement because the profile can only identify one person. Defense lawyers disagree on the basis that "DNA samples will degrade over time, even under optimal conditions and errors in the collection, handling and storage of DNA samples can result in errors in identification." Defense lawyers assert that nameless DNA warrants do not meet the requirement of reasonable certainty and that allowing that such John Doe warrants vitiates their rights under the applicable statute of limitations.

In *State v. Dabney*, the original Wisconsin case, the Wisconsin Court of Appeals of Wisconsin rejected both of the defense claims and affirmed the use of the "John Doe" warrant. The court held that "reasonable certainty" was provided when the government uses the best available description and held that "for purposes of identifying 'a particular person' as the defendant, a DNA profile is arguably the most discrete, exclusive means of personal identification possible." The court adopted a commentator's suggestion that a DNA profile is far superior to a name or a physical description. Subsequently, one commentator summarized the *Dabney* holding in this regard in by predicting that its analysis would withstand constitutional scrutiny in the federal courts:

The DNA-profile leaves less room for mistaken identity than does a name. For example, even though an individual can always assume an alias, or even legally change his name, he

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261 NAT'L ASS'N OF CRIMINAL DEF. LAWYERS, RESOLUTION OF THE BOARD OF DIRECTORS REGARDING JOHN DOE DNA WARRANTS/INDICTMENTS (2004), http://www.nacdl.org (follow "Who We Are" hyperlink to "Board Resolutions" hyperlink; then follow 05/01/2004 "John Doe DNA Warrants & Indictments" hyperlink).
263 *Id.* at 369.
264 *Id.* at 372.
265 *Id.* (quoting Meredith A. Bieber, Comment, *Meeting the Statute or Beating it: Using "John Doe" Indictments Based on DNA to Meet the Statute of Limitations*, 150 U. PA. L. REV. 1079, 1085 (2002)).
can never change or escape his DNA code. In addition, given the accuracy of contemporary technology, the chance of mistake in the formulation of the DNA-profile and its correspondence to an individual is minimal. As the Dabney court stated, the DNA profile is "arguably the most discrete, exclusive means of personal identification possible." Therefore, the DNA profile would most certainly meet the particularity standard of the Fourth Amendment and would satisfy the accompanying judicial scrutiny.266

The Dabney court also rebuffed the argument that the defendant's rights under the limitation statute had been violated.267 The court held that the protections of a statute of limitation are not fundamental rights, and that the legislative purpose of the statute was not violated by the use of a "John Doe" warrant.268 The Wisconsin court subsequently reaffirmed its Dabney decision in State v. Davis.269 State legislatures are also moving to explicitly approve the use of "John Doe" warrants, although it may not affect the Fourth Amendment analysis of the reasonable certainty requirement.270

Other courts have followed the Dabney analysis. In People v. Robinson,271 the prosecutor filed a complaint alleging rape, "four days before the six-year statute of limitations . . . was . . . to expire . . . against 'John Doe, unknown male,' [and] describing the defendant by a 13-locus DNA profile developed from semen taken from the victim."272 The California Court of Appeals held that "an arrest warrant, which describes the person to be arrested by his or her DNA profile, more than satisfies the reasonable certainty standard because DNA is the most accurate and reliable means of

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267 Dabney, 663 N.W.2d at 372-74.
268 Id. at 373-74.
270 Delaney, supra note 266, at 1110-13.
272 Id. at 395.
identifying an individual presently available to law enforcement." In State v. Danley, a trial court in Ohio held that the use of a "John Doe" DNA warrant withstood constitutional challenge, including a claim that it violated the defendant's right to a speedy trial. And in People v. Martinez, a New York court rejected constitutional challenges to a "John Doe" DNA warrant, including the defendant's contention that the warrant provided "inadequate notice" that he was accused of a crime because he the defendant did not know his own DNA profile.

In State v. Belt, the Supreme Court of Kansas made an important point about the use of "John Doe" DNA warrants. The court agreed with the Dabney, Davis, and Robinson proposition that a John Doe warrant with DNA identifiers that later proved to be unique to the defendant could meet the constitutional requirement of "reasonable certainty." However, the court dealt with six separate cases consolidated for appeal in which the DNA descriptions in the warrants were challenged as not reasonably certain. The prosecutors filed several complaints and warrants in which the defendant was identified as "John Doe described by deoxyribonucleic (DNA) analysis as LOCI D2S44 and D17S79" and other variants of the same description. The testimony, however, was "that the DNA loci listed in [all of] the complaints and warrants were common to all humans" and the court held that "neither the John Doe warrants nor the affidavits supporting them set forth the unique DNA profile of their subject." The ruling seemed obvious but serves as a lesson for prosecutors seeking to use such warrants to toll the statute of limitations.

273 Robinson, 67 Cal. Rptr. 3d at 400.
275 Id. at 6-8.
277 Id. at 525-27.
278 State v. Belt, 179 P.3d 443 (Kan. 2008).
279 Id. at 448-450 (noting that, although DNA can provide a unique profile of an individual, it is not the case every time).
280 Id. at 450.
281 Id. at 447-48.
282 Id. at 444-47 (internal quotation marks omitted) (quoting the criminal complaints and warrants).
283 Id. at 448, 450.
D. Defense Discovery and Requests for Expert Assistance

The increase in the use of forensic scientific evidence by the government also heightens the need for the defense in a criminal case both to investigate and respond to the government’s evidence and possibly to affirmatively seek forensic evidence of its own. Preliminarily, this means that the defense will seek to discover the test results obtained by the government as soon as possible. Unfortunately, many government crime laboratories are incapable of performing forensic tests within a reasonable period of time. In 2002, the federal government estimated that state crime laboratories "ended the year with over 500,000 backlogged requests for forensic services—a more than seventy percent increase in the backlog of requests compared to the beginning of the year."\(^{284}\) They also "estimated that about 1,900 additional FTEs [(full time equivalent personnel)] would have been needed to achieve a 30-day turnaround for all 2002 requests for forensic services . . . [and the] estimated cost of the additional FTEs exceeds $70.2 million."\(^{285}\) Often, the laboratories seem to base the priorities for testing on the proximity of a trial date, and defense attorneys rightly complain that this leaves them with little time to prepare a response or even to responsibly advise their clients about the weight of the evidence against them. In its simplest form, this may come before the trial judge as a defense motion to compel or enforce discovery. It may even come up in a motion to reduce bond based on an assertion that the laboratory results may be exculpatory.\(^{286}\) Ultimately, the judge may have to hear a request for a variety of sanctions for failure to respond to a discovery order.

Some states have enacted statutes to relieve the pressure on their crime laboratory personnel by specifically allowing the


\(^{285}\)Id.

\(^{286}\)In a recent motion before me to reduce bond based on government delay in processing DNA samples, the defense attorney argued that the defendant should not remain in jail while the DNA evidence that may demonstrate his innocence "sits in the in-box" of a laboratory technician.
admission of laboratory reports in lieu of the testimony of the persons who performed the testing. An example is a Massachusetts statute providing that a certificate of the result of a chemical analysis by a state laboratory technician "shall be prima facie evidence of the composition, quality, and the net weight of the narcotic or other drug." The statute was upheld against constitutional objections by the Supreme Judicial Court of Massachusetts in Commonwealth v. Verde, holding that the statute did not violate the defendant's Sixth Amendment right of confrontation and that certified laboratory reports are admissible as a "public record" because they "are neither discretionary nor based on opinion; rather, they merely state the results of a well-recognized scientific test determining the composition and quantity of the substance." Subsequently, a Massachusetts appellate court reaffirmed its Verde holding in an unreported case in Commonwealth v. Melendez-Diaz. The United States Supreme Court of the United States, however, has granted a petition for certiorari in the Melendez-Diaz case to determine if laboratory reports are indeed "testimonial" under the Supreme Court's recent holdings in Crawford v. Washington and Davis v. Washington.

A defendant has a constitutional right of confrontation to examine the evidence against him, and that certainly would include the specimens used in laboratory tests as well as the details of the testing performed on those specimens. Regardless of how the Supreme Court decides on the admissibility of the laboratory reports in lieu of analyst testimony at trial, the discoverable materials at the pretrial stage would certainly include more than just the laboratory report. Pretrial discovery would normally include a right by the defense to obtain, and perform its own

287 MASS. GEN. LAWS ANN. ch. 111, § 13 (West 2003).
testing and analysis on, the specimen. The circumstances of that examination, especially when the evidence is subject to contamination or even consumption, often will require close circumscription by the terms of a discovery order.

Indigent defendants clearly have the same discovery rights. Trial judges often, however, have to address the desire of indigent defendants to retain defense experts for analysis and testimony. In \textit{Ake v. Oklahoma}, the Supreme Court of the United States established that an indigent defendant in a criminal case has a constitutional right to the assistance of publicly funded experts. Some commentators believe that the right granted by the Supreme Court in \textit{Ake} has proven to be illusory in practice:

\begin{quote}
While the Supreme Court [of the United States] in \textit{Ake v. Oklahoma} recognized a constitutional right to publicly funded experts for the indigent, exercise of that right is dependent on the willingness of a local judge to order the expenditure of scarce local resources, and on a cumbersome case-by-case, expert-by-expert process for requesting funding. Any risk of failure of that case-by-case process to provide adequate expert services falls on the defendant, and courts have tended to apply \textit{Ake} narrowly.
\end{quote}

In determining whether the court must make public funds available for a defense expert witness, the trial judge must consider the probable value of the expert analysis to the defense. Public funding is required when the issue is likely to be significant in the trial. The burden is on the defense to show that the expert is necessary. However, at the least, when the prosecution has conducted a

\begin{footnotes}
\item[294] Note, however, that the failure of the police to preserve a specimen may not amount to a constitutional violation absent a showing of police bad faith. See Arizona v. Youngblood, 488 U.S. 51, 55-59 (1988).
\item[296] \textit{Id.} at 74.
\item[297] Findley, \textit{supra} note 24, at 930 (footnotes omitted); see also Giannelli, \textit{Forensic Science}, supra note 168, at 535 (revealing an example of \textit{Ake}'s narrow interpretation to be that some courts only require that a defendant be provided with adequate expert services in capital cases or that the defendant be limited only to psychiatric experts).
\item[298] Findley, \textit{supra} note 24, at 930.
\end{footnotes}
forensic examination of evidence, the defense would clearly seem to be entitled to its own similar expert examination of that evidence.

IV. JUROR EXPECTATIONS ABOUT SCIENTIFIC EVIDENCE—CSI AND THE "TECH EFFECT"

Trial judge decisions about the admissibility of forensic science evidence assume even larger importance to the extent that jurors consider such evidence to be especially critical to their ultimate decision about guilt. It is widely perceived, especially by prosecutors and other law enforcement agencies, that modern juries give a great deal of weight to scientific evidence. They complain that jurors today demand more from the prosecution in the way of scientific evidence and that they will wrongfully acquit defendants when such evidence is not presented. Most of the blame for these expectations is heaped on a single television show, CSI (and its spin-offs), to the degree that it has become known, both in the popular media and in legal circles, as the "CSI effect." However, while jurors clearly do have increased expectations and even demands for scientific evidence, it is far too simplistic to attribute those expectations and demands to a particular television show—or even to the a particular medium of television—and that to do so, distracts judges and lawyers from the important adjustments that need to be made in criminal trial practice to accommodate these new jurors.

A 2006 empirical study conducted by myself and two other criminology professors was the first of what we hope will be many empirical studies of jurors to determine whether current juries expect and demand scientific evidence and, if so, whether it is related to their television watching habits. Some commentators speculated that there was no increase in juror expectations or demands about scientific evidence, and the claimed CSI effect could be nothing more than "sour grapes" by prosecutors who were

299 For a listing of a few of the multitude of media reports of the CSI effect, see Shelton, Kim & Barak, supra note 1, at 335-36 n.12.
300 Id. at 332.
rationalizing losses or attorneys for both sides just trying to influence jurors during voir dire. On the contrary, we found that jurors do indeed now expect prosecutors to present scientific evidence and that, especially in cases where the rest of the evidence is circumstantial, they will demand scientific evidence before they will return a verdict of guilty. However, we also found that, contrary to the common media characterizations, these increased expectations and demands for scientific evidence were not related to watching CSI or similar television programs.

Subsequent researchers have come to a similar conclusion.

If it is not watching CSI, then what is causing these increased expectations and demands? It has long been understood by social scientists that juror perceptions of our criminal justice system are influenced by characterizations of that system in television and other media. An early theory for that influence was the "cultivation theory," posited over thirty years ago by George Gerbner. He

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302 Cole and Dioso-Villa explain:

Both sides may be seen as trying to influence the jury pool by getting the media to propagate the story that their side is being increasingly disadvantaged by the CSI Effect. In other words, litigators seek to benefit from media stories that claim that the other side has been unfairly benefited by television programming.

Id. at 464.

303 Shelton, Kim & Barak, supra note 1, at 333. Further statistical analysis of the Washtenaw County data has been conducted and is the subject of a forthcoming article. Additionally, a similar study is currently being conducted in Wayne County, Michigan, which includes the City of Detroit, to test the earlier results in a more metropolitan venue.

304 Id.

305 "We conclude that there is little support for the gravest of the CSI Effects, which is that jurors who watch CSI are wrongfully acquitting in cases lacking forensic evidence or that they are wrongfully convicting based on an unrealistic belief in the infallibility of forensic science." Cole & Dioso-Villa, supra note 301, at 436.

306 George Gerbner et al., Growing Up With Television: Cultivation Processes, in MEDIA EFFECTS: ADVANCES IN THEORY AND RESEARCH 43, 43-44 (Jennings Bryant & Dolf Zillmann eds., 2d ed. 2002); George Gerbner & Larry
theorized that television programs develop or "cultivate" the public's perceptions of societal reality.\textsuperscript{307} Indeed, he regarded television as such a strong force in our society that it was the source of our perceptions of reality.\textsuperscript{308} Gerbner found that one strong message that television communicated to the public was about crime and an overestimated likelihood of becoming a victim of crime in a "mean world."\textsuperscript{309}

The problem with the cultivation theory as a means of explaining the impact of popular culture on individual perceptions of reality, especially as it relates to a claimed CSI effect, is that it is seriously technologically outdated. Television no longer has the overwhelming media impact on our culture today that it did when Gerbner made his observations. Thirty years has turned out to be an enormous amount of time technologically. As we remarked in our study:

This is an amazing technological age. The last thirty years have brought about such scientific discoveries and developments that some justifiably have called it a "technology revolution." . . .

. . .

At the same time, new technology has been used to create another revolution in information availability and transmission. The Internet is certainly an obvious example, and in many ways is the catalyst for this still-developing information revolution. The World Wide Web is truly global and extends (at least in our society) into almost half of households in some way . . .

These developments in science and information are contemporaneous and feed off of one another. Advancements in science are fostered by the ability to exchange and transfer information among scientists. At the same time, scientific

\textsuperscript{308} Id.
\textsuperscript{309} Id. at 193.
developments almost immediately become available not only to scientists but to the entire world. The information technology system uses its media to grab scientific discoveries and quickly makes them part of our popular culture. The dissemination is fast and widespread through the media online, on television fiction and non-fiction, on film (now video transmission of course), and even on traditional "news" sources. DNA, for example, has gone from an abstract concept known only to the small biochemical community to a term that even children recognize and use. Ordinary people know, or at least think they know, more about science and technology from what they have learned in the media than they ever learned in school.\textsuperscript{310}

Even within television, the media has changed dramatically. In her look at the CSI effect, Kimberlianne Podlas noted how much the television world has changed and how those changes affect modern day reliance on the cultivation theory:

Researchers, however, have noted that our contemporary television environment differs significantly from that which inspired cultivation theory. In general, when Gerbner began collecting data, in general, viewers could watch only three network affiliates, and, in larger markets, a few independent stations. Therefore, a heavy viewer of television watched a homogenous, finite universe of options. This led Gerbner to argue that the themes and conventions of storytelling cut across all programming.

Since that time, television offerings have increased manifold. A heavy viewer can watch both a highly varied and highly specialized array of options. Consequently, many researchers assert that measuring the raw totality of TV viewing is no longer accurate.\textsuperscript{311}

It certainly remains true that portrayals of crime and criminal justice on television impact the perception of law and, in particular,
criminal justice in our popular culture.\footnote{See Steven D. Stark, Perry Mason Meets Sonny Crockett: The History of Lawyers and the Police as Television Heroes, 42 U. MIAMI L. REV. 229, 229-35 (1988); Steven Keslowitz, Note, The Simpsons, 24, and the Law: How Homer Simpson and Jack Bauer Influence Congressional Lawmaking and Judicial Reasoning, 29 CARDOZO L. REV. 2787, 2787-98 (2007).} However, as Podlas points out, today the medium of television conveys only a few of the many messages about crime and criminal justice we receive and, perhaps more importantly, that television itself is no longer the overpowering media influence in our society that it once was.\footnote{See John Dimmick Yan Chen, & Zhan Li, Competition Between the Internet and Traditional News Media: The Gratification-Opportunities Niche Dimension, 17 J. MEDIA ECON. 19, 27 (2004) ("[T]he Internet has a competitive displacement effect on traditional media in the daily news domain with the largest displacements occurring for television and newspapers."); Press Release, The Pew Research Ctr., Social Networking and Online Videos Take Off: Internet's Broader Role in Campaign 2008 (Jan. 11, 2008), available at http://people-press.org/reports/pdf/384.pdf (indicating that the number of people who get political information from the internet, as opposed to television, almost doubled between 2004 and 2008).} Our postmodern society is globalized and interconnected, not only by goods and commerce, but by "changing, swirling, and colliding" media messages and other cultural forces that frame our perceptions of crime and criminal justice in a myriad of different messages and media.\footnote{David Ray Papke, The Impact of Popular Culture on American Perceptions of the Courts, 82 IND. L.J. 1225, 1226-28 (2007).} As we concluded in our study:

Rather than any direct "CSI effect" from watching certain types of television programs, this article suggests that these juror expectations of and demands for scientific evidence are the result of broader changes in popular culture related to advancements in both technology and information distribution. Those broad and pervasive changes in technology lead jurors to expect that the prosecutor will obtain and present the scientific evidence that technology has made possible. These increased expectations and demands of jurors therefore could be more accurately referred to as the "tech effect."

It is not exposure to the CSI dramas alone that influences juror decisions in court; rather, it is their raised expectations regarding
scientific evidence presented by prosecutors based on the knowledge about science and forensic technology available these days from a multitude of sources.

A unique feature of the rapid development of new scientific technology is that it has led to applications that have almost immediately become part of popular culture. Ordinary citizens know about and use their own personal and business applications of this technology. They may use a personal laptop, a high-powered business computer, or perhaps a brightly colored cellular phone with some of the capabilities of both types of computers. They may have a satellite-driven global positioning system on the dash of their car, or perhaps it too is incorporated into that satellite-driven cellular phone as well. They may even use a mail-in or portable DNA kit to determine the parentage of their child. They also know that it can be used in criminal courts. They have learned from the media about the now hundreds of wrongly convicted defendants who have had their innocence proven with DNA. They have watched countless television and films with news or fictional depictions of police solving crimes with some new technology, whether that technology is real or imagined.

The sources of this tech effect, and the various sociological theories which might explain it, are relevant to criminal justice professionals only to the extent that we might tailor our reactions to it in court. If we appreciate the complexity of the tech effect, then law enforcement personnel and defense lawyers must tailor the investigations, the evidence, and the arguments either to provide the evidence the jury seeks or to explain to them why that evidence is not forthcoming in a particular case. If, on the other hand, juror expectations arise simply from watching a television show, as the CSI effect label suggests, then lawyers can ask simply ask jurors about whether they watch those shows and whether they understand the differences between fiction and reality as applied to criminal proceedings. Indeed, the latter approach is significantly easier and, probably predictably, is the approach most often used.

Prosecutors argue that heightened jury expectations, regardless of their source, have improperly increased their burden of proof.316

316 Cole and Dioso-Villa suggest that what prosecutors really mean is that jurors may be rejecting the adversarial system in favor of more scientific truth
Such arguments and complaints by prosecutors are almost condescending to jurors and their role in our constitutional democracy. Prosecutors who do so violate the admonition of Judge Margaret Hinkle that "an effective advocate cannot ignore or talk down to jurors, whatever the composition of the jury" and that, especially in the area of forensic science evidence, they should "[n]ever underestimate jurors' intelligence, wisdom and common sense." Margaret R. Hinkle, Criminal Practice in Suffolk Superior Court, BOSTON BAR J., Nov./Dec. 2007, at 6, 7.

Wendy Brickell, Is It the CSI Effect or Do We Just Distrust Juries?, 23 A.B.A. CRIM. JUST. 10, 17 (2008).

Lieberman et al., supra note 57, at 32. Our research also indicated that 22% of jurors expect to see DNA evidence in all criminal cases, with that number expanding to 46% in murder cases and 73% in rape cases. Shelton, supra note 118, at 3. One reason why CSI is so popular, and perhaps so threatening to prosecutors, is that "although CSI depicts unrealistic crimes in a melodramatic fashion, this crime drama does so in a manner that suggests that its science is valid, that the audience under stands science and can use it to solve crimes." Sarah Keturah Deutsch & Gray Cavender, CSI and Forensic Realism, 15 J. CRIM. JUST. & POPULAR CULTURE 34, 34 (2008), available at http://www.albany.edu/scj/jcjc/vol15is1/Deutsch_Cavender.pdf.

Lieberman et al., supra note 57, at 52.
random-match probability of one in 7.87 trillion as highly probative, if not dispositive.\textsuperscript{321} The trends by jurors to expect and demand scientific evidence, exemplified by the tech effect, will undoubtedly continue. It is the government and the judicial system that must respond and adapt to those trends.

One prosecutor response to the increasing tech effect demand for scientific evidence by jurors is to introduce evidence about tests that were not done or tests that did not incriminate the defendant. It is a technique designed to anticipate questions that jurors may have about the thoroughness of the government investigation so they will not speculate that had such testing been done it may have had exculpatory results.

A good example of this technique was presented in the recent Delaware case of \textit{State v. Cooke},\textsuperscript{322} in which the defendant was charged with murder, rape, burglary, and arson.\textsuperscript{323} The prosecutor attempted to introduce several test results which were either inconclusive or exculpatory, and the defense filed a motion in limine to exclude that evidence as irrelevant.\textsuperscript{324} The government's offer of proof read like a recitation of many modern forensic science testing procedures, including DNA prediction analysis, video enhancement, trace (hair) analysis, toolmark analysis, hair comparison, fingerprint analysis, voice identification analysis, footwear analysis, fabric impression analysis, and handwriting comparison.\textsuperscript{325} The prosecutor summarized its argument for relevancy:

Widespread media coverage of criminal trials and the popularity of television programs such as C.S.I. Crime Scene Investigation, C.S.I.-Miami and C.S.I.-New York (to name a few) have had the effect of developing unrealistic and preconceived notions in juror's minds about the availability and precision of forensic evidence in criminal trials. If not confronted by prosecutors, this so called "C.S.I. Effect" can lead to a misapprehension of the evidence actually introduced.

\textsuperscript{321} Imwinkelried, \textit{supra} note 30, at 97.
\textsuperscript{322} \textit{State v. Cooke}, 914 A.2d 1078, 1082 (Del. Super. Ct. 2007).
\textsuperscript{323} \textit{Id.} at 1080.
\textsuperscript{324} \textit{Id.} at 1080-81.
\textsuperscript{325} \textit{Id.}
or encourage improper speculation by jurors during their deliberations. . . . The State must therefore be permitted to present the jury with the complete story of the investigation in this case, even if the particular technique in question, is as is the case in this instance, produced inconclusive results.\textsuperscript{326}

In his extensive opinion, Judge Herlihy reviewed several studies and opinions regarding the so-called CSI effect, and the debate over whether it exists.\textsuperscript{327} In the end, he did not conclude that there actually is an effect attributable to CSI, but observed that jurors appear to have expectations for scientific evidence and that those expectations are influencing trials:

The State's "CSI Effect" argument has merit in two respects. First, this Judge in a number of trials in the last several years or so has witnessed defendants increasingly taking advantage of the "CSI Effect" phenomenon. They are aware of the phenomenon and are, correctly and appropriately, taking advantage of it by asking witnesses about tests they know were not conducted and contending in closing argument that the failure to test raises reasonable doubt. They are taking appropriate advantage of a different kind of proof expectations with which some jurors come into the courthouse in the last several years as a result of these programs. It would be naive not to recognize and acknowledge all of this. This does not mean the Court finds that there is a "CSI Effect" but, in fact, it means that there is enough of a possibility of it that it cannot be ignored.\textsuperscript{328}

The judge then addressed the prosecution's proposed method of dealing with these juror expectations by introducing other irrelevant evidence in what the judge characterized as "defensive prosecution":

The second factor in the State's argument is that prosecutors are caught in a "Catch 22" conundrum. If they produce no record that scientific tests were sought, they are subject to criticism and risk of verdict reversal if they, nevertheless,

\textsuperscript{326} Cooke, 914 A.2d at 1083.
\textsuperscript{327} Id.
\textsuperscript{328} Id. at 1087-88.
remark about the "CSI Effect". And then, if there were tests which were inconclusive but again do not introduce evidence that the tests were even conducted, the State's case is exposed to the argument that not enough was done. Prosecutors must be extraordinarily careful not to denigrate or disparage their role or the burden of proof placed on them. Nor are they to denigrate, minimize, or disparage the meaning of reasonable doubt. This can be a fine line. To avoid these traps, prosecutors now are almost required to engage in, shall we say, "defensive prosecution." It is like medical negligence cases where one wonders why physicians perform so many tests, some or many unnecessary, that is, "defensive medicine."  

The judge denied the relevancy objection and allowed the prosecution to present such evidence to show the "exhaustiveness" of its investigation.  

While Judge Herlihy's opinion is an example of a well-reasoned opinion for trial judges, the lesson of the Cooke case should not be lost on the law enforcement community, especially prosecutors. Coping with increased juror expectations resulting from the tech effect may well involve performing much more exhaustive forensic investigations than have been done in the past. Jurors expect and appear to demand that such thorough investigations occur before they will find guilt beyond a reasonable doubt.  

Increased juror demands for scientific evidence may in fact justify the introduction of evidence that might otherwise be considered more prejudicial than probative. In United States v. Fields, a death penalty case, the defendant argued that admitting nineteen photos of the body at the crime scene and thirteen autopsy photos was an abuse of discretion by the trial judge. Although

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329 Cooke, 914 A.2d at 1088.  
330 Id. In People v. Robles, there was a similar prosecutorial use of inconclusive scientific evidence (fingerprints) when fingerprint evidence "was brought out by the prosecutor defensively to argue the point that unlike on the television show CSI, the police generally did not discover a burglar's fingerprints at the scene of a crime." People v. Robles, No. D048357, 2007 WL 1140380, at *3 (Cal. Ct. App. 2007).  
331 United States v. Fields, 483 F.3d 313 (5th Cir. 2007).  
332 Id. at 323, 354.
the United States Court of Appeals for the Fifth Circuit found many of the pictures shocking and gruesome, including photos of the victim's decomposing body, it found them nevertheless to be highly probative based on the defense's position that there was no reliable DNA evidence and little crime scene evidence regarding the body itself. The court held that "[i]n this age of the supposed 'CSI effect,' explaining to the jury why the Government had little in the way of physical or scientific evidence was arguably critical to the Government's case" and found no error in the admission of the photographs.

V. VOIR DIRE, ARGUMENT, AND JURY INSTRUCTIONS

A second method of coping with the tech effect expectations of jurors is to address those expectations directly with the jurors at the trial. Attorneys have begun to do so using voir dire and opening and closing statements, and requesting jury instructions that pose the issue.

Voir dire about CSI watching habits has been a typical prosecutorial approach. Prosecutors' questions about whether potential jurors watch the program are certainly proper, and comments about the program or attempts to distinguish the investigations depicted on the program from reality have generally been upheld. Failing to object to a long prosecutor voir dire

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333 Fields, 483 F.3d at 355.
334 Id. (citing Tom R. Tyler, Viewing CSI and the Threshold of Guilt: Managing Truth and Justice in Reality and Fiction, 115 YALE L.J. 1050, 1050 (2006)).
335 See, e.g., People v. Marquez, No. B184697, 2006 WL 2665509, at *4-
*5 & n.5 (Cal. Ct. App. Sept. 18, 2006) (approving prosecutor's voir dire, which asserted: "All of you have watched one kind of show, whether it's 'Law and Order,' 'CSI,' any of those shows. How many of you do that? How many of you have a certain expectation that both Mr. Mack and I, and the judge will perform in a similar manner as in those shows? Those are shows and that's not real life, and this is real life."). In addition, People v. Smith held that the prosecutor's remarks during voir dire that "real life is not akin to CSI television shows and that he was not trying to 'pull the wool' over the juror's eyes" were "merely" attempts to ensure that the jury not hold the prosecution to a higher burden of proof than was required. People v. Smith, No. 271036, 2007 WL 4248571, at *5 (Mich. Ct. App. Dec. 4, 2007) Yet another example, State v. Latham, held that there was no prejudice in prosecutor's statements during voir dire:
statement about CSI was held not to be a sign of ineffective counsel by the Ohio Court of Appeals of Ohio in State v. Taylor.\textsuperscript{336} In United States v. Harrington,\textsuperscript{337} the trial judge took it upon himself to state to the jury venire during voir dire that "CSI evidence" was not required to convict the defendant.\textsuperscript{338} The Court of Appeals for the Eleventh Circuit found that the trial judge "did not err by questioning jurors about whether they would be able to separate television shows from the facts of the case and stating that there may not be 'CSI' evidence presented to them."\textsuperscript{339}

Many of the reported cases involving CSI voir dire have arisen in the context of a Batson challenge,\textsuperscript{340} where the prosecutor must prove that it was the juror's answers to CSI questions, rather than race, that motivated a peremptory challenge. In United States v. Hendrix,\textsuperscript{341} the prosecution claimed that it had excused the only two black jurors on race neutral grounds: as to one of the black jurors, the prosecutor explained that the exclusion was because he

\textsuperscript{336} State v. Taylor, No. 06CA009000, 2008 WL 834437, at *3-*4 (Ohio Ct. App. March 31, 2008) (quoting the prosecutor: "This is kind of an interesting story. I tell it in everyone of my Voir Dires. I had a rape case a few years back when I was a fairly new Prosecutor. They found a pubic hair on the victim's underwear. Now, the victim knew the perpetrator, the alleged perpetrator, so I said, let's test it and see if it is his pubic hair. So, I call the Attorney General's Office, who does our genetic testing, and they tell me that is not good science. No, no. I just saw it on CSI. Of course it is good science. Just to double-check I called the county Coroner's Office, and they tell me the same thing. So, a lot of those TV shows are fictional, or the science is no good. It is fictional for purposes of solving their fictional crimes.").

\textsuperscript{337} U.S. v. Harrington, 204 F. App'x 784 (11th Cir. 2006).
\textsuperscript{338} \textit{Id.} at 788.
\textsuperscript{339} \textit{Id.} at 789.
\textsuperscript{341} United States v. Hendrix, 509 F.3d 362 (7th Cir. 2007).
was "one of those CSI guys," and the prosecutor had "great concern about the jurors who watch a lot of CSI." The United States Court of Appeals for the Seventh Circuit held that, coupled with other factors, the CSI explanation was not pretextual and defeated the Batson challenge. In State v. Carson, a juror's response to the defense during defense voir dire about CSI was offered as the basis for the prosecution's peremptory challenge of a minority juror, and the court found that to be a race neutral reason. Other cases have similarly found answers to CSI voir dire to be a race neutral basis for excusing minority jurors.

Opening statements and closing arguments about the "CSI effect" have caused more difficulty for prosecutors. In Boatswain v. State, the prosecutor's closing argument also included the following:

The one issue left in this case is: Was it him? The defense would say, well—and you know they will—there's no fingerprints of him They didn't print the money. They didn't find his prints on the note. In today's day and age, unfortunately, the police and the State isn't put to the same test that they wrote 200 years ago in the Constitution which they said the proof must be beyond a reasonable doubt. Unfortunately, the test, of course, of criminal defendants now

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342 Hendrix, 509 F.3d at 367 (internal quotation marks omitted).  
343 Id. at 372.  
345 Id. at *6.  
346 See, e.g., Wells v. Ricks, No. 07 Civ. 6982(CM)(AJP), 2008 WL 506294, at *28-*30, *33 (S.D.N.Y. Feb. 26, 2008) (reading detective novels or watching CSI is a race neutral basis for excluding a juror); People v. Reyes, No. E040509, 2007 WL 4427856, at *9-*11 (Cal. Ct. App. Dec. 19, 2007) (responding to prosecutor's suggestion that the case "would not be like the CSI television show," juror indicated that she thought "it would be harder to evaluate the case just on testimony"); this was found to be a race neutral ground for excluding Hispanics); People v. Henderson, No. A102395, 2004 WL 2526448, at *4-*5 (Cal. Ct. App. Nov. 9, 2004) (holding juror's statement that CSI "shows how they get evidence that they do and things like that" was a race neutral ground for exclusion (internal quotation marks omitted)).  
is, can they meet the TV expectation that they hope folks like you want. Can they meet CSI?

[Objection overruled]

[If they don't have fingerprints, he can't be guilty. On TV, they would have found fingerprints. But this isn't TV, this is real life.]

Although the Supreme Court of Delaware did not find that the argument required reversal, it did find clear error in allowing such an argument:

[Statements that trivialize the actual constitutional standard by comparing it to a purportedly unnecessarily burdensome "television" standard may leave jurors with the impression that the State's burden of proof is pinned to either an abundance or dearth of a specific type of evidence. The prosecutor's comments here suggest that fingerprint evidence may be required to meet the burden of proof during fictionalized television programs but that same requirement has no bearing on the jury's determination of reasonable doubt at trial.

...]

While correct, that comment tends to trivialize the State's burden, a tactic that implicates the well-worn admonition against disparaging the reasonable doubt standard. The prosecutor told the jury that the State is not "put to the same test" established by the Constitution. By doing so, he disparaged the reasonable doubt standard by claiming that the State is held to an indeterminate, but implicitly lower, burden of proof. That created the risk that the jury might take him at his word. . . . Therefore, we find that the trial judge abused her discretion by overruling the objection and by failing to instruct the jury accordingly or to take other corrective action.

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348 Boatswain, 2005 WL 1000565 at *1-*2 (alterations in original).
349 Id. at *3 (footnote omitted).
In the subsequent case of *Mathis v. State*,\(^{350}\) the Supreme Court of Delaware distinguished *Boatswain* in a situation where it found that the prosecutor's opening statement did not disparage the burden of proof.\(^{351}\) Later, in *Morgan v. State*,\(^{352}\) the Supreme Court of Delaware reaffirmed *Boatswain* and found that it was improper for the prosecutor to argue that "[t]his is not CSI Las Vegas or CSI New York where police do all sorts of different tests all the time. It's fact specific. In this case it wouldn't have worked. So why do it?"\(^{353}\) The court held that the argument was improper because there was no evidentiary basis for the statement that the tests were unavailable or would have been to no avail.\(^{354}\) Other courts have followed the *Boatswain* reasoning and found *CSI* statements or arguments to be improper.\(^{355}\) In *People v. Compean*,\(^{356}\) the court found it to be error, although corrected by a jury instruction, for the prosecutor to claim that it is not economically feasible to perform some tests.\(^{357}\)

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\(^{350}\) *Mathis v. State*, No. 25, 2006, 2006 WL 2434741, at *4 (Del. 2006) (delivering closing argument, the prosecutor told the jury: "Now, keep in mind when you're listening to the testimony from the witness stand this is not CSI Miami, it's not Law and Order. Nobody involved in this case, no one in this room is an actor. These are real people." (internal quotation marks omitted)).

\(^{351}\) *Id.* (citing *Boatswain*, 2005 WL 1000565, at *2-*3).


\(^{354}\) *Id.* at 402-03. The court held that, unlike *Boatswain*, there had not been a timely objection, and therefore did not require reversal on that ground. *Id.; see State v. Snowden*, Nos. 04-07-2546, 03-09-3175, 2007 WL 1119339, at *4 (N.J. Super. Ct. App. Div. April 17, 2007) (per curiam) (finding a lack of evidentiary basis for prosecution arguments).


\(^{356}\) *People v. Compean*, No. A111367, 2007 WL 1567603, at *8 (Cal. Ct. App. May 31, 2007). The prosecutor stated: "Nobody is going to fingerprint a little baggie like you see there. This is not 'CSI!' These are the economic realities and times of Contra Costa County. ... All of ya'll lives [sic] in this county, I think you know the economic realities of it." *Id.* (internal quotation marks omitted).

\(^{357}\) *Id.*
On the other hand, some courts have approved arguments or statements that urge the jury to consider the CSI effect in a way that reinforces rather than disparages the burden of proof. For example, in *State v. Pittman*,358 the prosecutor's opening statement included the following comments:

Do not hold the State of New Jersey to a standard that is not given to you by the Court. Do not hold the State of New Jersey to what I call the Hollywood standard. This is not TV. This is not CSI New York. This is not CSI New Brunswick, okay. What you see on TV is not real. This is what happens. Not what you see on Law & Order. Not what you see on Court TV. Not what you see on the Grammys that come from a Hollywood producer with writers and producers that, to sell commercials. It is not real. Do not hold the State of New Jersey to the Hollywood standard. Hold it to the standard of what reality is. You're going to hear reality in this courtroom. That is how it's done. It is what happens on the streets.

Do not hold the State of New Jersey to that Hollywood standard. Hold it to the standard of reality and what the Court gives you. Keep that in mind when you are hearing the testimony.359

The Appellate Division of the New Jersey Superior Court found no error and held that the prosecutor was just "trying to dispel any illusion jurors may have had that a trial in the real world is like a trial in the world of fiction."360 Objections that comments about CSI are based on facts outside the record have been rejected on the basis that "the prosecutor was merely referring to the jurors' common knowledge that, unlike in the real world, investigations on television typically wrap up in less than an hour."361 Similar

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359 Id. at *3.
360 Id. at *7.
361 State v. Strong, 142 S.W.3d 702, 724-25 (Mo. 2004) (en banc) (citing State v. Christeson, 50 S.W.3d 251, 268-69 (Mo. 2001) (en banc)). The holding apparently presumes that jurors have a common knowledge about the length of
CSI arguments have been allowed by trial judges and approved on appeal. Prosecutors and even defense attorneys have also elicited testimony referring to CSI or the CSI effect, that has been the subject of appeals. For example, in State v. McKinney, the prosecutor questioned witnesses about whether defendant watched CSI and the defendant objected that the questioning was improper character evidence. On appeal, the Ohio court ruled that it was "not willing to hold that watching network crime series such as CSI or in previous decades Perry Mason, Dragnet, and others criminal investigation and/or that CSI has assumed such popularity that it can now be considered "popular knowledge." Id.; State v. Snowden, Nos. 04-07-2546, 03-09-3175, 2007 WL 1119339, at *4 (N.J. Super. Ct. App. Div. April 17, 2007). Snowden also addressed and rejected the "facts . . . not in evidence" objection. Snowden, 2007 WL 1119339, at *4. On the other hand, the Supreme Court of Montana brought up CSI in an interesting context dealing with a motion to suppress a search of a drug dealer, saying:

Truly, it is a different world today, not only in terms of technological advances, but also in the expectation of the use of technology. I would submit, as the questioning italicized above likewise indicates, that our citizens, especially young people in today's society who have been raised in the age of Law and Order and CSI, would think it unusual that a drug dealer would have a reasonable expectation that his conversations during a drug sale to a non-confidant were not being consensually monitored. The drug dealer may have a subjective expectation, but it is not an expectation that our society would deem reasonable.


See Snowden, 2007 WL 1119339, at *4 (holding that the prosecutor was legitimately responding to a defense argument that mistakes had been made in the investigation); see also United States v. Duronio, No. 02-0933 (JAG), 2006 WL 3591259, at *3 (D.N.J. Dec. 11, 2006) (holding the statement that the defense attorney's "favorite television program" must be CSI was not an ad hominem attack on counsel, but was a permissible response to the defense argument that fingerprints were not found on a computer); State v. Ash, No. A07-0761, 2008 WL 2965555, at *7 (Minn. Ct. App. Oct. 21, 2008) (citing State v. Walsh, 495 N.W.2d 602, 607 (Minn. 1993) (holding that the prosecutor's closing statement, asking the jury not to hold the State to a burden like CSI was not improper)).


Id. at *25.
constitutes evidence of bad character." \(^{365}\) Other courts have also allowed testimony referring to \textit{CSI}. \(^{366}\)

To address the tech effect, some courts have given jury instructions about how the jury should consider issues concerning the lack of scientific evidence. In \textit{United States v. Saldarriaga}, \(^{367}\) the defense had questioned government witnesses in a drug delivery trial about the failure of the government to record, photograph, or videotape the undercover transaction or to test the bag containing the drugs for fingerprints. \(^{368}\) Apparently sua sponte, the trial judge gave the following instructions to the jury:

\begin{quote}
The law is clear that the government has no obligation to use any particular techniques. The government's techniques [are] not on trial here. The government has no obligation to use all the possible techniques that are available to it. The government's function is to give enough evidence to satisfy you beyond a reasonable doubt that the charges are true, and the fact that there are a thousand[] other things they could have done is wholly irrelevant.

However, if suggesting things that they could have done leads you to think, well, maybe I have a reasonable doubt because I didn't have any evidence on that subject, if that happens, why, then, of course, that is a reasonable doubt like anything else.

\ldots If evidence is such that without the picture you would have a reasonable doubt as to whether the government established the defendant[']s identity as the person who did
\end{quote}


\(^{366}\) See, e.g., Cox v. State, 966 So. 2d 337, 353-54 (Fla. 2007) (citing Holland v. State, 916 So. 2d 750, 758 (Fla. 2005); Gordon v. State, 863 So. 2d 1215, 1223 (Fla. 2003)) (holding that it was not ineffective representation for failing to object to expert testimony that DNA evidence could be wiped from a murder weapon was "preposterous" because "anybody else with walking-around sense would think the same thing . . . in this day and age of watching CSI" (internal quotation marks omitted)).

\(^{367}\) \textit{United States v. Saldarriaga}, 204 F.3d 50 (2d Cir. 2000) (per curiam).

\(^{368}\) \textit{Id.} at 51 (alterations in original) (quoting the district court's charge).
these things, then you have a reasonable doubt and it doesn't make any difference whether the government could have or could not have. Maybe the government could establish beyond peradventure that it would be impossible to have that picture, it doesn't make any difference. If you have a reasonable doubt because you didn't get the picture, then you [have] a reasonable doubt.

It is wholly immaterial whether the government could have done it or couldn't have done it or how many people the government had available that would do it.  

The United States Court of Appeals for the Second Circuit, per curiam, held:

[T]he jury correctly was instructed that the government has no duty to employ in the course of a single investigation all of the many weapons at its disposal, and that the failure to utilize some particular technique or techniques does not tend to show that a defendant is not guilty of the crime with which he has been charged.

A similar instruction about the failure to conduct fingerprint tests was approved by the United States Court of Appeals for the Fourth Circuit earlier in United States v. Mason.  

In Evans v. State, the defense attacked the government's heroin delivery case because no video record had been made of the alleged undercover drug purchase. In its instructions to the jury, the court addressed the claimed testing deficiency:

During this trial, you have heard testimony of witnesses and may hear argument of counsel that the State did not utilize a specific investigative technique or scientific test. You may consider these facts in deciding whether the State has met its burden of proof. You should consider all of the evidence or lack of evidence in deciding whether a defendant is guilty.

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369 Saldarriaga, 204 F.3d at 51-52.
370 Id. at 53.
373 Id. at 628-29 (quoting the trial court's instruction).
However, I instruct you that there is no legal requirement that the State utilize any specific investigative technique or scientific test to prove its case. Your responsibility as jurors is to determine whether the State has proven, based on the evidence, the defendants' guilt beyond a reasonable doubt.\textsuperscript{374}

The appeals court noted that such arguments are commonly used by the defense to raise a reasonable doubt.\textsuperscript{375} Relying on \textit{Saldarriaga}, the court found that the instruction did not undermine the prosecution's duty to prove guilt beyond a reasonable doubt and affirmed the conviction.\textsuperscript{376} However, the court offered some advice as to a better way of giving such an instruction:

\begin{quote}
\textit{We} stress that the salutary effect of the instruction is found in the advisement that the absence of such evidence should be factored into the juror's determination of whether the State has shouldered its burden if, \textit{and only if}, the absence of such evidence, itself, creates reasonable doubt. The absence of evidence, available to the State, may not, \textit{ipso facto}, constitute reasonable doubt. The risk is greatest that such an instruction will run afoul of the prohibition against relieving the State of its burden where the instruction is predominant in the overall instructions and its relation to the reasonable doubt standard unclear. Consequently, the preferable practice is for the court's instruction to be promulgated in conjunction with the explication of the State's burden to prove the defendant guilty beyond a reasonable doubt.\textsuperscript{377}
\end{quote}

The advice in \textit{Evans} is worth heeding. If the trial judge gives an instruction regarding the lack of scientific evidence, whether requested or sua sponte, it should be cast in terms of reasonable doubt to make sure that the jury understands that while a lack of scientific evidence alone does not mean there is reasonable doubt, they must never nevertheless determine whether the government has proven, without such scientific evidence, the defendant's guilt beyond a reasonable doubt.

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\textsuperscript{374} \textit{Evans}, 922 A.2d at 628.
\textsuperscript{375} \textit{Id.} at 627.
\textsuperscript{376} \textit{Id.} at 631-33.
\textsuperscript{377} \textit{Id.} at 633.
\end{flushleft}
VI. POSTCONVICTON DNA TESTING

The developments in forensic science have seemed to proceed at a pace that has eclipsed the ability of our criminal justice system to keep up. The most obvious symptom of this lapse is the number of convictions that have been reversed many years later by the availability of DNA and other sophisticated analyses that prove innocence. Many of these exonerations have become public knowledge through media reports, and those reports undoubtedly contribute significantly to the tech effect on the expectations of jurors. The highly publicized Innocence Project reports that, as of 2009, there have been 232 postconviction exonerations by DNA testing in the United States. The availability of DNA testing has given rise to numerous postconviction requests for DNA testing on the basis that it could produce important exculpatory evidence. Many states have responded with legislation addressing the standards for those requests, and courts will continue to deal with such requests for some time.

DNA testing has a remarkable ability, in the right circumstances, to provide conclusive exculpatory evidence after conviction where when specimens were not tested at the time of trial. The postconviction power of DNA testing is attributable to the same characteristics of the technology that has made it so valuable in during investigation and trial: the durability of DNA permits reliable testing years after the incident, and the polymorphism of DNA sequence systems greatly increases the probability of a conclusive incriminating or exculpatory result.

379 See infra notes 382-83.
381 Imwinkelried, supra note 30, at 92-93, 96.
In 1999, the Department of Justice conducted a thorough study of the question of postconviction DNA testing. While a great deal has happened in the decade since that study, it does suggest a good framework for addressing such requests for DNA testing. The report of the study suggests that the requests can be viewed in the following categories: (1) "cases in which biological evidence was collected . . . still exists, [and if] subjected to DNA testing or retesting, exclusionary results will exonerate the petitioner"; (2) "cases in which biological evidence was collected . . . still exists, [and if] subjected to DNA testing or retesting, exclusionary results would support the petitioner's claim of innocence, but reasonable persons might disagree as to whether the results are exonerative"; (3) "cases in which biological evidence was collected . . . still exists, [and if] subjected to DNA testing or retesting, favorable results will be inconclusive"; (4) "cases in which biological evidence was never collected, or cannot be found despite all efforts, or was destroyed, or was preserved in such a way that it cannot be tested"; or (5) "cases in which a request for DNA testing is frivolous." Trial judges will usually encounter cases in the first two categories.

Neither common law standards nor existing court rules or statutes regarding postconviction relief were considered adequate to address the prospect of postconviction DNA testing. First, those standards and rules assume that the defendant already has what is regarded as newly discovered evidence, whereas DNA motions seek relief in the form of conducting tests to obtain such evidence. Second, DNA poses the distinct possibility of completely exonerating a defendant. Third, the durability of DNA suggests that arbitrary time rules or statute limits on postconviction motions may not be appropriate to requests for DNA testing. As a result of those concerns, a number of statutes have recently been enacted to specifically address postconviction DNA testing motions. The

382 See NAT'L COMM'N ON THE FUTURE OF DNA EVIDENCE, supra note 380 at iii, vi, xiii.
383 Id. at xiii-xiv.
Justice For All Act\textsuperscript{385} strengthened the right to postconviction DNA testing if convicts assert their innocence, if DNA testing would support that innocence, and if the "testing would create a reasonable probability that the applicant did not commit the offense.\textsuperscript{386}

In states without specific DNA testing statutes or rules, the courts must rely on the general procedures governing motions for postconviction relief. Initially, the defendant in these situations is seeking postconviction discovery in the form of evidentiary samples and testing of those samples. Some courts held that the right to some postconviction relief necessarily implies a right to postconviction discovery.\textsuperscript{387} Other courts held that \textit{Brady v. Maryland}, guaranteeing a defendant the constitutional right to be informed of exculpatory evidence,\textsuperscript{388} carries with it the

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\textsuperscript{386} Cormier, Calandro & Reeder, \textit{supra} note 33, at 15.
\textsuperscript{387} \textit{See}, e.g., \textit{People v. Callace, 573 N.Y.S.2d 137, 139-40} (Gen. Term. 1991).
concomitant right to obtain such evidence even after conviction.  

Recently, the United States Court of Appeals for the Ninth Circuit held in Osborne v. District Attorney's Office\textsuperscript{390} that the defendant had a due process right to have a type of DNA testing that was not available at the time of his trial.\textsuperscript{391} In that case, DNA testing had been attempted on hairs that were in evidence but the sample was too small for analysis in 1994.\textsuperscript{392} New DNA testing techniques of short tandem repeat ("STR") analysis and mitochondrial DNA ("mtDNA") analysis have subsequently emerged, and the court held that the defendant had a constitutional right to have the hair sample retested with those new methods, even though the defendant had subsequently admitted his guilt.\textsuperscript{393}

The Supreme Court of the United States granted certiorari and is currently considering Osborne on appeal.\textsuperscript{394} Osborne pushes access to postconviction DNA testing to a new level. But that has been the track record of DNA's impact on the criminal justice process. Justice Stephen Breyer recently surveyed DNA's impact on our criminal justice system when he wrote:

DNA evidence promises not only to make future criminal trials more reliable, but also to permit the re-evaluation of past convictions, perhaps convictions that were secured many years ago. When should those convictions be reexamined? Are present reopening procedures adequate, in light of both of the added certainty that DNA evidence can provide and of the numbers of closed cases in which potentially determinative DNA evidence might be obtained? Must the boundaries of preexisting legal rights be reshaped better to avoid the risk of


\textsuperscript{390} Osborne v. Dist. Attorney's Office, 521 F.3d 1118 (9th Cir. 2008), cert. granted, 129 S. Ct. 488 (2008).

\textsuperscript{391} Id. at 1122.

\textsuperscript{392} Id. at 1124.

\textsuperscript{393} Id. at 1126, 1141-42.

imprisoning a defendant who is in fact innocent? Are new statutes needed?395

Access to potentially exonerating postconviction DNA testing pits our need for judicial efficiency (motivated by a desire for finality) against our constitutionally and humanely motivated desire for certainty of guilt. While the Supreme Court of the United States or various legislatures may have the last word, the balancing of those interests falls, in the first instance, to trial judges.

VII. CONCLUSION

It is obvious that the rapid advancements in forensic science we have witnessed in the last decade are changing the way criminal investigations are being performed and how criminal trials are being conducted. The trial judge has been thrust—both by the immediacy and chronological primacy of the criminal trials over which we preside and by the opinions of appellate courts to make us the "gatekeepers" of that new science—into a critical position at the intersection of that new science with our old criminal justice court mechanisms. Appellate courts have the luxury, if you will, of being reactive in the traditional role of courts and dealing with new developments after they have been analyzed and parsed and after they have already played out in a factual setting. Trial judges, on the other hand, are confronted with these new scientific developments, and their effects on jurors and attorneys, in a setting that demands a much more immediate and prospective decision. Pretrial issues may determine what evidence is developed or offered by the prosecution and the defense. Admissibility issues will determine what science our new "tech-savvy" jurors will be allowed to hear or see and may even end up being dispositive of a verdict. Lawyer statements or arguments and new jury instructions will determine what our court system tells jurors how to think about scientific evidence, or the lack of it, in making a determination of guilt beyond a "reasonable doubt." Thus, these issues have a dramatic impact on the outcome. Issues of access to

395 Stephen Breyer, Furthering the Conversation About Science and Society, in DNA AND THE CRIMINAL JUSTICE SYSTEM, supra note 30, at 13, 16.
postconviction DNA analysis in our old cases tests our commitment to truth searching in a context where we may have to concede that an earlier verdict in our court might well be unjust.

Certainly, trial judges have always been at the forefront of the criminal justice system. In the last decade, however, a hard job has become a lot harder. On the other hand, the beauty of these new forensic science developments is that the trial judge now has the opportunity to play a pivotal and primary role in a system that—more than ever before—is capable of finding the truth and separating fact from fiction.