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Hair Comparison Evidence

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Forensic Science: Hair Comparison Evidence

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Introduction

Hair evidence may be invaluable in some criminal prosecutions,[1] but it is often abused. The publication of a 1996 Department of Justice report discussing the exoneration of twenty-eight convicts through the use of DNA technology highlights this point.[2] Some of these convicts had been sentenced to death. In several of these prosecutions, hair analysis was used to obtain the conviction.

Edward Honaker

In this case, the expert testified that the crime scene hair sample "was unlikely to match anyone" other than the defendant, Edward Honaker.[3] A prosecutor would later acknowledge that "[t]here was no question that the state hair expert [at Honaker's trial] had overstated the distinctiveness of the hair recovered from the victim's shorts in his trial testimony."[4] This com-

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[1] Generally, after making the determination that a sample is a hair and not a fiber, an analyst can determine: (1) whether the hair is of human or animal origin, (2) the sex of the person who was the source of the hair, (3) the race of the person who was the source of the hair, (4) the part of the body that the hair came from, (5) whether the hair has been dyed, (6) whether the hair was pulled or fell out due to natural causes or disease, (7) the presence of poisons or drugs, (8) whether the hair was cut or crushed, and (9) the ABO blood grouping of the hair source. See 2 P. Giannelli & E. Imwinkelried, *Scientific Evidence* § 24-2 (3d ed. 1999); Imwinkelried, "Forensic Hair Analysis: The Case Against the Underemployment of Scientific Evidence," 39 Wash. & Lee L. Rev. 41 (1982).

[2] E. Connors, T. Lundregan, N. Miller & T. McEwen, *Convicted by Juries, Exonerated by Science: Case Studies in the Use of DNA Evidence to Establish Innocence After Trial* (1996)[hereinafter "*Exonerated by Science*"].

[3] Id. at 58.

[4] H. Levy, *And the Blood Cried Out: A Prosecutor's Spellbinding Account of the Power of DNA* 153 (1996).

ment is a gross understatement. At best, the expert could have testified that the hairs were "consistent," which means that they could have come from Honaker or thousands of other people. A competent expert should have known this. A competent prosecutor should have also known this. Honaker spent ten years in prison. DNA proved him innocent. Indeed, another hair examiner would later opine that "the hairs were *not* comparable."[5]

There were other problems in the use of scientific evidence in this case. First, the fact that the prosecution witnesses had been hypnotized prior to trial was not revealed until the post trial proceedings.[6] This is a patent constitutional violation.[7] Second, "Honaker had a vasectomy in 1977, but the vaginal swab recovered intact sperm, inconsistent with Honaker's aspermic state."[8] The defense did not pursue this issue. This case represents all that is so troublesome in criminal litigation—bad lawyering (on both sides) combined with bad expert testimony.

Roger Coleman

Roger Coleman was executed in 1992 for a 1981 slaying in rural Virginia. The same expert who had testified against Honaker also testified against Coleman.[9] The United States Supreme Court ruled that a lawyer's mistake in filing Coleman's state collateral appeal (one day late) precluded

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[5] J. Tucker, *May God Have Mercy: A True Story of Crime and Punishment* 345 (1997) ("With the cooperation of a conscientious prosecutor, Kate Germond had the hairs reexamined by one of the world's leading experts on hair analysis and DNA tests performed on sperm found on a vaginal swab taken from the victim at the time of the rape. The hair expert said that in his opinion the hairs were *not* comparable, and the DNA analysis proved beyond doubt that Honaker was not the rapist.").

[6] Levy, supra note 4, at 153.

[7] E.g., Orndorff v. Lockhart, 998 F.2d 1426, 1436, 39 Fed. R. Evid. Serv. 283 (8th Cir. 1993), reh'g and reh'g en banc denied, (913513)(Aug. 3, 1994) (prosecution's failure to notify the defense that a witness had been hypnotized constituted a confrontation violation because it deprived the accused of the opportunity to cross-examine the witness on this issue), cert. denied, 510 U.S. 1060 (1994); U. S. v. Miller, 411 F.2d 825, 827 (2d Cir. 1969) (new trial granted because the prosecution failed to inform the defense that a key witness had undergone hypnosis); Brown v. State, 426 So. 2d 76, 81 (Fla. Dist. Ct. App. 1st Dist. 1983) (disapproved of by, Bundy v. State, 471 So. 2d 9 (Fla. 1985)) ("[D]ue process demands that counsel be afforded a fairer means by which to prepare his defense to this critical evidence."); State v. Armstrong, 110 Wis. 2d 555, 329 N.W.2d 386, 395 (1983); Gee v. State, 662 P.2d 103, 105 (Wyo. 1983).

[8] Levy, supra note 4, at 153. There were other problems. See also id. ("The rapist spoke obsessively about Vietnam; Honaker had never been there. Both the victim and her fiancé were sure that the rapist held the gun in his left hand, and Honaker was right-handed.").

[9] See Tucker, supra note 5, at 345 ("In October 1994, after nearly ten years in prison, Edward Honaker was released. The state forensic expert who had testified in 1985 that the hairs were comparable and unlikely to have come from anyone other than Honaker was Elmer Gist.")

federal habeas review.[10] Serious questions about Coleman's innocence have been raised, and the prosecution's use of hair evidence was problematic, at the very least.[11] In his book on the *Coleman* case, John Tucker interviewed the trial judge who underscored the crucial nature of the hair evidence: "Years later, in response to the author's question about what evidence in the case he thought had the most powerful impact on the jury, Judge Persin said it was Elmer Gist's testimony about the comparison of the pubic hairs. It was, Judge Persin observed, the first and only testimony that seemed to tie Roger Coleman to the murder specifically."[12] As Tucker correctly notes: "A finding of consistency is highly subjective, and experts may and often do disagree about such a finding."[13] Nevertheless, at trial the prosecutor "described, with great emphasis, the scientific evidence, and especially the comparison of the pubic hairs, asserting that 'it would be extremely unlikely that anyone else would have hair that would be consistent with this hair.'"[14] Unfortunately for Coleman, the defense counsel failed to challenge this statement.[15] Tucker describes the testimony as follows: Nor did [the expert] compare the pubic hairs found on Wanda [the victim] with anyone other than Coleman and Wanda herself—not even her husband Brad. Nevertheless, when he asserted that he had made a comparison of those hairs with Roger's pubic hair, and that the hairs were "consistent" with each other, meaning, he said, that is was "possible, but unlikely" that the hairs found on Wanda could have come from anyone other than Roger Coleman, the jurors exchanged glances and settled back in their seats.[16]

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[10] Coleman v. Thompson, 501 U.S. 722, 752, 111 S. Ct. 2546, 115 L. Ed. 2d 640 (1991).

[11] See Tucker, supra note 5; Taylor, "Was An Innocent Man Executed?," American Lawyer 40, 40-41 (Dec. 1997))("I'd put the odds that Coleman was innocent somewhere above fifty-fifty." "The state's hair evidence was shown (after the trial) to be far from probative and far from reliable."). See also Tabak, "Death Penalty Be Not Proud," 84 A.B.A. J. 80, 80 (Jan. 1998)("[D]efense counsel did not seriously challenge a highly dubious hair comparison that greatly influenced the jury. The lawyer who dealt with the evidence had never examined a hair expert before.")(reviewing Tucker's book).

[12] Tucker, supra note 5, at 75 ("According to Gist, he had microscopically compared the pubic hair found on Wanda McCoy with those removed from Roger Coleman on March 13, and they were 'consistent.'"); id. at 51 ("Unlike fingerprints, hairs are not positive identifiers, and unlike blood types, there is no scientifically accepted figure for the number or percentage of people whose hair is 'consistent' with one another. . . . But as Jack Davidson and Mickey McGlothlin knew, or would soon find out, Elmer Gist had often testified, and would surely testify again, that it is 'possible, but unlikely' that consistent hairs could come from different people.").

[13] Id. at 51.

[14] Id. at 63.

[15] Id. at 64 ("The scientific evidence was ignored altogether, leaving unchallenged McGlothlin's exaggerated claim about the importance of the public hairs.").

[16] Id. at 76.

Ron Williamson

The use of hair evidence in convicting the innocent is also discussed in Scheck, Neufeld and Dwyer's *Actual Innocence: Five Days to Execution and Other Dispatches from the Wrongly Convicted.*[17] They include a chapter on *Williamson v. Reynolds*,[18] a federal habeas corpus case. There, an expert testified at trial that hair samples were "consistent microscopically."[19] The expert then went on to explain what this meant: "In other words, hairs are not an absolute identification, but they either came from this individual or there is—could be another individual *somewhere in the world* that would have the same characteristics to their hair."[20] However, the federal district court noted that the "expert did not explain which of the 'approximately' twenty-five characteristics were consistent, any standards for determining whether the samples were consistent, how many persons could be expected to share this same combination of characteristics, or how he arrived at his conclusions."[21] Moreover, the district court professed that it had "been unsuccessful in its attempts to locate *any* indication that expert hair comparison testimony meets *any* of the requirements"[22] of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,[23] the Supreme Court case setting forth a reliability test for the admissibility of scientific evidence. The district court observed: "Although the hair expert may have followed procedures accepted in the community of hair experts, the human hair comparison results in this case were, nonetheless, scientifically unreliable."[24] Finally, as is often the case, the prosecutor exacerbated the problem by stating in closing argument, "There's a match."[25] Even the state court misinterpreted the evidence, writing that the "hair evidence placed [petitioner] at the decedent's apartment."[26] The district court decision was subsequently reversed on this ground.[27] Nonetheless, the defendant was later exonerated by exculpatory

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[17] B. Scheck, P. Neufeld & J. Dwyer, *Actual Innocence Innocence: Five Days to Execution and Other Dispatches from the Wrongly Convicted* (2000).

[18] Williamson v. Reynolds, 904 F. Supp. 1529, 1558 (E.D. Okla. 1995), aff'd, 110 F.3d 1508 (10th Cir. 1997), rev'd on this ground, 110 F.3d 1508, 1523 (10th Cir. 1997).

[19] Id. at 1554.

[20] Id. (emphasis added).

[21] Id.

[22] Id. at 1558.

[23] Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579, 589, 113 S. Ct. 2786, 125 L. Ed. 2d 469, 37 Fed. R. Evid. Serv. 1 (1993) ("[U]nder the Rules the trial judge must ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable.").

[24] *Williamson*, 904 F. Supp. at 1558.

[25] Id. at 1557.

[26] Id.

[27] Williamson v. Ward, 110 F.3d 1508, 1523 (10th Cir. 1997) (due process, not *Daubert,* standard applies in habeas proceedings).

DNA evidence, and as Scheck and his colleagues point out, "The hair evidence was patently unreliable."[28]

Steven Paul Linscott

As *Williamson* demonstrates, the misleading nature of hair evidence may be attributable to the prosecutor rather than the expert. *People v. Linscott*[29] is illustrative. In this case, "the prosecutor argued that hairs found in the victim's apartment and on the victim's body were in fact defendant's hairs."[30] Reversing, the Illinois Supreme Court wrote: "With these statements, the prosecutor improperly argued that the hairs removed from the victim's apartment were conclusively identified as coming from defendant's head and pubic region. There simply was no testimony at trial to support these statements. In fact, [the prosecution experts] and the defense hair expert . . . testified that no such identification was possible."[31] DNA testing exculpated Linscott.[32]

Other Innocents

Several other convicts later exonerated by DNA also had to confront hair evidence at their trials: David Vasquez[33] and Dennis Williams.[34] One of the most infamous cases involved the prosecution of Glen Woodall.[35] The expert in the *Woodall* case was Trooper Fred Zain, chief serologist in West

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[28] Scheck, Neufeld & Dwyer, supra note 17, at 146. See also id. at 134 ("Not until December 1985, three years after the murder, did the state finish its first report on the hair examination. A trained hair man named Melvin Hett concluded that thirteen hairs found around the victim's body appeared to have come from the head and pubis of Dennis Fritz [an alleged accomplice]. Another four hairs from the murder scene were linked to Ron Williamson. By itself, though, the hair report was not strong enough to prove capital murder.").

[29] People v. Linscott, 142 Ill. 2d 22, 153 Ill. Dec. 249, 566 N.E.2d 1355 (1991).

[30] Id. at 1358.

[31] Id. at 1359.

[32] See *Exonerated by Science*, supra note 2, at 65 ("The State's expert on the hair examination testified that only 1 in 4,5000 person would have consistent hairs when tested for 40 different characteristics. He only tested between 8 and 12 characteristics, however, and could not remember which ones. The appellate court ruled on July 29, 1987, that his testimony, coupled with the prosecution's use of it at closing arguments, constituted denial of a fair trial.")(citation omitted).

[33] Id. at 73 (discussing Vasquez case). David Vasquez was also convicted based upon a false confession. Indeed, Vasquez, who was borderline retarded, pled guilty. His confession was based on a dream, and "his account was incoherent and inconsistent." The police convinced Vasquez that his fingerprints were found at the scene, and then they fed him the details of the crime. See P. Mones, *Stalking Justice: The Dramatic True Story of the Detective Who First Used DNA Testing to Catch a Serial Killer* 54 (1995); Giannelli, "The DNA Story: An Alternative View," 88 J. Crim. L. & Criminology 380 (1997).

Virginia, who reported the results of phantom lab tests for a decade—all favoring the prosecution. Even after he left the state, West Virginia prosecutors sent him evidence to examine because they could no longer get the "right" results from their own crime lab. A judicial inquiry concluded that "as a matter of law, any testimonial or documentary evidence offered by Zain at any time in any criminal prosecution should be deemed invalid, unreliable, and inadmissible."[36] The West Virginia Supreme Court opinion adopting this judicial investigative report speaks of "shocking" and "egregious violations," "corruption of our legal system," and "mock[ing] the ideal of justice under law."[37] An accompanying report states:

> The acts of misconduct on the part of Zain included (1) overstating the strength of results; (2) overstating the frequency of genetic matches on individual pieces of evidence; (3) misreporting the frequency of genetic matches on multiple pieces of evidence; (4) reporting that multiple items of evidence had been tested, when only a single item had been tested; (5) reporting inconclusive results as conclusive; (6) repeatedly altering laboratory records; (7) grouping results to create the erroneous impression that genetic markers had been obtained from all samples tested; (8) failing to report conflicting results; (9) failing to conduct or to report conducting additional testing to resolve conflicting results; (10) implying a match with a suspect when testing supported only a match with the victim; and (11) reporting scientifically impossible or improbable results.[38]

Misconduct

Zain was not the only government official who abused his office in using hair evidence. In *Nelson v. Zant*[39] the critical evidence was a hair found on the victim's body. The state's expert testified that the hair not only could have come from the defendant but that it could only have come from about 120 people in the entire Savannah area. The prosecution failed to disclose

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[34] See Scheck, Neufeld & Dwyer, supra note 17, at 184 (discussing the Williams case)("And then there was the Caucasian hair collected from the backseat of Williams' car. The state's lab expert said three of the hairs matched the victims' hair. [The defense attorney] didn't talk to any other forensic experts. Years later, it would be shown that the hair was nothing like the victims'.").

[35] Id. at 111 ("Then there was the single reddish-brown hair recovered from the car. Could the hair have come from anyone but Glen Dale Woodall's beard? 'Highly unlikely,' was Zain's answer."); id. at 113 ("Just three months before the trial, Zain had written a report stating that it was a pubic hair—not, as he would testify in court, a beard hair from Woodall. The other expert who examined the hair said that it bore no similarities to any of Woodall's hair, from any part of his body."). See also Giannelli, "The Abuse of Scientific Evidence in Criminal Cases: The Need for Independent Crime Laboratories," 4 Va. J. Social Policy & L. 439 (1997).

[36] In re Investigation of the W. Va. State Police Crime Lab., Serology Div., 438 S.E.2d 501, 502 (W. Va. 1993).

[37] Id. at 518.

[38] Id. at 516.

[39] Nelson v. Zant, 261 Ga. 358, 405 S.E.2d 250 (1991).

that the FBI had also examined the hair and concluded that it was not suitable for comparison purposes. On review, the prosecution argued that the hair evidence was not "material" within the meaning of *Brady*.[40] The Georgia Supreme Court reversed.

Scheck and his colleagues provide other illustrations, including cases where laboratory results were inconsistant and where important information was deleted.[42]

Court Cases

In the past courts[43] have upheld the admissibility of hair evidence under the Frye general acceptance test.[44] Recent cases have followed this trend, even under Daubert. In *Johnson v. Commonwealth*[45] the Kentucky Supreme Court upheld the admissibility of hair evidence. Because hair comparison evidence had been accepted by Kentucky courts and other state courts, the supreme court held that trial courts in Kentucky could take judicial notice that hair comparison evidence was scientifically reliable. Thus, the proponent of hair comparison evidence does not need to prove reliability; the burden shifts to the opponent of the evidence to prove unreliability. The court also rejected Johnson's argument that there was no proficiency testing for hair analysis as there is for DNA analysis, since, unlike DNA analysis, hair analysis depends on the skill of the person making the comparison. One justice dissented, noting that "Appellant's future is, both literally and figuratively, hanging by a hair."[46] The dissenting justice correctly believed that the hair comparison evidence should have been scrutinized in accordance with *Daubert*. He noted that the level of acceptance of scientific techniques can change over time and judicial notice "should be reserved for the rare occasion when the evidence sought to be admitted is seemingly beyond dispute, such as, for example, evidence that the sun rises every day in the east, or acknowledgment of the law of gravity."[47] Similarly, the Hawaii Supreme Court has ruled that "[b]ecause the scientific principles and procedures underlying hair

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[40] Brady v. Maryland, 373 U.S. 83, 87, 83 S. Ct. 1194, 10 L. Ed. 2d 215 (1963) ("[T]he suppression by the prosecution of evidence favorable to an accused upon request violates due process where the evidence is material either to guilt or to punishment, irrespective of the good faith or bad faith of the prosecution.").

[42] Id. at 167 (Timothy Durham case) ("There was something else she had never seen before: the tips of the pubic hairs had been cut, as if shaved by a razor. This was such a remarkable fact that Hair Examiner Cox did not even mention it in her written report.").

[43] E.g., U. S. v. Brady, 595 F.2d 359, 363, 4 Fed. R. Evid. Serv. 492 (6th Cir. 1979); People v. Watkins, 78 Mich. App. 89, 259 N.W.2d 381, 385 (1977).

[44] 293 F. 1013 (D.C. 1923). See 1 Giannelli & Imwinkelried, supra note 1, ch. 1 (discussing the Frye test).

[45] Johnson v. Commonwealth, 12 S.W.3d 258 (Ky. 1999)

[46] Id. at 267.

[47] Id.

and fiber evidence are well-established and of proven reliability, the evidence in the present case can be treated as 'technical knowledge.' Thus, an independent reliability determination was unnecessary.''[48]

Challenging Hair Evidence

Despite these cases, hair evidence—if overstated—is vulnerable to attack. Significantly, the attack on hair evidence in *Williamson* ultimately failed not because the evidence satisfied *Daubert* but because *Daubert* was not the appropriate standard of review of state evidentiary findings in federal habeas proceedings. The attack on admissibility should be continued even though courts have upheld the admissibility of hair evidence.

Subjectivity

First, as noted above, opinion testimony concerning the comparison of hairs is subjective.[49] One study focused on this subjectivity and examiner bias: ''The findings of the present study raise some concern regarding the amount of unintentional bias among human hair identification examiners. . . . A preconceived conclusion that a questioned hair sample and a known hair sample originate from the same individual may influence the examiner's opinion when the samples are similar.''[50]

Positive Identifications

Second, the expert should not make a ''positive'' identification—i.e., that two hairs match to the exclusion of all other persons. If an expert insists

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[48] State v. Fukusaku, 85 Haw. 462, 946 P.2d 32, 44 (Haw. 1997). See also McGrew v. State, 682 N.E.2d 1289, 1292 (Ind. 1997) (hair comparison admissible, more a matter of observation by persons with specialized knowledge than a matter of scientific principles); McCarty v. State, 1995 OK CR 48, 904 P.2d 110, 125 (Okla. Crim. App. 1995) (admitting hair evidence).

[49] Miller, ''Procedural Bias in Forensic Science Examinations of Human Hair,'' 11 Law & Hum. Behav. 157, 157-58 (1987)(''Hair cannot be 'individualized' as with fingerprints. Human hair characteristics (e.g., scale patterns, pigmentation, size, etc.) vary within a single individual. . . . Although the examination procedure involves objective methods of analysis, the subjective weights associated with the characteristics rest with the examiner.'').

[50] Id. at 161. This study reports that the usual method of human hair analysis is less accurate than an alternative line-up procedure, due to outside sources of influence on the examiner. In the conventional method the examiner is given hair samples from a known suspect along with a report including other facts and information relating to the guilt of the suspect. The line-up method gives the examiner hair samples from the suspect along with hair samples with similar characteristics from other individuals. The examiner is in no way informed which samples come from the suspect or even if there is a particular suspect. In short, using the line-up method may reduce the impact of preconceived opinions and result in less false positives.

on making a positive identification, the expert should be asked the basis of this opinion. What scientific text supports this? If it is only based on personal experience, the expert should be asked how many hair examinations the expert has conducted. Suppose the expert replies: "500 examinations." Often, the 500 examinations did not involve comparing each hair against the other 499. Rather, the expert examined three hairs in one case and six in another; the three hairs in the first case were never compared with six hairs in the second case.

"Consistent With" Testimony

Third, if the expert testifies that the accused's exemplars are "consistent with" the crime scene hairs, the expert should concede on cross-examination that the hair could have come from a person other than the accused. Once the expert makes this concession, the cross-examiner could take the expert "up the ladder": The crime scene hair could have come from 5 other persons, 10, 50, 100, 500, 1,000, 100,000 and so forth—until the expert balks. But why does the expert balk? What scientific text supports a lower number?[51]

Proficiency Testing

Fourth, as Scheck and his colleagues note, "In the early 1970s, the U.S. Law Enforcement Assistance Administration (LEAA) sponsored a proficiency testing program for 240 laboratories that provided evidence in criminal cases. The labs botched many kinds of tests: paint, glass, rubber, fibers. But by far, the worst results came from hair analysis."[52] The study cited was a 1978 Laboratory Proficiency Testing Program sponsored by the LEAA.[53] Over 200 crime laboratories participated in this program, which involved such common forensic examinations as firearms, blood, drug, and trace evidence analyses. Seventy one percent of the crime laboratories tested provided unacceptable results in a blood test, 51.4 percent made errors in matching paint samples, 35.5 percent erred in a soil examination, and 28.2 percent made mistakes in firearms identifications. The Report concluded: "A wide range of proficiency levels among the nation's laboratories exists, with several evidence types posing serious difficulties for the laboratories. . . ."[54] As

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[51] See Thorton, "The General Assumptions and Rationale of Forensic Identification, in 2 *Modern Scientific Evidence* § 20-9.2.3, at 28 (Faigman et al. 1997) ("In an inclusionary mode, . . . hair is a miserable form of evidence. The most that can be said about a hair is that it is *consistent* with having originated from a particular person, but that it would also be consistent with the hair of numerous other people. Stronger opinions are occasionally expressed, but they would not be supportable.").

[52] Scheck, Neufeld & Dwyer, supra note 17, at 162.

[53] J. Peterson, E. Fabricant & K. Field, *Crime Laboratory Proficiency Testing Research Program* 188-89 (L.E.A.A. Oct. 1978).

[54] Id. at 3.

for the five hair tests,[55] the unacceptable rates were: (A) 50.0 percent,[56] (B) 27.8 percent,[57] (C) 54.4 percent,[58] (D) 67.8 percent,[59] and (E) 35.6 percent.[60]

A later study showed similar results.[61] Between 1980 and 1991, crime laboratories were given eight hair proficiency tests in which the exercises ranged from identifying species of animal hairs to identifying the area of the human body from which a hair originated. In two separate tests, an average of 44 percent and 30 percent of the laboratories correctly identified the species of animal.[62] When trying to determine the location of human hair, an average of 56 percent of the laboratories were correct, with greater success identifying hair as coming from the pubic and head region than identifying hair from the beard, arm, and chest regions.[63] The authors of the study concluded: "Animal and human (body area) hair identifications are clearly

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[55] The tests consisted of five sample items: (A) dog hair, (B) cat hair, (C) deer hair, (D) cow hair, and (E) mink hair.

[56] Id. at 232. Of the 90 laboratories tested, 19 identified the dog hair as coming from some animal other than a dog, 17 identified the hair only as "non-human," 8 reported inconclusive results, and 3 reported no results. Forty-three laboratories correctly identified the hair.

[57] Id. at 232. Of the 90 laboratories tested, 13 identified the cat hair only as "non-human," 6 identified the hair as coming from some animal other than a cat, 3 reported no results, and 2 reported inconclusive results. Sixty-six laboratories correctly identified the hair.

[58] Id. at 232. Of the 90 laboratories tested, 31 identified the deer hair as coming from some animal other than a deer, 10 identified the hair only as "non-human," 4 reported inconclusive results, and 4 reported no results. Forty-one laboratories correctly identified the hair.

[59] Id. at 252. Of the 90 laboratories tested, 36 identified the cow hair as coming from some animal other than a cow, 12 identified the hair only as "non-human," 7 reported inconclusive results, and 4 reported no results. Thirty-one laboratories correctly identified the hair.

[60] Id. at 232-33. Of the 90 laboratories tested, 17 identified the mink hair as coming from some animal other than a mink, 12 identified the hair only as "non-human," 4 reported no results. Fifty-seven laboratories correctly identified the hair.

[61] Peterson & Markham, "Crime Laboratory Proficiency Testing Results, 1978-1991, I: Identification and Classification of Physical Evidence, 40 J. Forensic Sci. 994, 1007 (1995) ("In sum, laboratories were no more successful in identifying the correct species of origin of animal hair . . . than they were in the earlier LEAA study.").

[62] Id. at 1004-05. In the first test, 76 percent of the laboratories tested correctly identified deer hair, 28 percent correctly identified opossum hair, and 28 percent correctly identified bear hair. In the second test, 45 percent correctly identified squirrel hair, 36 percent correctly identified moose hair, and 9 percent correctly identified fox hair.

[63] Id. at 1004-05. Ninety-six percent of the laboratories tested correctly identified human wig head hair, 87 percent correctly identified human head hair, 84 percent correctly identified human pubic hair, 40 percent correctly identified human arm hair, 33 percent correctly identified human beard hair, 25 percent correctly identified human beard/facial hair, and 25 percent correctly identified human chest/body hair.

the most troublesome of all categories tested."[64] In another series of hair tests, the examiners had to "include" or "exclude" in comparing known and unknown samples: "Laboratories reported inclusions and exclusions which agreed with the manufacturer in approximately 74 percent of their comparisons. About 18 percent of the responses were inconclusive, and 8 percent in disagreement with the manufacturers' information."[65]

Statistical Evidence

Not content with "consistent with" testimony, some experts have used statistical probability evidence in presenting their conclusions. For example, in *United States v. Massey*[66] the expert testified that three of five hairs found in a blue ski mask similar to one worn by one of the robbers were microscopically similar to the defendant's hair. He also cited a study for the proposition that there was a one in 4,500 or one in 2,000 chance of his identification being wrong. The prosecutor emphasized these numbers in closing argument, telling the jury that the "hair sample would be proof beyond a reasonable doubt because it is so convincing."[67] The Eighth Circuit correctly found plain error. Similarly, in *State v. Carlson*[68] the Minnesota Supreme Court ruled probability hair evidence inadmissible.

The issue also arose in *United States ex rel. DiGiacomo v. Franzen,*[69] where the "one in 4,500" probability was again used. During its deliberations, the jury submitted the following question to the judge: "Has it been established by sampling of hair specimens that the defendant was positively proven to have been in the automobile?"[70] Surprisingly, the conviction was upheld on a narrow ground—i.e., in habeas proceedings the misuse of evidence violates due process only in extreme cases.[71] Unfortunately, the

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[64] Id. at 1007.

[65] Peterson & Markham, "Crime Laboratory Proficiency Testing Results, 1978-1991, II: Resolving Questions of Common Origin, 40 J. Forensic Sci. 1009, 1023 (1995). See also id. at 1022 ("Examiners warned that "they needed to employ particular caution in interpreting the hair results given the virtual impossibility of achieving complete sample homogeneity.")

[66] U. S. v. Massey, 594 F.2d 676 (8th Cir. 1979).

[67] Id. at 681.

[68] State v. Carlson, 267 N.W.2d 170 (Minn. 1978).

[69] U. S. ex rel. DiGiacomo v. Franzen, 680 F.2d 515 (7th Cir. 1982).

[70] Id. at 516.

[71] Id. at 519 ("The Constitution does not and, indeed, cannot guarantee that only completely reliable evidence will be placed before the jury. Although it does demand that a defendant be given a full and fair opportunity to challenge whatever evidence is admitted, DiGiacomo was afforded that opportunity here. Through his counsel, he was free to challenge Dillon's testimony if it was not true, or clarify it if it was misleading. He was also free to call his own expert if he thought Dillon's testimony was at odds with the established views of the scientific community. DiGiacomo in fact did none of these things. No attempt was made to cross-examine Dillon regard-

Seventh Circuit did not appreciate that it was confronting that "extreme" case.

Although the "one in 4,500" was derived from published studies,[72] these estimates, as one commentator notes, "are easily challenged."[73] Two other commentators reviewed the research in this field.[74] Almost all empirical evidence concerning human hair comparison is based on the experiments of one man (Gaudette).[75] Before courts admit figures of statistical probability based on Gaudette's findings, critical examination is required. One major flaw in his study was the lack of "blindedness"; he knew that each match was a false positive. This flaw is compounded by the fact that hair analysis is subjective since every hair, even hair from the same individual, is variable. Hair examiners are simply looking for unaccountable differences, but there are no objective guidelines to follow. Another problem is that some people have "featureless hair"—their hair has very few unique characteristics. Gaudette's study does not estimate the frequency of "featureless hair," nor does he account for the impact that this might have on his numbers.

Furthermore, important differences between Gaudette's controlled testing and the forensic setting exist. Gaudette did not account for pre-comparison exclusions that would be common in a criminal investigation. If a suspect is known to be Caucasian, the police are not going to present the hair examiner with samples from an African American individual. Gaudette's comparison of hair samples with such obvious differences will inflate the statistical results in favor of true positives. Another important difference between Gaudette's study and forensics is the expertise and reliability of the examiners. Gaudette was probably more careful than the average technician, and as already stated, hair analysis is very subjective. Finally, there is the issue of outside influence and preconceived bias. When a hair analysis expert gets a sample in the forensics world, it is usually because that individual is

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ing her testimony that hairs found in Marik's car belonged to the defendant.")(citation omitted).

[72] See Gaudette & Keeping, "An Attempt at Determining Probabilities in Human Scalp Hair Comparison," 19 J. Forensic Sci. 599 (1974); Gaudette, "Probabilities and Human Pubic Hair Comparison," 21 J. Forensic Sci. 514 (1976).

[73] D. Kaye, *Science in Evidence* 28 (1997). See also A. Moenssens, J. Starrs, C. Henderson & F. Inbau, Scientific Evidence in Civil alnd Criminal Cases 578 (4th ed. 1995) ("The problem with using these statistics is that, while they appear to tell the jury that the likelihood is great that we are dealing with a near positive match between the crime scene hair and the hairs known to have come from the defendant, that is not at all what they mean.").

[74] Smith & Goodman, "Forensic Hair Comparison Analysis: Nineteenth Century Science or Twentieth Century Snake Oil?," 27 Colum. Hum. Rts. L. Rev. 227, 231 (1996) "If the purveyors of this dubious science cannot do a better job of validating hair analysis than they have done so far, forensic hair comparison analysis should excluded altogether from criminal trials.").

[75] Although human hair analysis has generally been accepted into American courts as a reliable science, since the only practical use of hair analysis is in the criminal setting its exposure to scientific evaluation is very limited.

already a suspect. Any outside influence is likely to taint the examiner's belief as to the validity of the match. Although Gaudette made a worthwhile effort to support the use of hair analysis in criminal investigations, the opinion of more than one person should be required before such evidence may be introduced in court.[76]

Basis Of Testimony

One of the more remarkable hair cases ended up in the United States Supreme Court. In *Delaware v. Fensterer*[77] the Supreme Court considered a confrontation challenge involving the basis of expert testimony. In that case an FBI analyst testified that hair found at a murder scene had been forcibly removed. He further testified that three methods were available to make this determination, but he could not remember which method he had used to reach his conclusion. According to the Delaware Supreme Court, the expert's lack of memory precluded the defense from testing the basis for the opinion by cross-examination and thus violated the right of confrontation.[78]

The U.S. Supreme Court disagreed and reversed. In the Court's view, "[T]he Confrontation Clause is generally satisfied when the defense is given a full and fair opportunity to probe and expose . . . infirmities through cross-examination, thereby calling to the attention of the factfinder the reasons for giving scant weight to the witness' testimony."[79] The Court went on to hold that such an opportunity had been provided at trial, noting that the "defense counsel's cross-examination of Agent Robillard demonstrated to the jury that Robillard could not even recall the theory on which his opinion was based."[80] The Court, however, did caution that its decision was limited to the facts presented.[81] Nevertheless, on remand the Delaware Supreme Court again held the opinion inadmissible, but on evidentiary, rather than constitutional, grounds. According to the court: "While a witness's mere lack of memory as to a particular fact may go only to the weight of that evidence, an expert witness's inability to establish a sufficient basis for his

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[76] Smith & Goodman, supra note 72, at 257 ("Despite the paucity of empirical study upon which a hair expert may rely when testifying about the probability of matching hairs, experts have nonetheless testified in a number of cases to *specific* probabilities of match hairs based on statistical studies of mysterious origin.").

[77] Delaware v. Fensterer, 474 U.S. 15, 106 S. Ct. 292, 88 L. Ed. 2d 15, 18 Fed. R. Evid. Serv. 945 (1985).

[78] Fensterer v. State, 493 A.2d 959, 964 (Del. 1985), cert. granted, judgment vacated, 474 U.S. 15, 106 S. Ct. 292, 88 L. Ed. 2d 15, 18 Fed. R. Evid. Serv. 945 (1985).

[79] 474 U.S. at 22.

[80] Id. at 20.

[81] Id. ("We need not decide whether there are circumstances in which a witness' lapse of memory may so frustrate any opportunity for cross-examination that admission of the witness' direct testimony violates the Confrontation Clause.").

opinion clearly renders the opinion inadmissible under D.R.E. 705."[82] No matter what the U.S. Supreme Court may say about the Constitution, expert testimony based on a "forgotten" methodology is worthless as a matter of science and evidence law.

DNA Testing

The advent of DNA evidence alters the use of hair evidence. If the root of a hair is recovered, it may be analyzed by several DNA methods: RFLP, PCR, STRs.[83] In addition, mitochondrial DNA has been used for this purpose.[84] *State v. Council* [85] was the first reported case.

Conclusion

As noted earlier, hair evidence may be invaluable in some cases. Nevertheless, it is also one of the most abused types of scientific evidence. It should be challenged as a matter of routine.

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[82] Fensterer v. State, 509 A.2d 1106, 1109-10 (Del. 1986).

[83] See Linch, Smith & Prahlow, "Evaulation of the Human Hair Root for DNA Typing Subsequent to Microscopic Comparison," 43 J. Forensic Sci. 305 (1998); 2 Giannelli & Imwinkelried, supra note 1, ch. 18.

[84] See Allen et al., "Mitochondrial DNA Sequencing of Shed Hairs and Saliva on Robbery Caps: Sensitivity and Matching Probabilities, 43 J. Forensic Sci. 453 (1998). See also Savolainen & Lundeberg, "Forensic Evidence Based on DNA from Dog and Wolf Hairs," 44 J. Forensic Sci. 77 (1999).

[85] State v. Council, 335 S.C. 1, 515 S.E.2d 508 (1999), cert. denied, 528 U.S. 1050, 120 S. Ct. 588, 145 L. Ed. 2d 489 (1999). See Curriden, "A New Evidence Tool: First Use of Mitochondrial DNA Test in a U.S. Criminal Trial," 82 A.B.A. J. 18, 18 (Nov. 1996) (the rape-murder of a 4-year-old girl was solved from a small red hair found in the victim's throat). Previously, RFLP and PCR has been used, both of which test for DNA in the cell nucleus. Mitochondrial DNA is found outside the cell nucleus and is inherited from the mother.