

2-9-2017

**Brief of Amici Curiae Brandon L. Garrett and 35 Scientists,
Statisticians, Law and Science Scholars, and Practitioners, People
v. Genrich, No. 2016CA651**

Brandon L. Garrett

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Brief of Amici Curiae Brandon L. Garrett and 35 Scientists, Statisticians, Law and Science Scholars, and Practitioners, People v. Genrich, No. 2016CA651

Abstract

In this case, a toolmark “expert” testified against James Genrich by assuring the jury that several of Genrich’s tools made purportedly unique marks on fragments of the bombs recovered from the crime scene, “to the exclusion of any other tool” in the world. That testimony all but assured Genrich’s conviction. But as this brief describes, the scientific community has now recognized that it is not appropriate to express such a conclusion in the area of toolmarks, or in any forensic discipline. “The reality is that uniqueness is impossible to prove, and is not anywhere near as relevant as some may claim[.]”² Part I.A of this brief describes how the relevant field of toolmark comparisons lacks scientific research support. While firearms comparisons, which are far more commonly conducted, have been the subject of some studies, toolmarks research is nearly nonexistent. Part I.B describes the “theory” used to advance toolmark identifications in court and explains why scientists have found it unsupported. The section also describes criticism of toolmark comparisons in influential scientific reports that have highlighted problems of overstated testimony, error rates, and lack of research. Part I.C describes toolmark identifications in the courts and how, in recent years, courts have excluded or limited testimony like that presented in the Genrich case. Finally, Part II describes how the flaws inherent in toolmark evidence were borne out in this particular case. In light of the unreliable nature of toolmark evidence, Amici respectfully urge this Court to grant a full evidentiary hearing to review the faulty and wholly unscientific forensic testimony that led to Genrich’s conviction.

Disciplines

Forensic Science and Technology

Comments

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<p>COLORADO COURT OF APPEALS 2 East 14th Avenue, Denver, CO 80203</p>	<p>DATE FILED: February 9, 2017 12:24 PM FILING ID: 8C155AD6BBD3E CASE NUMBER: 2016CA651</p> <p style="text-align: center;">▲ COURT USE ONLY ▲</p>
<p>Appeal from the Colorado District Court, Mesa County, Colorado, No. 92CR95, Judge Richard T. Gurley</p> <p>Plaintiff-Appellee, THE PEOPLE OF THE STATE OF COLORADO v. Defendant-Appellant, JAMES GENRICH</p>	
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<p style="text-align: center;">BRIEF FOR AMICI CURIAE BRANDON L. GARRETT AND THIRTY-FIVE SCIENTISTS, STATISTICIANS, LAW AND SCIENCE SCHOLARS, AND PRACTITIONERS IN SUPPORT OF JAMES GENRICH</p>	

RULE 32(H) CERTIFICATE OF COMPLIANCE

I hereby certify that this brief complies with C.A.R. 29 and C.A.R. 32, including all formatting requirements set forth in these rules. Specifically, the undersigned certifies that:

The amicus brief complies with the applicable word limit set forth in C.A.R. 29(d).

It contains 4,700 words (does not exceed 4,750 words)

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I acknowledge that my brief may be stricken if it fails to comply with any of the requirements of C.A.R. 29 and C.A.R. 32.

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INTEREST OF *AMICI CURIAE*¹

This brief is signed by scholars representing a variety of disciplines, including law, forensic science, medicine, and statistics. The scholars have an interest in the quality and improvement of forensic science. *Amici* believe that forensic reports should be founded on empirical data and logical reasoning, and that reports not so founded are detrimental to forensic science as a scientific enterprise. *Amici* are also interested in improving the administration of justice in general, and in maintaining the quality of evidence law in particular. *Amici* are concerned that invalid, overstated, and unreliable forensic conclusions can cause wrongful convictions.

INTRODUCTION

In this case, a toolmark “expert” testified against James Genrich by assuring the jury that several of Genrich’s tools made purportedly unique marks on fragments of the bombs recovered from the crime scene, “to the exclusion of any other tool” in the world. That testimony all but assured Genrich’s conviction. But as this brief describes, the scientific community has now recognized that it is not

¹ The signatories are listed in the Appendix to this brief. The views expressed herein reflect those of Professor Brandon L. Garrett and the other signatories, but not those of any academic or other institution to which they belong, such as the University of Virginia.

appropriate to express such a conclusion in the area of toolmarks, or in any forensic discipline. “The reality is that uniqueness is impossible to prove, and is not anywhere near as relevant as some may claim[.]”²

Part I.A of this brief describes how the relevant field of toolmark comparisons lacks scientific research support. While firearms comparisons, which are far more commonly conducted, have been the subject of some studies, toolmarks research is nearly nonexistent. Part I.B describes the “theory” used to advance toolmark identifications in court and explains why scientists have found it unsupported. The section also describes criticism of toolmark comparisons in influential scientific reports that have highlighted problems of overstated testimony, error rates, and lack of research. Part I.C describes toolmark identifications in the courts and how, in recent years, courts have excluded or limited testimony like that presented in the Genrich case. Finally, Part II describes how the flaws inherent in toolmark evidence were borne out in this particular case.

² Mark Page et al., *Uniqueness in the Forensic Identification Sciences—Fact or Fiction?*, 206 *Foren. Sci. Int’l* 12, 17 (2011). Conclusions of the type reached in Genrich’s case are predicated on what is known in the literature as the “individuation fallacy.” See Michael J. Saks & Jonathan J. Koehler, *The Individualization Fallacy in Forensic Science Evidence*, 61 *Vand. L. Rev.* 199 (2008).

In light of the unreliable nature of toolmark evidence, *Amici* respectfully urge this Court to grant a full evidentiary hearing to review the faulty and wholly unscientific forensic testimony that led to Genrich's conviction.

ARGUMENT

I. TOOLMARK EVIDENCE IS SCIENTIFICALLY UNSUPPORTED

In 1993, James Genrich was convicted of murder and other felonies resulting from several pipe bomb explosions in Grand Junction, Colorado. The central evidence presented against Genrich at trial was the testimony of an agent with the Federal Bureau of Alcohol, Tobacco and Firearms, John O'Neil, who was permitted to testify as an expert in the area of toolmark identification. He examined marks made on wires used in the bombs, and compared them to sets of pliers and wire strippers found in Genrich's toolbox. O'Neil testified that all tools are unique at the microscopic level, and that those unique characteristics can be imprinted and positively identified. And, although he described no research supporting the ability to make toolmark identifications, he nevertheless testified that the tools recovered from Genrich were the only ones in the world that could have left the marks on the evidence collected.³

³ The trial court ordered O'Neil to submit to the court all of the "test cuts" he had made to determine the type of marks the tools in question created. Instead, O'Neil submitted only those he believed were "of value." Of ten or more sheets

O'Neil acknowledged that it is more challenging to match toolmarks than bullets fired from firearms. For a tool, "by simply applying the cutting edge at an angle to the wire, instead of straight through, it can change how the tool marks." PR. Tr. (Apr. 15, 1993), p. 1994. Indeed, in another case, O'Neil acknowledged that "just having a match come up one time could be random luck." PR. Tr. (Apr. 20, 1993), p. 2370. O'Neil also noted that, "by their very nature," explosive devices damage or eliminate many marks that may otherwise be present. PR. Tr. (Apr. 21, 1993), p. 2605. He also acknowledged that the toolmark work he performed was "subjective" and "based on [his] training." *Id.* at 2752.

Yet, O'Neil testified that "the individual jaw" in Genrich's pair of pliers "was identified as having cut the wire in question to a degree of certainty to exclude any other tool." *Id.* at 2632. According to O'Neil, no other tool in the world could have made that particular cut. O'Neil made similar claims with regard to Genrich's other tools. *See id.* at 2638, 2648. As described in more detail below, these claims are unscientific and unsupportable.

with test cuts on them, only one was supplied to the court. PR. Tr. (Apr. 15, 1993), pp. 1977-1980. As many as fifty test cuts were not supplied to the court or to the defense. *Id.* at 1979. Those test cuts include those that did not match the physical evidence from the crime. *Id.* at 1990-1999.

A. The Field of Toolmark Comparison Lacks Any Scientific Research Foundation

“The basic principle in toolmark comparison is the reproduction of similar marks with the suspected tool or instrument, simulating as nearly as possible the conditions under which the original marks were made.”⁴ However, there are few studies of any kind regarding toolmark evidence as applied to needle-nose pliers, slip-joint pliers, or wire strippers, and none is an appropriately designed scientific study. Nor has any research been performed on exploded objects and their suitability for comparison. While some studies have explored the possible uses of statistical analysis and 3-D imaging to improve toolmark comparisons, these studies are not definitive, and, in any event, no such techniques were available at the time of Genrich’s trial.

Most studies focus primarily on marks made by firearms, not toolmarks. The first firearms comparisons were likely conducted in the 1830s in London, England, by Henry Goddard; comparisons involving tools other than firearms were

⁴ Leland V. Jones, *Locating and Preserving Evidence in Criminal Cases*, 1 Am. Jur. Trials 555, § 69 (1964, updated Dec. 2016).

not conducted until much later. Some believe that Dr. R. Kockel in Leipzig, Germany, was the first to attempt to match striations from knife cuts around 1900.⁵

Academic papers studying toolmark comparisons are few and far between. One paper from 1942 examined marks made by screwdrivers and suggested the importance of the angle of application of the screwdrivers, and proposed criteria for studying such marks.⁶ Other publications merely described single toolmark comparisons and did not purport to study the accuracy of the technique as a whole.⁷ And while there was a single 1980 study of plier comparisons, that study involved just three sets of pliers making a limited number of marks. Knowing *a*

⁵ L.S. Chumbley & M. Morris, *Significance of Association in Tool Mark Characterization*, Report No. 243319, at 11 (Aug. 2013) (summarizing history of toolmark evidence), available at <https://www.ncjrs.gov/pdffiles1/nij/grants/243319.pdf>.

⁶ *See id.*

⁷ *See, e.g.*, R. R. Ogle, Jr. & G. T. Mitosinka, *The Identification of Cut Multistranded Wires*, 19 J. Foren. Sci. 865, 867 (1974) (two-and-a-half-page summary of “method for the comparison of cut multistranded wires”); Sgt. Arthur R. Paholke, Chi. Police Dep’t, *A Change in Technique*, AFTE Newsletter No. 16, at 2-3 (Oct. 1971) (two-page summary of attempt to identify one of a suspect’s “two small wire cutters” as having cut a window screen at the scene of a burglary); David L. Williams, *Comparison of Cut Telephone Cables*, 21 AFTE J. 221 (1989) (two-page summary of attempt to match marks with a pair of cable cutters recovered from the suspects).

priori which pliers made which marks, the examiner's sole task was to determine whether there were differences in the marks.⁸

All of these studies used a limited universe of tools—i.e., they sought either to determine which of a few specified tools made a particular mark, or to determine whether there were differences among marks made by known tools. The studies do not, and cannot, support conclusions in cases where there are no such limits—i.e., where one seeks to determine whether *some* set of pliers recovered *somewhere* can be the sole source of a mark. Further, none of the articles attempts to extrapolate from the facts of those specific cases to broader generalizations about the methodology of toolmark examination. Nor do they set any standards, rules, statistical validity, reproducibility, statistical reliability assessment, guidelines for analysis, or research to test the accuracy of such methods.

B. The “Theory” of Toolmark Comparison Lacks Scientific Support

Despite this lack of research, for decades, examiners claimed they could link a toolmark to a specific tool, to the exclusion of all others in the world, with complete confidence and accuracy. Since at least 1990, the Association of Firearm and Tool Mark Examiners (“AFTE”) has proffered its “theory” of firearms and

⁸ See F. H. Cassidy, *Examination of Toolmarks from Sequentially Manufactured Tongue-and-Groove Pliers*, 25 J. Foren. Sci. 796, 799 (1980).

toolmarks forensics as follows: “The theory of identification as it pertains to the comparison of tool marks enables opinions of common origin to be made when the unique surface contours of two tool marks are in ‘sufficient agreement.’”⁹

But what supports this “theory”? It is not stated, and there is no basis for such a theory in the literature. Further, the AFTE does not define what counts as “sufficient agreement,” except to circularly say that it is “significant” and is of such quantity and quality that it is “considered a practical impossibility” that another tool made the mark.¹⁰ The AFTE admits that this interpretation is “subjective in nature” and “based on the examiner’s training and experience.”¹¹ It nevertheless claims that there are “scientific principles” supporting such conclusions while failing to describe or reference such principles. Review of the literature fails to identify the scientific underpinnings of that statement. It is one thing to advance a testable theory; it is quite another matter to show that the theory

⁹ AFTE Criteria for Identification Comm., *Theory of Identification, Range of Striae Comparison Reports and Modified Glossary Definitions*, 22 AFTE J. 275, 276 (1990); see also Comm. for the Advancement of the Sci. of Firearm & Toolmark Identification, *Theory of Identification as it Relates to Toolmarks: Revised*, 43 AFTE J. 287, ¶ 1 (2011) (providing same theory).

¹⁰ *Theory of Identification*, 43 AFTE J. at ¶ 2.

¹¹ *Id.* ¶ 3.

has in fact been tested and validated. Until a theory has been subjected to testing and passed muster, it does not qualify as scientific knowledge.

Indeed, as the 2009 National Academy of Sciences Report (“NAS Report”) summarized, the toolmarks field has “unarticulated standards,” “no statistical foundation,” and requires “additional studies” to “understand the reliability and repeatability of the methods.”¹² The NAS Report also noted that the AFTE theory “does not provide a specific protocol” to conduct the relevant comparisons.¹³ The AFTE theory is the “best guidance available for the field,” and yet it “does not even consider, let alone address, questions regarding variability, reliability, repeatability, or the number of correlations needed to achieve a given degree of confidence.”¹⁴ The NAS Report concluded that the method of toolmark examination involves “subjective qualitative judgments by examiners,” and, “[b]ecause not enough is known about the variabilities among individual tools and guns,” one is “not able to specify how many points of similarity are necessary for a

¹² Nat’l Research Council, Comm. on Identifying the Needs of the Foren. Sci. Cmty., *Strengthening Forensic Science in the United States: A Path Forward* 153-154 (Aug. 2009) (hereinafter “NAS Report”), available at <https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf>.

¹³ *Id.* at 155

¹⁴ *Id.*

given level of confidence in the result.”¹⁵ Even for firearms analysis—the subject of far more research than toolmarks—the NAS Report observed that “[s]ufficient studies have not been done to understand the reliability and repeatability of the methods.”¹⁶

The 2016 President’s Council of Advisors on Science and Technology Report (“PCAST Report”) echoes these statements, describing at length why the theory of identification is “clearly not a scientific theory” and is instead an entirely “circular” argument in which “sufficient agreement” occurs when the examiner decides agreement is sufficient.¹⁷ The PCAST Report ultimately concluded that studies purporting to validate firearms analysis were generally “inappropriately designed,” and that testimony suggesting or implying greater certainty than what the scientific literature and empirical evidence support *should not be used in court*.¹⁸

¹⁵ *Id.* at 153-154.

¹⁶ *Id.* at 154.

¹⁷ Exec. Office of the President, President’s Council of Advisors on Sci. & Tech., *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods* 60 (Sept. 2016) (hereinafter “PCAST Report”), available at <http://www.crime-scene-investigator.net/PDF/forensic-science-in-criminal-courts-ensuring-scientific-validity-of-feature-comparison-methods.pdf>.

¹⁸ *Id.* at 11, 19. PCAST reiterated its conclusions upon hearing from a range of respondents after its report was issued. See Exec. Office of the President,

Significantly, there is also a wide gulf between firearms comparison and toolmark identification. As a district court put it in a recent case involving toolmark evidence:

The first important distinction between tool marks and firearms is that while a firearm can generally only be used in one way, by pulling the trigger, a tool can be used in any number of ways, such as by slashing, stabbing, prying, or scraping.

United States v. Smallwood, 2010 WL 4168823, at *11 (W.D. Ky. Oct. 12, 2010), *aff'd*, 456 F. App'x 563 (6th Cir. 2012) (per curiam). The court added:

The second important distinction is that, given the subjective nature of firearm and tool mark identification, the relative frequency of firearm cases compared to tool mark cases—and knife cases in particular—necessarily makes a tool mark identification less reliable than a firearm identification.

Id. The court also noted that, as compared with “strides made in firearm identification . . . [,] toolmark identification has made no such similar progress.”

Id. Based on the relative lack of reliability of toolmark identification and the expert’s lack of experience with the particular tool at issue, the court excluded the expert’s testimony, which was upheld on appeal.

President’s Council of Advisors on Sci. & Tech., *An Addendum to the PCAST Report on Forensic Science in Criminal Courts* (Jan. 2017), available at https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensics_addendum_finalv2.pdf.

C. Toolmark Evidence Lacks Widespread Legal Support

Only sporadic decisions have discussed the admissibility of toolmark as opposed to firearms testimony. Most of those cases pre-date *Daubert* and *Shreck*, and some of the more recent decisions have been skeptical of the admissibility of toolmark testimony,¹⁹ and even more so in the last decade. Far more reported decisions discuss firearms comparisons. A leading treatise notes: “case law on the admissibility of toolmark identification and firearms identification expert evidence is typified by decisions admitting such testimony with . . . adroit sidestepping of any judicial duty to assure that experts’ claims are valid.”²⁰ In recent years, more judges have expressed concerns about firearms comparisons, and some judges have limited the scope of testimony so that examiners are not permitted to reach the types of sweeping conclusions reached in the Genrich case. For example, the Texas Court of Criminal Appeals concluded that lack of evidence regarding “the reliability of the technique” rendered the more novel firearms identification presented in that case (which the expert testified was “one hundred percent

¹⁹ See Adina Schwartz, *A Systemic Challenge to the Reliability and Admissibility of Firearms and Toolmark Identification*, 6 Colum. Sci. & Tech. L. Rev. 2, 92-102 (2004-2005).

²⁰ See 4 David L. Faigman et al., *Modern Scientific Evidence, Firearms and Toolmark Identification—Legal Issues* § 34:6 (updated Dec. 2016).

accurate”) inadmissible. *Sexton v. State*, 93 S.W.3d 96, 101 (Tex. Crim. App. 2002).

Other courts have similarly limited the degree of certainty that experts are permitted to express to “more likely than not” or a “reasonable certainty.” *United States v. Green*, 405 F. Supp. 2d 104, 108-109 (D. Mass. 2005) (not permitting examiner to testify that there was a match “to the exclusion of every other firearm in the world,” and noting 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. Glynn*, 578 F. Supp. 2d 567, 574-575 (S.D.N.Y. 2008) (permitting the expert to testify only that the bullet was “more likely than not” a match to the firearm in question, “but nothing more”); *United States v. Willock*, 696 F. Supp. 2d 536, 546-547, 549 (D. Md. 2010) (ruling that firearms and toolmarks examiner could testify as to his opinions and conclusions, but “without any characterization as to the degree of certainty with which he holds them”); *see also United States v. Diaz*, 2007 WL 485967, at *14 (N.D. Cal. Feb. 12, 2007); *United States v. Monteiro*, 407 F. Supp. 2d 351, 375 (S.D.N.Y. 2006).

Some courts have gone even further and excluded certain toolmark testimony altogether. The Florida Supreme Court has *twice* returned a case

involving knife toolmark identification to the lower courts due to the lack of reliability of the expert's identification technique. *Ramirez v. State*, 810 So. 2d 836, 841 (Fla. 2001) ("newly formulated" testing procedure that could purportedly "identify the murder weapon to the exclusion of every other knife in the world" lacked general acceptance); *Ramirez v. State*, 542 So. 2d 352, 354-355 (Fla. 1989) (noting that the only evidence received was the expert's "self-serving statement supporting this procedure"). The expert had concluded that an "approximate half inch area contained such similarity . . . to conclude that the mark[s] were made by [one] knife to the exclusion of all others." *Ramirez*, 810 So. 2d at 848. With respect to the expert's technique, the court emphasized that "[t]here is no objective criteria that must be met, . . . and the final deduction is in the eyes of the beholder, i.e., the identification is a match because the witness says it is a match." *Id.* at 847.

The court also emphasized the lack of research in the area: "[T]he only record evidence that even hints at general acceptance of [the examiner's] testing procedure is a single published article describing an experiment wherein German forensic scientist Wolfgang Bonte examined the wounds left in cartilage by twelve different types of serrated-blade knives." *Id.* at 849. The focus of that article, however, was on the nature of the wound and the size and shape of the blade, not the "[m]icroscopic imperfections in knife blades" to which the expert testified. *Id.*

The court summarized that this was precisely “the kind of novel ‘scientific’ evidence that *Frye* was intended to banish—i.e., a subjective, untested, unverifiable identification procedure that purports to be infallible.” *Id.* at 853.

In another case, a court found expert testimony inadmissible to identify a knife used to vandalize a car’s tires. *Smallwood*, 2010 WL 4168823, at *9-12. The expert would have testified “to a reasonable degree of scientific certainty” that it was the same knife, but the court rejected such testimony, noting that, “[r]ather than comparing tool mark identifications to the highly developed firearm identifications,” a “more relevant comparison is to the similarly controversial polygraph test.” *Id.* at *12.

This Court’s 1996 decision in *People v. Genrich*, 928 P.2d 799 (Colo. Ct. App. 1996), did not address the lack of a statistical foundation for the toolmark evidence presented against Genrich, nor the conclusions reached “to the exclusion of all others.” The Court held that no evidentiary hearing was needed given a lack of evidence challenging the expert’s premise that no two tools make exactly the same mark.²¹ *Id.* at 801-802. But *Amici* respectfully contend that such evidence should be developed in precisely such a hearing. Indeed, under current legal

²¹ The Court also determined that Genrich’s concerns regarding the toolmark evidence “address the weight to be accorded the expert’s opinion” rather than its admissibility. *Genrich*, 928 P.2d at 802.

authority, a court must now scrutinize such evidence far more carefully. *See People v. Shreck*, 22 P.3d 68 (Colo. 2001); *see also Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993). And, as discussed above, recent rulings concerning firearms testimony have noted that, without known proficiency, more cautious conclusions must be demanded than those drawn in this case.

II. THE TOOLMARK TESTIMONY PRESENTED AGAINST GENRICH WAS SEVERELY FLAWED

The scientific research described above—or lack thereof—demonstrates that toolmark evidence is generally flawed. The toolmark evidence presented in Genrich’s case is no exception. The discussion below characterizes the flaws and problems that permeated the evidence presented against Genrich.

1. *Recognizing a Toolmark.* While it may be commonsense that if wires were cut, they must have been cut by a tool suited for that purpose, there are no objective criteria for determining whether marks from an object were in fact caused by a tool. And there are certainly no objective criteria for determining whether marks on an object were caused by one type of tool—and distinguishing among the various individual representative tools within that one type—versus another.
2. *Qualities of Tools and Marks.* There is wide variability in the marks made by a single tool depending on the angle with which it is held and the pressure with which it is applied. While it may, in some instances, be straightforward to exclude a large knife as having been incapable of making a small, precise cut, distinguishing between tools of the same basic type, much less manufacture, lacks any objective criteria or method.

Moreover, the discipline recognizes that there is wide variability in the marks made by a single tool. Tools leave marks that vary widely depending

upon the myriad ways in which they can be manipulated (which would include pressure, angle, twisting, pulling, and multiple application). The challenge for the toolmark examiner is the task of determining the exact tool that produced the mark under the unknown conditions of its creation.

3. *Methods for Comparison.* There are no recognized criteria for determining what types of marks, or sub-class characteristics within marks are most diagnostic for making a conclusion that marks came from a tool.
4. *What is an Inclusion?* There are no criteria in the field for deciding how probative an inclusion or a “match” is. Could an examiner find a “similarity,” or a “match,” or would an examiner need more information to exclude every other tool in the world? What criteria would allow an examiner to reach that conclusion, and with what certainty? There are none.
5. *Observer Effects.* The limited information relied upon and the ambiguity of toolmarks makes the process vulnerable to well-established “observer” (or “context”) effects. Subconsciously, examiners will tend to resolve ambiguities by confirming what they are expecting or hoping to see. Toolmark examiners have not adopted procedures for protecting their work from errors resulting from such cognitive distortions, such as blinded identifications or analysis in which they are not provided with contextual information about a case that is not necessary to conduct a comparison.²²
6. *Reliability and Validity.* What are the error rates when examiners reach conclusions regarding toolmarks? How often do different examiners reach the same results? What is the proficiency of a given examiner? How do toolmark examiners generally fare on tests? We do not know. As the PCAST Report noted, this is a central scientific problem of validity and reliability.

In the Genrich case, the examiner reported no information about error rates to the jurors. They were therefore left with the impression that it was a

²² The only precaution adopted in this case was to perform a verification, in which the two verifying examiners were unable to confirm O’Neil’s test results or conclusions with respect to some of the marks. PR. Tr. (Apr. 22, 1993), pp. 2869-2877.

foolproof technique. But the PCAST Report highlighted the importance of an expert clearly reporting scientifically sound error rates to the factfinders.²³ There must also be rigorous proficiency testing of examiners.

A particular type of proficiency test is conducted regularly by the leading commercial provider, Collaborative Testing Services Inc. (“CTS”) on toolmark comparisons. However, by the company’s own admission, these tests are *not* designed to measure error rates,²⁴ and the results cannot be used to provide assurance that toolmark examiners’ conclusions are accurate. For example, the samples that are used in existing commercial proficiency tests are, by design, not as challenging as difficult samples that commonly appear in casework.²⁵ Nor are the test participants blind to the fact that they are being tested, as they would be if estimating casework error rates.²⁶

7. *Ultimate Conclusion Testimony.* O’Neil’s assertion that Genrich’s tools were used to make the marks “to the exclusion of any other tool” is a conclusion unsupported by any scientific research. And, as the PCAST Report noted: “courts should never permit scientifically indefensible claims such as: ‘zero,’ ‘vanishingly small,’ ‘essentially zero,’ ‘negligible,’

²³ PCAST Report at 12.

²⁴ Collaborative Testing Servs. Inc., CTS Statement on the Use of Proficiency Testing Data for Error Rate Determinations 2-3 (Mar. 2010), *available at* <http://www.ctsforensics.com/assets/news/ctserrorratestatement.pdf>.

²⁵ The National Forensic Science Commission has noted that the President of CTS “told the Commission . . . that he has been under commercial pressure to make proficiency tests easier.” Nat’l Comm’n on Foren. Sci., *Views of the Commission: Optimizing Human Performance in Crime Laboratories Through Testing and Feedback* 4 n.10 (May 2016), *available at* <https://www.justice.gov/ncfs/file/864776/download>.

²⁶ See Jonathan J. Koehler, *Forensics or Fauxrensic: Ascertaining Accuracy in the Forensic Sciences* (Aug. 2016), *available at* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2773255 p. 26-32 (providing extensive discussion of the difference between the “Type I” proficiency tests currently conducted by CTS and the “Type II” proficiency tests that measure error rates, but that are currently not being conducted in toolmark analysis).

‘minimal,’ or ‘microscopic’ error rates; ‘100 percent certainty’ or proof ‘to a reasonable degree of scientific certainty;’ identification ‘to the exclusion of all other sources;’ or a chance of error so remote as to be a ‘practical impossibility.’”²⁷ The National Commission on Forensic Science has similarly recommended that no examiner use “reasonable scientific certainty” conclusions.²⁸ Such overstated forensic conclusions are a high-profile and recurring problem in known wrongful convictions, as shown by studies of forensic testimony in cases of persons exonerated by DNA.²⁹

8. *Lack of Probabilities.* No probability or even a possibility that another tool could have made the marks was presented to the jurors in Genrich’s case. Indeed, O’Neil acknowledged that there was no database to supply information about the probability of a coincidental match. PR. Tr. (Apr. 21, 1993), p. 2751. More broadly, no research of any kind was presented to support the validity of the type of comparisons made in the case. No such research has, to date, been conducted.

For all of these reasons, the toolmark evidence offered against Genrich was, in the words of the PCAST Report, “scientifically indefensible.”

²⁷ PCAST Report at 19.

²⁸ Nat’l Comm’n on Foren. Sci., *Testimony Using the Term ‘Reasonable Scientific Certainty’* 5 (Apr. 2013), available at <https://www.justice.gov/ncfs/file/795336/download>.

²⁹ See Brandon L. Garrett, *Convicting the Innocent Redux* (Aug. 2015), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2638472 (updating earlier research); Brandon L. Garrett, *Convicting the Innocent: Where Criminal Prosecutions Go Wrong* ch. 4 (2011); see also Jonathan J. Koehler & John B. Meixner Jr., *An Empirical Research Agenda for the Forensic Sciences*, 106 J. Crim. L. & Criminology 1, 31 (2016) (given advancements in the understanding of flawed forensics, “[t]estimony about having individualized a marking to its one and only source in the world to the exclusion of all others” ought to “disappear” in time).

CONCLUSION

The underlying evidence presented in this case was unscientific and unsupportable. Simply stated, the prosecution did not lay a foundation adequate to establish that, by using the unscientific methodology he purported to rely upon, O'Neil could accurately draw the inference to which he testified. There is nothing empirically testable about the conclusions reached in the case. Thus, *Amici* respectfully request that the trial court be ordered to hold an evidentiary hearing to develop the myriad scientific flaws in the toolmark evidence.

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February 9, 2017

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CERTIFICATE OF SERVICE

I certify that, on February 9, 2017, a copy of this Brief for *Amici Curiae* was electronically served through Colorado Courts E-Filing on Beth L. Krulewitch, attorney for James Genrich, and L. Andrew Cooper of the Attorney General's office through the AG Criminal Appeals account.

/s/ Adam Mueller