Footwear or shoeprint examiners seek to determine whether a footprint impression recovered from the scene of the crime matches a suspect’s shoe. They do this by examining class characteristics – characteristics that result from the manufacturing process like design or physical size – and Randomly Acquired Characteristics (RACs) -- those that occur through wear and tear on the shoe. RACs can include a cut, gouge, crack, or a piece of gum attached to the shoe. Examiners believe that RACs are highly discriminating, while class characteristics are not.

Shoeprint examiners do not know whether RACs are unique to each shoe. No studies show frequently RACs arise, nor do they show that RACs are independent from one another. Examiners do not know how many RACs must be observed both on the footwear impression and the known shoe to declare a match. And critically, while examiners have conducted few studies evaluating assumptions made by examiners, the few studies that exist suggest different examiners often reach inconsistent conclusions when evaluating the same samples.

Two recent reports make clear that shoeprint analysis is not scientifically valid, and that its admission during criminal trials creates an impermissible risk of a wrongful conviction. The first, a 2009 report by the research arm of the National Academy of Sciences,[1](#_bookmark0) concluded that there is “no consensus regarding the number of individual characteristics needed to make a positive identification, and the committee is not aware of any data about the variability of class or individual characteristics or about the validity or reliability of the method.” NAS at 149. Without such

1 The National Research Council (NRC) is a component of the National Academy of Sciences, which was created by congressional charter in 1863 to “investigate, examine, experiment, and report upon any subject of science.” Act to Incorporate the National Academy of Sciences, sec. 3,

12 Stat. 806 (1863), <http://www.nasonline.org/about-nas/leadership/governing-documents/act-> of=incorporation.html. The NRC was established in 1916 “to associate the broad community of science and technology with the Academy’s purposes of furthering knowledge and advising the federal government.” National Research Council, Committee to Assess the Feasibility, Accuracy, and Technical Capability of a National Ballistics Database, Ballistic Imaging iii (2008).

studies, the report concluded, “it is impossible to assess the number of characteristics that must match in order to have any particular degree of confidence about the source of the impression.” [*Id*. at 149.]

The second, issued by the President’s Council of Advisors on Science and Technology (PCAST), went further, calling claims of identification based on footwear analysis “breathtaking” and “lack[ing] [in] scientific foundation.” President’s Council of Advisors on Science and Technology, *Forensic Science in Criminal Courts: Ensuring Validity of Feature-Comparison Methods,* p. 116 (Sept. 20, 2016) [hereafter PCAST Report]. Conclusions of identification “are unsupported by any meaningful evidence or estimates of their accuracy and are thus not scientifically valid.” *Id*. at 117. The report also found no evidence showing that, even assuming uniqueness, examiners could reach accurate conclusions with any consistency. *Id*

Because the hallmark of legal admissibility is scientific validity and reliability, courts must exclude footwear testimony until examiners produce appropriate independent empirical evidence

1. that shoeprints have unique characteristics, (2) that shoes consistently imprint those characteristics, and (3) that examiners can identify and evaluate those marks using a reliable and repeatable method, with a known and acceptable error rate.

Failure to exclude this testimony will result in grave harm to Mr. XXXXX’s trial, and this Court must ask at a gatekeeper and prohibit the government from introducing it. The significance of expert testimony at trial cannot be overstated. Scientific expert testimony carries with it the “aura of special reliability and trustworthiness,” creating a grave risk that jurors will receive it without a critical eye. *United States v. Dowling*, 753 F.2d 1224, 1236 (3d Cir. 1985); *see also United States v. Haines*, 803 F.3d 713, 730 (5th Cir. 2015) (recognizing the significance of expert testimony to juries); *People v. Kelly*, 17 Cal.3d 24, 31 (1976) (“Lay jurors tend to give considerable

weight to scientific evidence when presented by experts with impressive credentials.”). Perhaps because juries view forensic testimony with unflinching trust, the use of unreliable forensic science is one of the leading causes of wrongful convictions. Brandon L. Garrett, *Judging Innocence*, 108 Colum. L. Rev. 55, 83-84 (2008).

For Daubert Jurisdictions: Further, as the arbiters of evidentiary admissibility, *Daubert v. Merrell Dow Pharmaceuticals*, *Inc*., 509 U.S. 579, 588-89 (1993); *Nations v. State*, 944 S.W.2d 795, 797 (Tex. Ct. App. 1997), trial judges must exercise caution and only admit scientific evidence if the proponent of the testimony shows it is both reliable and relevant to a contested issue. *Daubert*, 509 U.S. at 589; *Kelly v. State*, 824 S.W.2d. 568, 572 (Tex. Crim. App. 1992). “Unreliable . . . scientific evidence simply will not assist the [jury] to understand the evidence or accurately determine a fact in issue; such evidence obfuscates rather than leads to an ‘intelligent evaluation of the facts.’” *Kelly*, 824 S.W.2d at 572 (quoting Kenneth R. Kreiling, *Scientific Evidence: Toward Providing the Lay Trier with the Comprehensible and Reliable Evidence Necessary to Meet the Goals of the Rules of Evidence*, 32 Ariz. L. Rev. 915, 941-42 (1990)). Because there is no empirical evidence that footwear comparison evidence is reliable, this Court should exclude it until the field conducts “multiple independent black box studies” establishing that the method can produce the right answer with an acceptable frequency. PCAST Report at 106.

For California and Other *Frye* Jurisdictions: The *Kelly-Frye* rule governing admissibility is conservative in nature, designed to account for advances in science that cast doubt on the validity of a scientific technique. Judges must apply particular scrutiny when the “identification technique is offered to identify the perpetrator of the crime,” as in the case of firearms identification evidence. *People v. Kelly*, 17 Cal.3d at 32. “When identification is chiefly founded upon an opinion, which

is derived from utilization of an unproven process or technique, the court must be particularly careful to scrutinize the general acceptance of the technique.” *Id*. Footwear evidence is, at this juncture, not generally accepted among experts because there is a dearth of scientific evidence demonstrating its reliability or scientific validity. This Court should exclude it until the field conducts “sufficient foundational research to satisfy the scientific community that the method can produce the right answer with an acceptable frequency” establishing, to the satisfaction of the scientific community, foundational validity and that the method can produce the right answer with an acceptable frequency. PCAST Report at 106.

If this Court will not grant this motion on the papers, the defense requests the Court hold a

*Daubert* [*Kelly-Frye*] hearing where the government must prove, by clear and convincing evidence

(preponderance of the evidence), that the proffered testimony meets the requirements of Texas

Rule of Evidence 702. *Kelly v. State*, 824 S.W.2d 568, 573 (Tex. Crim. App. 1992). Failure to do so will violate Mr. XXXX’s evidentiary rights, his constitutional right to due process of law, and,

in this most serious death penalty case, his Eighth Amendment Right against cruel and unusual

punishment.

**ARGUMENT**

* 1. FOOTWEAR ANALYSIS

“The scientific basis for the evaluation of impression evidence is that mass-produced items (e.g., shoes, tires) pick up features of wear that, over time, individualize them.” [NAS at 149]. Shoeprint examiners believe that by evaluating two types of markings – class characteristics and Randomly Acquired Characteristics (RACs), they can tell, with scientific certainty, that a known shoe is the source of a print left at a crime scene.

Shoeprint examiners first evaluate “class characteristics” – markings left on certain shoe types during the mechanical manufacturing process. They are, in other words, “an intentional or unavoidable characteristic that repeats during the manufacturing process and is shared by one or more other shoes.” W.J. Bodziak, *Footwear Impression Evidence–Detection, Recovery, and Examination,* CRC Press, 2nd ed., p. 329 (1999). They include physical size, design – Nike Jordans or Chuck Taylors, for example, and mold characteristics. *See* Michael B. Smith, The Forensic Analysis of Footwear Impression Evidence (2009) (available at https://archives.fbi.gov/archives/about-us/lab/forensic-science- communications/fsc/july2009/review/2009\_07\_review02.htm) last visited on June 1, 2017 [hereinafter FBI Forensic Analysis]. Examiners believe that while class characteristics are sufficient to eliminate shoes as the source of an impression, hey are insufficient to make an identification. FBI Forensic Analysis.

If the known shoes shares class characteristics with footwear impression, an examiner then evaluates “Randomly Acquired Characteristics” or RACs – individual characteristics on the shoe acquired through daily wear and tear, or by “random, uncontrolled processes.” NAS at 147. They are, in other words, “characteristics that result when something is randomly added to or taken away from a shoe outsole that either causes or contributes to making that shoe outsole unique.” Bodziak at 335. These might include nics, cuts, holes, gouges, or items that occur as a result “from adherent substances, such as rocks, chewing gum, papers, or twigs.” [NAS at 147]. “Although unpredictable in their occurrence,” shoeprint examiners assume that “the size, shape, and position of these characteristics have a low probability of recurrence in the same manner on a different shoe.” FBI Forensic Analysis.

Shoeprint examiners make an identification, or exclude a shoe as the source of the print, based on the number of similar characteristics identified. There are no set number of matching characteristics required for an examiner to make an identification. Incredibly, according to one textbook, “even one identifying characteristic is extremely powerful evidence to support a conclusion.” FBI Forensic Analysis; *see also* Bodziak *supra* (“Positive identifications may be made with as few as one random identifying characteristic, but only if that characteristic is confirmable; has sufficient definition, clarity, and features; is in the same location and orientation on the shoe outsole; and in the opinion of an experienced examiner, would not occur again on another shoe.”).

In making identifications, shoeprint examiners do not rely on data documenting the rarity of class characteristics and RACs. Rather, they make identifications based on training and experience, “recollections and guesses about the frequency of features.” PCAST at 116; FBI Forensic Analysis.

# IN THIS CASE, THE GOVERNMENT’S FOOTWEAR EXAMINER SEEKS TO TESTIFY THAT

* 1. **EXAMINER TESTIMONY ON SHOEPRINT ANALYSIS IS INADMISSIBLE UNDER THE *DAUBERT-KELLY* TEST AND TEXAS RULE OF CRIMINAL EVIDENCE 702 [Relevant case law]BECAUSE IT LACKS SCIENTIFIC VALIDITY.**
     1. THE *DAUBERT-KELLY* STANDARD.[2](#_bookmark1) (insert relevant state or federal standard)

In Texas, expert testimony on scientific evidence is admissible only if it will “assist the trier of fact to understand the evidence or to determine a fact in issue,” and if the witness is

2 Insert relevant state/federal case law here

“qualified as an expert by knowledge, skill, experience, training, or education.” Tex. R. Crim. Evid. 702. To determine whether expert testimony will assist the trier of fact, the trial judge must evaluate whether the proffered testimony is reliable. “Unreliable . . . scientific evidence simply will not assist the jury to understand the evidence or accurately determine a fact in issue; such evidence obfuscates rather than leads to an intelligent evaluation of the facts.” *Kelly v. State*, 824 S.W.2d 568, 572 (Tex. Cr. App. 1992) (citing K. Kreiling, *Scientific Evidence: Toward Providing the Lay Trier With the Comprehensible and Reliable Evidence Necessary to Meet the Goals of the Rules of Evidence*, 32 Ariz. L. Rev. 915, 941-42 (1990)). Even if the evidence is reliable, trial judges may exclude expert testimony if it is cumulative, would mislead or confuse the jury, or would consume an inordinate amount of time. The judge, in other words, must determine whether the probative value of the testimony is outweighed by one or more of the factors identified in Rule

403. *Kelly*, 824 S.W.2d at 572.

To demonstrate that evidence is reliable, the proponent of the evidence must show, by “clear and convincing evidence,” that it satisfies three criteria:

* + - 1. The underlying scientific theory must be valid;
      2. The technique applying the theory must be valid;
      3. The technique must have been properly applied on the occasion in question.

Tex. R. Crim. Evid. 705; *Kelly*, 824 S.W.2d at 573. Factors affecting reliability include, but are not limited to: (1) “The extent to which the underlying scientific theory and technique are accepted as valid by the relevant scientific community, if such a community can be ascertained; (2) whether it has been subjected to peer review; (3) the known or potential error rate in the field; (4) the qualifications of the expert testifying; and (5) the availability of other experts to evaluate the technique; and (6) the clarity with which the underlying theory can be explained to the court.”

These factors largely mirror those articulated by the Supreme Court when interpreting Federal Rule of Evidence 702 in *Daubert v. Merrell Dow Pharmaceuticals, Inc*., 509 U.S. 579, 593-95, (1993); *Hartman v. State*, 946 S.W.2d 60, 62-63 (Tex. Crim. App. 1997) (en banc).

The *Kelly-Daubert* test applies not just to novel scientific evidence or to unconventional techniques, but to all scientific or technical methods. *Hartman*, 946 S.W.2d at 62. As the Texas Court of Criminal Appeals noted, citing the Supreme Court, “under the Rules, the trial judge must ensure that *any and all scientific testimony* or evidence admitted is not only relevant, but reliable.” *Id*. at 63 (emphasis in original) (citing *Daubert*, 509 U.S. at 589). There is no value in having a “different standard of admissibility for novel scientific evidence.” *Hartman*, 946 S.W. 2d at 63.

A. *Kelly-Frye* Rule Admissibility

The standard for the admissibility of scientific evidence in California is commonly referred to as the “*Kelly-Frye* rule.[3](#_bookmark2) Under *Kelly-Frye*, evidence is admissible only after it has been established that the reliability of a method has gained general acceptance in the relevant scientific community; the witness testifying about the technique and its application is a properly qualified expert on the subject; and the person performing the test in the particular case used correct and accepted scientific procedures. *People v. Kelly,* 17 Cal.3d 24, 30 (1976).

Critically, longstanding acceptance by the courts does not establish “general acceptance.” “The *Frye* test emphasizes “’counting scientists’ votes, rather than on verifying the soundness of a scientific conclusion.’” *People v. Wesley*, 611 N.Y.S.2d 97, 99 (1994) (*quoting Jones v. United States*, 548 A.2d 35, 42 (D.C.Ct.App. 1988)). In other words, the Court must rely on the relevant scientific community and its assessment of the reliability of the technique rather than to verify the scientific reliability of the technique itself. Nor does longstanding acceptance preclude a court

3 *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

from reassessing whether new information calls into question the reliability of a technique that courts have previously found generally accepted. Indeed, the *Kelly* rule was designed specifically to accommodate changes in scientific understanding and development. Precedent governs admissibility only until new evidence is presented reflecting a change in the attitude of the scientific community. *Id.* at 32. “To hold that a scientific technique could become immune from *Kelly* scrutiny merely by reason of long-standing and persistent use by law enforcement outside the laboratory or the courtroom, seems unjustified.” *People v. Leahy* 8 Cal.4th 587, 606 (1994). “Novelty” is in no way required for the admissibility of a scientific technique to be challenged.

Courts should construe the relevant scientific community broadly and include all scientists who have the background and knowledge to opine on the acceptance of a particular technique. Numerous cases recognize that the scientific community upon whose acceptance admissibility relies cannot be made up solely of those forensic scientists who practice the discipline. In a case involving the admissibility of a field sobriety test, for example, the California Supreme Court stated that “(c)onsistent with both the weight of authority and the cautious, ‘conservative’ nature of *Kelly*, we conclude that testimony by police officers regarding the mere administration of the test is insufficient to meet the general acceptance standard required by *Kelly*.” *People v. Leahy* 8 Cal.4th 587, 609 (1994). It has also recognized that witnesses, such as a law enforcement officer without sufficient academic training and with a vested interest in the admissibility of the discipline, cannot supply evidence of general acceptance. *Kelly,* 17 Cal.3d at 38-39.)

* + 1. TWO REPORTS BY COMMITTEES OF EXPERTS FROM THE SCIENTIFIC COMMUNITY CONCLUDE THAT FOOTWEAR IDENTIFICATION IS NOT SCIENTIFICALLY VALID.

In the past eight years, two reports issued by separate committees of nationally recognized experts have concluded that shoeprint comparison evidence lacks scientific validity. Their

conclusions were both uniform and devastating. Claims of identification “based on footwear analysis are breathtaking – but lack scientific foundation.” PCAST at 115. The “entire process – from choice of features to include (and ignore) and the determination of rarity – relies entirely on an examiner’s subjective judgment,” and the lack of studies make it “impossible to assess the number of characteristics that must match in order to have any particular degree of confidence about the source of the impression.” PCAST at 116; NAS at 149.

1. The Conclusions Offered in These Reports are the Views of the Relevant Scientific Community.

Each committee either included or consulted with independent scientists, statisticians, medical examiners, judges, forensic practitioners, lawyers, and professors with expertise in scientific issues. Each committee also heard testimony from forensic scientists, reviewed nearly every available journal article and study involving firearms examination, and read every article or study submitted by the forensic community. *Addendum to the PCAST Report on Forensic Science in the Criminal Courts* pp. 2-3 (Jan. 6 2017) [hereinafter PCAST Addendum].[4](#_bookmark3) The committees were chosen for their “special competence and with regard for appropriate balance.” NRC Forensics Report, at ii, 2. Each committee had members with expertise in core sciences – physics, chemistry, biology, materials science, engineering, biostatistics, statistics, and medicine. *See* NRC Forensics Report, at ii, 2; *see also* PCAST Report, at v-vii. With trained scientists on each committee, they were uniquely qualified to both define the steps necessary to move a hypothesis or observation into a valid, reliable scientific principle or methodology; and to determine whether

4 Available at

[https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast\_forensics](https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensics_addendum_finalv2.pdf)

[\_addendum\_finalv2.pdf](https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensics_addendum_finalv2.pdf)

each forensic discipline reviewed performed these steps. Courts have treated the reports of the NRC as authoritative works for purposes of evaluating the validity of a scientific field.[5](#_bookmark4)

Critically, the committees authoring the reports included scientists versed in scientific methodology, rather than simply firearms examiners. These multidisciplinary groups of nationally renowned scientists and professionals are the relevant community to determine whether a technique or method discipline has developed the requisite research and data to demonstrate scientific validity and reliability. Professionals from relevant and foundational disciplines are critical to an appropriate, scientific evaluation, but they also ensure an unbiased review of the field’s validity. A firearms examiner has a strong incentive to declare his or her work reliable and valid. “It is simply not credible,” therefore, “to argue . . . that . . . acceptance may be premised simply on the opinion of forensic scientists.” *United States v. Porter*, 618 A.2d 629, 634 (D.C. 1992) (citing *Reed v. State*, 391 A.2d 364 368 (Md. 1978)). “To allow . . . acceptance to be established on the testimony alone of witnesses whose livelihood is intimately connected with a new technique would eliminate the safeguard of scientific community approval” implicit in the *Daubert* factors. *People v. Young*, 391 N.W.2d 270, 276 n.24 (Mich. 1986). “Scientific community approval is absent where those who have developed and whose reputation and livelihood depends on use of the new technique alone certify, in effect self-certify, the validity of

the technique.” *Id*. [As described above, the witness furnishing testimony in support of general

acceptance may not have a significant financial or professional interest in promoting the new

technique and must have training in the relevant subject matter. Furthermore, Courts are to take

5 *See, e.g., United States v. Porter*, 618 A.2d 629, 642 n.24, 643 n.26 (D.C. 1992); *Commonwealth*

*v. Gaynor*, 820 N.E.2d 233, 250 (Mass. 2005); *Hayes v. State*, 660 So.2d 257, 264 (Fla. 1995);

*Commonwealth v. Blasioli*, 713 A.2d 1117, 1120 n.3 (Pa. 1998); *State v. Tester*, 968 A.2d 895,

906 (Vt. 2009).

into consideration relevant scientific literature in ascertaining the views of the scientific

To evaluate the reliability of shoemark identification, this Court must consider the opinions of the broader scientific community, which are collected and reflected in the two reports discussed below.

community. *People v. Barney* 8 Cal.App.4th 798, 812 (1992).]

1. The 2009 National Academy of Sciences Report (NRC Forensics Report)

In 2009, the National Academy of Sciences issued a scathing report on pattern-matching sciences, and the authors did not spare footwear examination from their strongly worded critique. *See* NRC Forensics Report. As recommended by Congress, a committee including “members of the forensic science community, members of the legal community, and a diverse group of scientists”—“chosen for their special competence and with regard for appropriate balance”— authored the report. NRC Forensics Report, at ii, 2.[6](#_bookmark5) The committee’s findings, including those specific to shoemark identification, were informed by its extensive review of scientific literature. The committee also consulted with numerous other scientists, meeting agenda, *available at* [http://sites.nationalacademies.org/PGA/stl/forensic\_science/.](http://sites.nationalacademies.org/PGA/stl/forensic_science/.7)[7](#_bookmark6) Following their literature review, the committee concluded that insufficient evidence existed demonstrating that footwear examiners can validly and reliably conclude that an impression recovered from a crime scene matches a known shoe. *See id.* at 7 145-150.

6 *See also* Hon. Harry T. Edwards, *The National Academy of Science Report on Forensic Sciences: What It Means for the Bench and Bar* (May 6, 2010) [hereinafter Edwards Forensics] (“Seven of the 17 Committee members are prominent professionals in the forensic community, with extensive expertise in forensic analysis and practice; 11 members of the Committee are trained scientists (with expertise in physics, chemistry, biology, biostatistics, statistics, and medicine); 10 members of the Commission have PhDs, 2 have MDs, 5 have JDs, and one has an

M.S. in chemistry.”).

7 *See also* Edwards Forensics at 2 (“[W]e also carefully considered any peer-reviewed, scientific research purporting to support the validity and reliability of existing forensic disciplines.

Additionally, we invited experts in each discipline to refer us to any pertinent research.”)

The NRC Forensics Report explains that, for a forensic discipline to qualify as a generally accepted science, it must meet two basic requirements: (1) its underlying theory and methodology must be tested and validated through repeated, controlled studies measuring error rates and associated confidence intervals; and (2) it must employ specific protocols for the interpretation of the evidence to minimize human error and bias. *Id*. at 112-24. “[T]he law’s admission of and reliance upon forensic evidence in criminal trials,” depends on “the extent to which a forensic science discipline is founded on a reliable scientific methodology, leading to accurate analyses of evidence and proper reports of findings, and the extent to which practitioners in those forensic science disciplines that rely on human interpretation adopt procedures and performance standards that guard against bias and error.” *Id*. at 111.

The NRC Forensic Report found that the footwear field had not testified and validated its methodology and that it did not employ specific and objective protocols. For testing and validation, the report concluded that the field lacked “any data about the variability of class or individual characteristics or about the validity or reliability of the method.” NRC at 149. The committee also stressed that the field lacked a “consensus regarding the number of individual characteristics needed to make a positive identification.” *Id*. “Without such population studies, it is impossible to assess the number of characteristics that must match in order to have any particular degree of confidence about the source of the impression.” *Id*.

The NRC Forensic Report also strongly criticized the field’s use of an entirely subjective methodology and its failure to require procedures minimizing human error and bias. Highlighting the field’s reliance on training and experience, the report stressed that “it is difficult to avoid biases in experience-based judgments, especially in the absence of a feedback mechanism to correct an erroneous judgment.” *Id*. The report also stressed the field’s failure to conduct research into

population frequencies or the assumptions of individuality. “[N]either IAI nor SWGTREAD addresses the issue of what critical research should be done or by whom, critical questions that should be addressed include the persistence of individual characteristics, the rarity of certain characteristic types, and the appropriate statistical standards to apply to the significance of individual characteristics.” *Id*. at 150.

Despite these criticisms, little to no research occurred in the next seven years.

1. The President’s Council of Advisors on Science and Technology, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods*.

In 2016, the President’s Council of Advisors on Science and Technology (PCAST) issued a Report to the President, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods* (Sept. 2016) (“PCAST Report”). The authors were “an advisory group of the Nation’s leading scientists and engineers, appointed by the President to augment the science and technology advice available to him from inside the White House and from cabinet departments and other Federal agencies.” PCAST Report at 3. “PCAST is consulted about, and often makes policy recommendations concerning, the full range of issues where understandings from the domains of science, technology, and innovation bear potentially on the policy choices before the President.” The PCAST group included the President of the Broad Institute of Harvard and MIT, experts in biology, aerospace, natural resources and environment, astrophysical sciences, electrical engineers and computer science, nanotechnology, and a Medical Doctor. PCAST Report

1. vi.

In 2015, President Barack Obama requested the PCAST group to determine whether there were “additional steps on the scientific side,” in addition to those already taken in response to the “highly critical” 2009 NRC Forensics Report, “to help ensure the validity of forensic evidence

used in the Nation’s legal system.” PCAST Report at x. PCAST formed a working group that included several members of the PCAST permanent advisors.[8](#_bookmark7) In contrast to the NRC Forensics Report, which touched on twelve separate disciplines, PCAST examined just six “forensic feature comparison” disciplines: firearms analysis; DNA analysis of single source samples, simple mixture samples, and complex-mixture samples; bitemark analysis; latent fingerprint analysis; footwear analysis; and hair analysis. The committee’s goal was to determine whether those disciplines were scientifically valid and whether they had a methodology that could be reliably applied—the foundational requirements for admissibility. PCAST Report at x.

The group evaluated over 2,000 papers and studies from various sources, including papers submitted in response to PCAST’s request for information from the forensic-science stakeholder community. It consulted with forensic scientists, including those at the Federal Bureau of Investigations and the National Institute of Standards and Technology. *Id*. at 2.

Much like in the NRC Forensics Report, PCAST asked whether each forensic discipline meets two key requirements for scientific validity: “foundational validity” – whether the method can, in principle, be reliably applied; and “validity as applied” – whether the method has been reliably applied in practice. PCAST Report at 56.

8 The Group included Eric S. Lander, the President of the Broad institute of Harvard and MIT, Michael McQuade, the Senior Vice President for Science and Technology at United Technologies Corporation, S. James Gates, Jr., the John S. Toll Professor of Physics and the Director of the Center for String and Particle Theory at the University of Maryland, College Park, William Press, the Raymer Professor in Computer Science and Integrative Biology at the University of Texas, Austin, Susan L. Graham, the Pehong Chen Distinguished Professor Emerita in Electrical Engineering and Computer Science at the University of California, Berkeley, Daniel Schrag, the Sturgis Hooper Professor of Geology and Professor Environmental Science and Engineering at Harvard University, and the Director of the Harvard University Center for Environment, two staff members: Diana E. Pankevich, AAAS Science and Technology Policy Fellow and Kristen Zarrelli, the Advisor on Public Policy & Special Projects at the Broad Institute of Harvard and MIT, and Writer Tania Simoncelli, the Senior Advisor to the Director at the Broad Institute of Harvard and MIT. PCAST Report at vii.

* 1. Foundational validity.

To be “foundationally valid,” a field must utilize a method that has been subject to “*empirical* testing by multiple groups, under conditions appropriate to its intended use.” *Id*. at 5 (emphasis in original). PCAST acknowledged that it is possible for a field to be scientifically valid even if it does not employ an objective method like simple DNA analysis. But the field must still show through studies that the method is “repeatable and reproducible.” *Id*. at 47. A method is “repeatable” if, with a known probability, an examiner can reach the same result when examining samples from the same sources. *Id*. A method is “reproducible” if, with known probability, different examiners can obtain the same result when evaluating the same samples. *Id*. Put differently, a method is foundationally valid if studies show it has a “reproducible and consistent procedure for (a) identifying features within evidence samples; (b) comparing the features in two samples; and (c) determining, based on the similarity between the features in two samples, whether the samples should be declared to be a proposed identification (‘matching rule’).” *Id*. at 48. The studies must also provide “valid estimates of the method’s accuracy,” demonstrating how often an examiner is likely to draw the wrong conclusions even when applying the method correctly.[9](#_bookmark8) *Id*. “Without appropriate estimates of [the method’s] accuracy, an examiner’s statement that two samples are similar – or even indistinguishable – is scientifically meaningless: it has no probative value, and considerable potential for prejudicial impact.” *Id*. at 6; *see also id*. at 48 (“Without an

appropriate estimate of its accuracy, a metrological[10](#_bookmark9) method is useless – because one has no idea

9 This is a determination of the method’s accuracy. It is not an estimation of an individual’s accuracy or error rate. See the discussion on “validity as applied” for a discussion of an individual examiner’s accuracy. For foundational validity the concern is with estimating the method’s error rate empirically by testing many examiners applying the method as specified.

10 Metrology is the science of measurement and its application. PCAST Report at 23. All forensic pattern matching disciplines, include firearms analysis, fall under this umbrella.

how to interpret its results.”).[11](#_bookmark10) In other words, in order to be foundationally valid, the field has to “show its work” through black box studies[12](#_bookmark11) documenting that examiners are able to do what they say they can do, and how often.

* 1. Validity as applied.

The second requirement for scientific acceptance, “validity as applied,” requires that the method or technique be “reliably applied in practice.” *Id*. pp. 4-5. An examiner must be *capable* of reliably applying the method, and he or she must have *actually* reliably applied the method. To ensure that the examiner is capable of applying the technique, the examiner must conduct rigorous proficiency tests that are designed to evaluate how often the examiner reaches the correct answer in circumstances modeling the procedures actually used in case work.[13](#_bookmark12) *Id*. at 56. To show that the examiner has applied the method reliably in each case, the examiner must make available all procedures used, the results obtained, and any laboratory notes taken. *Id*.

* 1. The PCAST Report concludes footwear identification is subjective and lacks both “foundational” and “as applied” validity.

11 For objective methods – such as the interpretation of Single Source DNA evidence – the field can show foundational validity by studying and “measuring the accuracy, reproducibility, and consistency of each of its individual steps” in interpretation. PCAST Report at 5. For subjective feature-comparison methods such as toolmarks or fingerprint analysis, which to-date rely on an examiner’s eyeball comparison of features on known and unknown samples, the method must be evaluated “as if it were a ‘black box’ in the examiner’s head,’” with many studies involving numerous examiners “render[ing] decisions about many independent tests” with corresponding error rates determined. *Id*. “)

12 A black-box study is an empirical study used to estimate a subjective method’s error rate. Black-box studies have significant numbers of examiners analyze samples and render opinions about the origin or similarity of samples. PCAST Report p.48.

13 Proficiency tests are designed to determine the ability on an individual examiner and not to determine the method’s error rate. Proficiency tests cannot be generalized to establish a method’s error rate; that requires black box studies.

Without qualification, PCAST found that the field of footwear identification failed the test of both foundational validity and validity as applied. The report did not evaluate class characteristics, focusing only on the reliability of identifications based on RACs. *Id*. at 115.

Like the NRC, the report emphasized the “absence of empirical studies that measure examiners’ accuracy,” and it highlighted claims of statistical uniqueness unmoored to any actual data or studies. *Id*. at 115. One examiner has claimed that the chance of two shoes sharing one identifying characteristic is 1 in 16,000; the chance of sharing three is 1 in 683 billion. The PCAST authors concluded: such claims were “breathtaking,” and lacked “scientific foundation.” *Id*. at

115. That claim is based on “unsupported assumptions (about the frequency and statistical independence of marks) that it does not test in any way.” *Id*.

The PCAST authors also lambasted the absence of studies proving that examiners can do what they say they can do – identify the source of a foot impression with consistency and accuracy. Because the “entire process – from choice of features to include (and ignore) and the determination of rarity – relies entirely on an examiner’s subjective judgment,” *id*. at 116, the field needed to conduct “multiple, appropriate black-box studies” to establish the “scientific validity of the method.” *Id*. The footwear field has none – a fact recognized by the OSAC Footwear and Tire subcommittee, who wrote that there is “no or limited current research being conducted.” *Id*. at 116-17.

PCAST concluded that footwear analysis has “no appropriate empirical studies to support the foundational validity of footwear analysis to associate shoeprints with particular shoes based

on specific identifying marks Such conclusions are unsupported by any meaningful evidence

or estimates of their accuracy and thus are not scientifically valid.” *Id*. at 117.[14](#_bookmark13)

* + 1. THIS COURT SHOULD EXCLUDE FOOTWEAR ANALYSIS AS SCIENTIFICALY INVALID.

As the above reports demonstrate, the field of footwear analysis lacks the scientific validity that is the predicate for evidentiary admissibility. Indeed, the conclusions of these reports are uniform: there is no scientific theory or technique that is generally accepted by the relevant scientific community, there is no evidence that examiners regularly reach accurate conclusions, and the assumptions made by examiners are “breathtaking.” [PCAST at 115]; *See Daubert*, 509

U.S. at 593-95. This Court should take note of what scientists have said and exclude footwear expert testimony.

Both reports found no empirical research proving the “theory of identification” – the OSAC working group acknowledged the “major gap in current knowledge.” PCAST at 117. Instead, this so-called “theory” is nothing more than a series of unproven assumptions embraced by examiners. The field assumes that shoeprints acquire unique characteristics resulting from wear and tear, and that examiners, based solely on experience can identify these marks. There is no standard for how

14 Shortly after the release of PCAST, law enforcement and the forensic science community denounced the report, complaining that the report ignored significant studies demonstrating the validity of the disciplines. The FBI issued the following statement:

The report does not mention numerous published research studies which seem to meet PCSAT’s criteria for appropriately designed studies providing support for foundational validity. The omission discredits the PCAST report as a thorough evaluation of scientific validity.14

In response to these criticisms, PCAST issued a broad request asking forensic scientists to submit any additional studies PCAST failed to consider that provided empirical support for the scientific validity of the feature matching disciplines considered in the report. No such studies were provided – the Department of Justice affirmatively stated it had no such studies to submit. *See* PCAST Addendum pp. 3-4.

many RACs must match, nor is there empirical data supporting any particular threshold number of marks that must align. To the contrary, examiners assume that each characteristic is so unique that an analyst can make an identification based on just one randomly acquired characteristic. And examiners rely on their personal recollection of the amount of agreement observed to reach conclusions; the analysis is wholly subjective.

Assumptions and observations do not constitute a valid scientific theory tested through independent empirical research. To the contrary, a “valid theory” is a “comprehensive explanation of some aspect of nature that is supported by a vast body of evidence.” PCAST Report p. 60 (citing the National Academy of Science); PCAST at 117).[15](#_bookmark14) The field therefore violates prong 1 of

Texas’s admissibility rule – “the underlying scientific theory must be valid.” Texas Rule of Crim.

Evid. 705.

These reports all also uniformly and emphatically conclude that the field of footwear examination has not proved it has a reliable or valid scientific technique for reaching conclusions about individualization, and is therefore not generally accepted in the scientific community. *See Daubert*, 509 U.S. at 593-95 (courts must consider “the extent to which the underlying scientific theory and technique are accepted as valid by the relevant scientific community.”) As both reports recognized, to be an accepted scientific method, the field must conduct empirical testing to prove that examiners can reliably and repeatedly reach accurate conclusions. The footwear field has engaged in no testing to prove examiners can accurately identify the source of a shoeprint: “there are no appropriate empirical studies to support the foundational validity of footwear analysis to associate with particular shoes based on specific identifying marks.” “Such conclusions are

15 Arguments that the theory has *not* been disproven turn science on its head. A validated scientific theory is one that “is *supported* by a vast body of evidence,” rather than an idea that hasn’t been disproven. PCAST Report p. 60 (emphasis added).

unsupported by any meaningful evidence or estimates of their accuracy and thus are not scientifically valid.” *Id*. at 117. The field instead allows each examiner to draw his own subjective conclusions about whether there are sufficiently unique characteristics to declare a match. *Id*. at 115-17; *see also* NRC Forensics at 145-150.

Further, no studies show that examiners are actually accurate in their analysis. To the contrary, the 2009 NRC report pointed to studies showing considerable variation in footwear analysts’ conclusions. NRC Forensics at 148. Seven years later, the PCAST report found that no additional studies provided any evidence of accuracy, which could only be “evaluated . . . from large, appropriately designed black-box studies,” none of which existed. *Id*. at 116. Because no studies exist evaluating accuracy, the field also lacks sufficient peer review. *Daubert*, 509 U.S. at 593-95 (requiring courts to evaluate whether peer-reviewed studies exist demonstrating the field’s validity).

And, because no studies exist evaluating the accuracy of the field, it lacks a known error rate. *Daubert*, 509 U.S. at 593-95 (emphasizing the importance of a known error rate in assessing a field’s reliability). Without a known error rate, “an examiner’s statement that two samples are similar – or even indistinguishable – is scientifically meaningless: it has no probative value, and considerable potential for prejudicial impact.” PCAST at 6.

Until the footwear field shows, through empirical research rather than unsupported assertions, that its underlying theory is true, that Randomly Acquired Characteristics are unique, that an examiner can follow a proven methodology to declare a “match,” and that its examiners produce accurate results when applying that methodology, this Court should exclude footwear evidence from this trial. Two separate reports have alerted the criminal justice system that the field lacks scientific validity. It is time for courts to heed their call. Admission of a field that is

entirely untested is dangerous. The use of such unvalidated testimony not only violates Texas

Rule of Evidence 702 (*Kelly-Frye*) and case law interpreting that rule, but it also calls into question

the “fairness, integrity [and] public reputation of judicial proceedings,” jeopardizing Mr. XXX’s

Due Process and, in this death penalty case, his Eighth Amendment rights. *Puckett v. United States*, 556 U.S. 129, 135 (2009) (quoting *United States v. Olano*, 507 U.S. 725, 736 (1993)). This Court should exclude it.

**IV. IN THE ATLERNATIVE, THIS COURT SHOULD LIMIT THE SCOPE OF THE EXPERT’S TESTIMONY AND EXCLUDE ANY CONCLUSIONS THAT DO NOT REST ON A RELIABLE SCIENTIFIIC FOUDATION. [Sargon in CA. A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered] *[IF YOU HAVE A REPLY BRIEF: CONSIDER HOLDING THIS FOR THE REPLY]***

Should this Court refuse to exclude the examiner’s testimony on footwear evidence, it should nonetheless limit the examiner’s conclusions to describing the similarities he sees between the two sources, without declaring a match. This Court should also insist that experts testify that there is no evidence showing how rare a given characteristic is, and that no studies show how many similarities an expert must see before declaring a match. Failure to limit this testimony will mislead the jury, violating Texas Rule 702, Texas Rule 403, and Mr. XXXX’s Due Process and

Eighth Amendment rights.[16](#_bookmark15)

16 The defense does not concede that limiting the examiner’s testimony in such a way will prevent the expert and therefore the government from misleading the jury. Studies suggest that jurors still believe that there is an unqualified match between two sources, even when experts provide limiting language. *See* Dawn McQuiston-Surrett & Michael Saks, Communicating Opinion Evidence in the Forensic Identification Sciences: Accuracy and Impact, 59 Hastings L.J. 1159, 1188-89 (2008); *see also* Sarah Lucy Cooper, *The Collision of Law and Science: American Court Responses to Developments in Forensic Science*: 33 Pace L. Rev. 234 (2013).

Courts must limit the examiner’s testimony if there is a gap between the conclusions supported by existing data and the examiner’s conclusions. *General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997); *Whirlpool Corp. v. Camacho*, 298 S.W.3d 631, 639 (Tex. 2009); *Sargon*

*Enterprises Inc. v. University of Southern California*, 55 Cal. 47, 7474, 881 (2012). Permitting the examiner to state conclusions beyond those supported by the data blindsides the jury into giving the examiner’s testimony more significance than is due.

To date, no evidence shows the rarity of a given characteristic – examiners just assume that they are unique. Experience and training, however, are no substitute for studies and fact. This Court should therefore preclude the government from introducing testimony suggesting there is any statistical significance tied to similar RACs or class characteristics. There is insufficient empirical evidence suggesting that such RACs are unique or that examiners can declare a match at the exclusion of all other shoes. Instead, this Court should limit the examiner to pointing to the similarities he sees between the footwear impressions, and any differences identified, and it should require that the examiner tell the jury about the absence of studies supporting many of the field’s assumptions.