No. WR-89,339-01
IN THE COURT OF CRIMINAL APPEALS
STATE OF TEXAS

EX PARTE JOE D. BRYAN

CAUSE NO. CR 01319-A
IN THE 220TH DISTRICT COURT, COMANCHE COUNTY

BRIEF OF AMICI CURIAE OF SCHOLARS
In Support of Applicant Joe Bryan

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TO THE HONORABLE JUDGES OF THE COURT OF CRIMINAL

APPEALS AND TO ALL PARTIES AND THEIR ATTORNEYS OF RECORD:

INTERESTS OF *AMICI CURIAE*[1]

This brief is signed by scholars representing a variety of disciplines,

including forensics, fluid dynamics, law, materials science, psychology, and

statistics, as well as by the law students in Duke Law's Amicus Lab, a course in

which students participate in amicus briefing in cases raising law, science, and

technology issues. The signatories have an interest in the quality and improvement

of forensic evidence. Amici believe that forensic analysis and courtroom

testimony should be founded on scientific methods and knowledge. Amici are

interested in improving the administration of justice in general, and in maintaining

the accuracy of evidence in particular. Amici are concerned that unreliable

forensic procedures and evidence can cause wrongful convictions.

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1. Amici are listed in the Appendix to this brief. The views expressed herein reflect those of
Professors Nita Farahany, Brandon L. Garrett, and the other amici, but not those of any academic
or other institution to which they belong, such as Duke University.

SUMMARY OF ARGUMENT

Joe Bryan was convicted of murdering his wife at two trials held in Clifton, Texas in 1986 and 1989. Bryan seeks relief under Texas Art. 11.073, which permits post-conviction relief based on "relevant scientific evidence" that "contradicts scientific evidence relied on by the state at trial." We submit that new scientific evidence—not available at the time of Bryan's trials—indisputably contradicts the evidence relied upon to convict him. At Bryan's trials, Harker Heights police officer Robert Thorman presented blood pattern analysis ("BPA") that he claimed established that a flashlight, later found in Bryan's car, was held by the shooter during a close-range shooting. Significantly, however, Officer Thorman conceded that he had not done, was not qualified to do, and did not ask anyone else to perform, serological testing that could determine whether the material on the flashlight was in fact blood. Officer Thorman instead *assumed* that the spatter was human blood. Together, the BPA presented by Officer Thorman and the unfounded assumption that the spatter on the flashlight was blood, were critical to Officer Thorman's conclusions, all of which were instrumental to Bryan's conviction.

Since the time of Bryan's trials, BPA has been subjected to more rigorous scientific research, substantial scrutiny of methods used in the past, and new

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awareness of the uncertainty inherent in BPA. The methods used and conclusions reached by Officer Thorman at Bryan's trials have been discredited by subsequent scientific consensus. Specifically, Officer Thorman's conclusions (1) that the flashlight had "high velocity" blood upon it, and (2) about the "area of convergence" of the blood spatter at the scene, have since been discredited. For instance, subsequent research has led the field to discard the use of the terms high, medium, or low velocity as wholly unfounded and unreliable indicators. Officer Thorman specifically concluded that this "high velocity" spatter was "blow back blood," yet recent research has shown that a firearm, because it releases muzzle gas, tends to push material away from it and thus blow-back may not occur at all. Furthermore, research has since undermined Officer Thorman's measurement methods regarding the area of convergence and the angles and distances involved at the crime scene and resulting conclusions.

In addition, research now highlights the role cognitive biases play in expert analysis of highly ambiguous evidence, such as BPA, particularly when, as in this case, the analysis is not conducted independent of the police. The National Academy of Sciences ("NAS") has cautioned that such biases can profoundly affect BPA analysis, and studies have shown that it does occur.

Because Officer Thorman reached a series of unsupported conclusions,

using methods which subsequent research has shown were deeply flawed, we

believe that Texas Art. 11.073 provides the necessary vehicle for review. We write

to describe how research on BPA has evolved since Bryan's trials and how this

new research negates the evidence presented at Bryan's trials.

ARGUMENT

I.   THE SCIENTIFIC UNDERSTANDING OF BPA HAS CHANGED OVER THE LAST THIRTY YEARS, RESULTING IN A FUNDAMENTAL CHANGE IN THE ENTIRE FIELD OF ANALYSIS.

A.   There was Insufficient Scientific Research on BPA at the Time of Bryan's Trials to Justify Officer Thorman's Conclusions.

At the time of Bryan's trials in 1986 and 1989, BPA had been utilized for

many decades and practitioners long emphasized the need to carefully measure and

document exact positions of spots or stains.[2] But, very little research had been

done to support the use of BPA. In 1939, Balthazard et al. published a study

relating the angle of impact of a blood drop with the height and width of a

bloodstain.[3] This study first introduced the idea of using string to determine a

blood spatter's point of origin.[4] In 1953, Dr. Paul Kirk observed that increased

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2. Tom Bevel, *Geometric Bloodstain Interpretation*, 52 FBI Law Enforcement Bull. 7 (1983).

3. P.A. Pizzola *et al.*, *Blood Droplet Dynamics--I*, 31 J. of Forensic Sci. 36, 37 (1986).

4. *Id.* at 37.

impact velocity of a drop of blood led to greater distortion of the edge of the corresponding stain.[5] However, Dr. Kirk did not offer ways to quantify this phenomenon.[6] Two years later, *State v. Sheppard*, a case in which Dr. Kirk was retained as a defense expert, marked the legal debut of Dr. Kirk's theories and BPA.[7] After observing the positions of bloodstains in that case, Dr. Kirk alleged he was able to approximate the velocity of the drops, and concluded that the murderer was left-handed (the defendant was actually right-handed).[8] BPA analysts subsequently began to categorize blood spatters as "high velocity" and "low velocity." In 1971, researchers adopted the terms "high velocity" and "low velocity," and added a midrange level of "medium velocity."[9] The researchers did not, however, give objective criteria to support these velocity-related terms.

In 1983, the International Association of Bloodstain Pattern Analysts was formed to bring together professionals in the field. At the time of Bryan's trials (approximately three years later), little research had been done, few standards

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5. *Id*.

6. Paul L. Kirk, *Blood, Physical Investigation,* in Crime Investigation: Physical Evidence and the Police Laboratory 176. (1953)

7. State v. Sheppard, 128 N.E.2d 504, 514 (Ohio App. 1955), app. dismissed, 131 N.E.2d 837 (Ohio 1956); see also Pizzola, supra, at 37.

8. *See* Jurgen Thorwald, Crime and Science 152-53 (1967).

9. H. L. MacDonell & L. F. Bialousz, *Flight Characteristics and Stain Patterns of Human Blood* (1971).

existed for methods or terminology used in BPA, and BPA analysts were aware

that further research was needed.

B. **Research Conducted Since Bryan's Trials Has Established Far Greater Limitations on the Permissible Use of BPA.**

As a consequence of more recent research, BPA analysts now reach far more

limited conclusions than at the time of Bryan's trials. In 2009, the NAS submitted

a report to Congress identifying areas where forensic science could be strengthened

and standardized across the United States in order to better assure the reliability of

forensic disciplines.[10] The NAS stressed that blood pattern interpretation "in many

cases" can be "difficult or impossible," and explained that while only modest

conclusions can be made based on present-day research, "some experts extrapolate

far beyond what can be supported."[11] The NAS further explained, reflecting recent

research on the role of cognitive biases in forensics, how "targeted requests," often

prosecution- or defense-driven, can lead to context bias and affect reconstruction

of the crime.[12] In light of these observations and conclusions, and given the

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10. Nat'l Research Council, Strengthening Forensic Science in the United States: A Path Forward (2009).

11. *Id*. at 177–78.

12. *Id.* at 178.

"enormous" associated uncertainties, the NAS recommended that BPA testimony

be delivered with extra care, given the "enormous" associated uncertainties.[13]

In the past decade, there have been significant developments in BPA

research. Research has questioned fundamental assumptions underlying

longstanding BPA practices, including the reliability of the method of strings used

to reconstruct a spatter's area of origin. Furthermore, researchers have identified

parameters omitted in previous studies, such as significance of blood temperature,

composition, and air movement.[14] We discuss those developments below in the

context of the evidence presented at Bryan's trials.

II.   THE UNFOUNDED BPA CONCLUSIONS REACHED AT BRYAN'S TRIALS ARE UNDERMINED BY CURRENT RESEARCH.

A.   The BPA Expert at Bryan's Trials Lacked Adequate Training or Background.

At the time of Bryan's trials, Officer Thorman was a detective lieutenant

with the Harker Heights Police Department. Although he had been an officer for

thirty-four years, he had only recently begun training as a BPA analyst.[15] During

the trials, Officer Thorman stated that he had studied "bloodstain interpretation[s],

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13. *Id*. at 179.

14. Daniel Attinger et al., *Fluid dynamics Topics in Bloodstain Pattern Analysis: Comparative, Review and Research Opportunities*, 231 Forensic Sci. Int'l. 375, 353 (2013).

15. Trial Tr. vol. 5, 253:21.

geometric bloodstain interpretation, [and] evidence type."[16] However, his formal education in the subject consisted of just one forty-hour training program in June 1985,[17] and the Bryan case was his first assignment as a bloodstain analyst. Despite his lack of experience, at trial, Officer Thorman repeatedly presented his findings as "based on [his] experience, knowledge and education."[18] Officer Thorman clearly had not satisfied the training and education criteria emphasized by the 2009 NAS Report, which includes a scientific education, knowledge of terminology, an understanding of applied mathematics, the physics of fluid transfer, and the pathology of wounds.[19]

B. There Are Serious Concerns About The Integrity Of The Crime Scene.

As discussed in detail in the brief filed by Bryan's counsel, there are serious concerns about crime scene contamination and alteration. At approximately 8:25 a.m. on October 15, 1985, the body of Mickey Bryan was discovered in the home she shared with her husband.[20] But it was not until approximately 7:00 p.m.

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16. Trial Tr. vol. 5, 254:17–18.

17. Trial Tr. vol. 6, 38:17–39:3.

18. Trial Tr. vol. 6, 120:14–15.

19. Nat'l Research Council, Strengthening Forensic Science in the United States: A Path Forward (2009) 177 [NAS Report].

20. Trial Tr. vol. 4, 130:15.

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that Officer Thorman arrived and began conducting his analysis.[21] During this ten-and-a-half-hour period, at least four civilians, at least six law enforcement officers, an entire crime-scene lab team, and an unknown number of employees from the local funeral home entered the Bryan house. Exacerbating the issue, it had rained and, according to Officer Thorman's testimony, officers had tracked water, mud, and even possibly a cigarette butt into the house before Officer Thorman arrived.[22] They had stepped on the bloody carpet in the Bryans' bedroom and had begun removing items from the crime scene.[23] By the time Officer Thorman arrived, officers had removed the Bryans' bedding[24] and employees of a private funeral home had removed Mickey Bryan's body.

C.   There is No Evidence the Flashlight Was Tested for Blood.

All of Officer Thorman's conclusions were predicated on the assumption that the substance shown on photographs of the flashlight—the actual flashlight was never examined[25]—was human blood. Officer Thorman testified to supposedly unique characteristics of human blood, explaining "human blood . . .

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21. Trial Tr. vol. 5, 257:1–2.
22. Trial Tr. vol. 6, 108–09.
23. *Id*.
24. Trial Tr. vol. 5, 257:16–18.
25. Trial Tr. vol. 6, 82:24.

will produce a specific or characteristic type pattern when dropped, thrown, or projected from certain angles."[26]

The flashlight found in the trunk of Bryan's car was the key piece of evidence used to tie Bryan to the murder. Yet, when the actual flashlight was tested for blood in 2012, "the stains on the flashlight were negative for a presumptive test for blood."[27] And, while an analyst at the Texas Department of Public Safety's Laboratory examined the flashlight in 1985-1986, as the Texas Forensic Science Commission Report noted, it is unclear if the flashlight was tested for blood at that time.[28]

D. The Methods Used to Analyze the Blood Pattern Evidence in Bryan's Trials Were Unreliable.

1. Velocity Analysis.

In reaching his conclusions, Officer Thorman relied on a determination that the flashlight had "high velocity" blood on it in order to conclude that the flashlight was held close to both the firearm and the victim. Officer Thorman categorized blood spatter into three separate types: high, medium, and low

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26. Trial Tr. vol. 5, 261:5–7.

27. Tex. Forensic Sci. Comm'n., Report on Investigation of Complaint Filed by Walter M. Reaves, Jr. on Behalf of Joe D. Bryan, Concerning Bloodstain Pattern Analysis, Serology and Trace Evidence at 11 (2018).

28. *Id.*

velocity blood spatter—concepts and terms no longer accepted or used by competent BPA analysts—to reach conclusions not supported by science.

Officer Thorman described high velocity blood spatter as blood spatter "that is made when it travels at a rate of a speed of a hundred feet per second or more,"[29] which occurs as "a result of a gunshot and usually within forty-six inches from the point of impact to the source of energy [because the blood] will evaporate after forty-six inches."[30] Officer Thorman described "medium type velocity" blood spatter as blood spatter that results from blood "travel[ing] between twenty-five feet per second or higher."[31] He described low velocity blood as "secondary projected blood" produced at "five feet per second."[32] Officer Thorman failed to cite any authority—because no authority existed—for those statements.

Applying this velocity analysis to the flashlight found in Bryan's car, Officer Thorman testified that the "atomized" blood on the left side of the flashlight and the rim of the flashlight were "back spatter or . . . blow back blood . . . which returns to the source of energy . . . due to the effect of the explosion of

29. Trial Tr. vol. 5, 259:16–18.
30. Trial Tr. vol. 5, 261:19–22.
31. Trial Tr. vol. 5, 260:1–4.
32. Trial Tr. vol. 5, 260:5–8.

[gun]powder, propelling [] the gas and drawing the blood backwards within forty-six inches."[33] Officer Thorman then referred to the atomized blood as a "secondary drop," a term he previously applied only to medium and low velocity blood.[34] He testified that because the blood drop on the left side of the flashlight was elongated, and "the tail is always in the direction that the blood travels," that particular drop was caused by blood traveling back in the direction of the weapon.[35] Finally, Officer Thorman stated that "atomized" blood on the lens of the flashlight was enough to determine that the flashlight was "right next to [the gun]" when it was being fired at Bryan.[36]

In 2009, the FBI's Scientific Working Group of Bloodstain Pattern Analysis ("SWGSTAIN") published a glossary for the BPA field.[37] The glossary lists thirty-eight terms covering BPA spatter types and significant factors. The velocity classification scheme of low, medium, and high velocity impact spatters, as used

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33. Trial Tr. vol. 5, 264:16–24.

34. Trial Tr. vol. 5, 265:23.

35. Trial Tr. vol. 5, 265:24–266:22.

36. Trial Tr. vol. 5, 267:5–16.

37. SWGSTAIN, Recommended Terminology, at https://archives.fbi.gov/archives/about-us/lab/forensic-science-communications/fsc/april2009/standards/2009_04_standards01.htm#terms.

by Officer Thorman, was abandoned due to observed overlap between categories, rendering such terms unreliable indicators in the context of BPA.[38]

We also know today that a gunshot can create a large range of drop sizes and velocities.[39] Recent research has identified previously unconsidered factors that influence blood spatter patterning: volume of fluid, target material, blood temperature, blood composition, air movement, and the influence of muzzle gases produced by a gunshot,[40] and there is currently no method for reconstructing blood droplet trajectories in moving air. This presents a significant problem of BPA reliability with the muzzle gases produced by a gunshot, as in this case.[41]

2. Area of Convergence Analysis.

Officer Thorman conducted what he referred to as a point of convergence analysis, which was intended to estimate where the flashlight would have been

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38. Daniel Attinger *et al.*, *Fluid Dynamics Topics in Bloodstain Pattern Analysis: Comparative, Review and Research Opportunities*, 231 Forensic Sci. Int'l. 375, 391 (2013); see also Hulse-Smith, Mehdizadeh & Chandra, *Deducing Drop Size and Impact Velocity from Circular Bloodstains*, 50 J. Forensic Sci. 54, 62 (2005) ("[i]t has proved difficult to accurately infer drop velocity by examining bloodstains); W. Ristenpart, F. Tulleners, S. Siu, J. Saifi & F. Springer, Quantitative Analysis of High Velocity Bloodstain Patterns (Apr. 2013).

39. P. M. Comiskey, A. L. Yarin & D. Attinger, *High-Speed Video Analysis of Forward and Backward Spattered Blood Droplets*, 276 Forensic Sci. Int'l. 134 (2017).

40. Laan, Bremmer, Aalders & de Bruin, *Volume Determination of Fresh and Dried Bloodstains by Means of Optical Coherence Tomography*, 59 J. of Forensic Sci. 34 (2014).

41. Attinger at 391.

held in the crime scene room. His analysis was performed by taking a piece of string and "tacking it to the lower tail . . . of the bloodstain to a point on the bed near the pooling that was located on the bedding itself . . . ."[42] He repeated this process five times until he determined what he believed at the time was the point of convergence.[43] Officer Thorman then drew conclusions about the location of the victim at the time of the shooting: she was "sitting up and had her hands on her knees" when shot.[44] But Officer Thorman's analysis was conducted without examining the bloodstained bedding officers had removed, and that led him to admit during direct examination that he "later found out that [his] convergent point would have been further . . . on the right-hand side."[45]

Recent research has highlighted significant limitations of the string method of measurement[46] because, in fact, blood can travel in "bent," "ballistic," or "parabolic" trajectories, yet the method of using strings to reconstruct trajectories assumes that droplets travel in a straight line.[47] Today, BPA experts are aware that

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42. Trial Tr. vol. 5, 274:6–10.

43. Trial Tr. vol. 5, 275:4–5.

44. Trial Tr. vol. 5, 278:1–2.

45. Trial Tr. vol. 5, 278:1–4.

46. Attinger, supra, at 387.

47. *Id*. at 392.

reconstruction methods based on straight lines yield only an approximate area of origin.[48] Experiments regarding the accuracy of the string method show that the string method can greatly overestimate the height of a blood spatter's area of origin, with greater uncertainty as the distances involved increase.[49]

3.   Cognitive Bias Concerns.

The sharing of a theory of the case, or a theory concerning the crime scene, by law enforcement with an expert can unconsciously influence or outright alter an expert's conclusions. Here, Officer Thorman knew that a search warrant had been executed on Bryan's vehicle where the flashlight was found.[50] He also discussed, with two Texas Rangers at the scene, his theories regarding the case.[51] The officers had been present at the scene for many hours, raising physical alteration concerns as well as the risk of bias, as the officers apparently discussed their work with Thorman. Such conversations can introduce cognitive bias. There were no

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48. *Id.* at 385.

49. Table 1 in K. G. de Bruin, R. D. Stoel & J. C. M. Limborgh, *Improving the Point of Origin Determination in Bloodstain Pattern Analysis*, 56 J. of Forensic Sci. 1476 (2011); for the growth of the uncertainty with the distance, see also D. Attinger, P. M. Comiskey, A. L. Yarin & K. D. Brabanter, *Determining the Region of Origin of Blood Spatter Patterns Considering Fluid Dynamics and Statistical Uncertainties*, 298 Forensic Sci. Int'l 323, 330 (2019).

50. Trial Tr. vol. 6, 56:12–16.

51. Trial Tr. vol. 6, 56:23–57:2.

procedures in place, or procedures that Officer Thorman used, to ensure that his

work was not biased by the influence of this contextual information.

Subsequent research has shown cognitive bias can have a profound impact

on BPA interpretation. In 2014, the National Institute of Justice received a study

that found an error rate of 16% for firearms-related blood spatter.[52] Another study,

published in 2016, found that out of 416 scenarios involving different types of

blood patterns (e.g. whether it was from cast off or dripped blood), experts

wrongly identified the type in approximately 13.1% of the cases.[53] The error rate

increased to over 15% for impact- and gunshot-produced spatter. The study found

that analysts who receive misleading contextual information regarding an event are

significantly more likely to interpret spatters incorrectly than peers who receive

neutral or true contextual information.[54] Additionally, analysts are more likely to

provide an accurate assessment when there is a greater amount of staining to

evaluate.[55]

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52. T. Laber, P. Kish, M. Taylor, G. Owens, N. Osborne & J. Curran, Reliability Assessment of Current Methods in Bloodstain Pattern Analysis (June 2014).

53. Michael Taylor *et al.*, *Reliability of Pattern Classification in Bloodstain Pattern Analysis, Part I: Bloodstain Patterns on Rigid Non-absorbent Surfaces*, 64 J. Forensic Sci. 922, 925 (2016).

54. *Id.* at 926.

55. *Id*. at 925.

When the pattern is more limited, like here, analysts tended to seek out contextual clues as an aid.[56] A follow-up study found even higher error rates on fabric surfaces.[57] In general, research suggests the more ambiguous the evidence, the more experts are subject to the influence of outside information, making Officer Thorman's conversations sharing theories with officers at the scene quite troubling.[58] More such research is needed to better estimate error rates of BPA.

III. BASED ON CURRENT BPA RESEARCH, AN EXPERT TODAY WOULD NOT AND COULD NOT REACH THE CONCLUSIONS THAT OFFICER THORMAN REACHED AT BRYAN'S TRIALS.

At a post-conviction hearing on Aug 20, 2018, Officer Thorman revisited his own testimony. He agreed that some of the techniques and methodology he used were incorrect, and "therefore, some of [his] testimony was incorrect."[59] Although we place the most weight on new scientific research, it is noteworthy that he recanted his conclusions and realizes he made errors.

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56. *Id*. at 927.

57. Taylor, Laber, Kish, Owens & Osborne, *The Reliability of Pattern Classification in Bloodstain Pattern Analysis—Part 2: Bloodstain Patterns on Fabric Surfaces,* 61 J. Forensic Sci. 1461 (2016).

58. Saul M. Kassin, Itiel E. Dror & Jeff Kukucka, *The Forensic Confirmation Bias: Problems, Perspectives, and Proposed Solutions*, 2 J. App. Res. Memory & Cogn. 43, 45 (2013) (describing why "ambiguous stimuli prove particularly susceptible to confirmation biases").

59. Writ of Habeas Corpus Hr'g. Tr. vol. 4, 59:3–4.

Furthermore, two BPA experts, Bob Henderson and Celestina Rossi, recently reviewed Officer Thorman's scene reconstruction and trial testimony, and issued reports stating that Officer Thorman's findings were not scientifically supportable at the time of the trial, and are not today.[60]

To summarize the flawed conclusions reached by Officer Thorman at Bryan's trials:

- The flashlight had human blood on it.

- The assailant was holding the flashlight as he shot the decedent.

- The left side of the rim and lens of the flashpoint had back spatter on it.

- The flashlight was held within inches of the firearm.

- The flashlight was held to the left at a downward angle.

- The flashlight (and firearm) were held within forty-six inches of the victim.

- High velocity blood can travel at most forty-six inches.

- The victim was sitting on the bed with her hands on her knees.

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60. Tex. Forensic Sci. Comm'n, Report on Investigation of Complaint Filed by Walter M. Reaves, Jr. on Behalf of Joe D. Bryan, Concerning Bloodstain Pattern, Analysis, Serology and Trace Evidence, 9–10 (2018).

- The fan in the room was turned on three minutes after the shooting.

Today, it would not be appropriate for an analyst to reach *any* of those conclusions and certainly not with the certainty with which Officer Thorman expressed them. At the time of Bryan's trials, Officer Thorman could not opine the flashlight had human blood on it, without subjecting it to serological testing. The remaining conclusions are undermined by subsequent scientific research. Most recently, the Texas Forensic Science Commission concluded, by a unanimous vote, that Officer Thorman's work specifically was "scientifically unsupportable" and "unreliable."[61]

CONCLUSION

Not only was the BPA testimony presented at Bryan's trials unreliable at the time, but the research on BPA has advanced since then in a manner that undercuts each of the methods used and the conclusions reached concerning BPA in the case. We respectfully urge the Court to consider this new scientific understanding concerning BPA, and the limits of its precision and reliability, as it applies to the evidence introduced at Bryan's trials, during its review of this petition under Texas Art. 11.073.

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61. Tex. Forensic Sci. Comm'n Report, supra, at 10.

PRAYER

For these reasons, amici respectfully request that this Court grant Bryan's application for writ of habeas corpus.

RESPECTFULLY SUBMITTED this 31st day of October, 2019,

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CERTIFICATE OF SERVICE

I certify that a copy of this brief was served on all parties by first class U.S.

mail and / or electronic service on this 31st day of October, 2019.

/s/ Russell L. Hirschhorn
Russell L. Hirschhorn

CERTIFICATE OF COMPLIANCE

I hereby certify that this brief complies with the requirements of Tex. R. App. P. 11 and 73.1. It was prepared in a conventional typeface no smaller than 14-point, except for footnotes, and contains 3905 words.

/s/ Russell L. Hirschhorn
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APPENDIX

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