No. COA22-632 TWENTY-SIXTH JUDICIAL DISTRICT

NORTH CAROLINA COURT OF APPEALS

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STATE OF NORTH CAROLINA, Plaintiff-Appellee, v. TAIQUAN RODGERS, Defendant-Appellant.	)	From Mecklenburg County 19 CRS 236872-74

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BRIEF OF AMICI CURIAE[1]

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[1] The full roster of *amici curiae* and a detailed statement of their interests is included in the concurrently filed Motion for Leave to File *Amicus Curiae* Brief. The views expressed herein reflect those of the *amici curiae*, but not those of any academic institution to which they belong, such as Duke University and the University of Colorado Boulder. No person or entity other than *amici curiae*, their members, or their counsel directly or indirectly wrote this brief or contributed money for its preparation.

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SUMMARY OF THE ARGUMENT

As the field of forensic science develops and our justice system becomes more dependent on the proper application of such techniques, courts play an increasingly critical role in ensuring that only expert testimony based on reliable methods is admitted as evidence. Accordingly, courts have an obligation to ensure that unscientific forensic testimony is excluded. Even in the case of forensic techniques that are widely recognized as valid – like DNA analysis – it is critical that courts ensure that such techniques are applied reliably to the facts in each case before admitting the evidence against a criminal defendant.

Here, the trial court abdicated its gatekeeping role by improperly admitting problematic testimony from the State's forensic analyst without conducting any reliability analysis. The DNA sample relied on by the State's expert failed to meet the criteria defined in the Charlotte-Mecklenburg Crime Laboratory's ("Lab") Standard Operating Procedure ("SOP") as sufficient for reliable analysis and interpretation, and the Lab failed to employ any additional measures to test the reliability of the conclusions based on the non-routine DNA samples in this case.

ARGUMENT

I. COURTS HAVE AN OBLIGATION TO SERVE AS GATEKEEPERS FOR THE ADMISSION OF POTENTIALLY UNRELIABLE SCIENTIFIC EVIDENCE.

Expert testimony in North Carolina is governed by North Carolina Rule of Evidence 702 ("Rule 702"), which was amended to conform to the expert admissibility standard established by *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993) and its progeny. *State v. McGrady*, 368 N.C. 880, 892, 787 S.E.2d 1, 10 (2016). Under Rule 702(a), expert testimony is admissible only if the testimony is based upon sufficient facts or data; the testimony is the product of reliable principles and methods; and the witness has applied the principles and methods reliably to the facts of the case. N.C.G.S. § 8C-1, Rule 702(a). To satisfy this three-

pronged reliability test, an expert witness "must be able to explain not only the abstract methodology underlying the witness's opinion, but also that the witness reliably applied that methodology to the facts of the case." *State v. McPhaul*, 256 N.C. App. 303, 316, 808 S.E.2d 294, 305 (N.C. Ct. App. 2017). Where there is "simply too great an analytical gap between the data and the opinion proffered," the courts need not, and should not, "admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert." *McGrady*, 368 N.C. at 890, 787 S.E.2d at 9 (quoting *General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997)).

While trial courts have considerable discretion with regard to the procedures used to evaluate the reliability of expert testimony, a court must exercise that discretion with due regard for the complexity of the principles and methods at issue and the evidence to be considered. It cannot simply abdicate its gatekeeping obligation. Where the methods at issue or the evidence of reliability is not straightforward, courts should "order submission of affidavits, hear *voir dire* testimony, or conduct an in limine hearing." *McGrady*, 368 N.C. at 893, 787 S.E.2d at 11. Moreover, the trial court must articulate the basis for concluding that the preponderance of evidence supports a finding that the expert testimony is reliable without relying on the expert's bare assertion of reliability. *Id.* at 892, 787 S.E.2d at 10-11.

II. THE DNA EVIDENCE AND EXPERT TESTIMONY SHOULD HAVE BEEN EXCLUDED UNDER RULE 702(a).

Misleading and problematic forensic evidence such as the DNA evidence admitted in this case without inquiry from the trial court undermines the truth-seeking function of criminal proceedings and is a leading cause of wrongful convictions. Scientific reviews of forensic science methods have repeatedly recognized that standard methods of forensic DNA analysis are

one of the most reliable of all forensic methods ***when properly applied***.[2] The reliability of DNA analysis depends, in large part, on the fact that SOPs used by laboratories are based on extensive research and empirical validation studies that delineate the standards for reliable application. While those standards offer some flexibility to exceed the established limits, deviation is only appropriate when based on empirical validation studies that demonstrate the reliability of such application.

Here, the State's expert testimony was flawed in two ways. *First*, both the amount of DNA recovered from the DNA sample and the data used to determine a DNA profile from the sample were below the relevant thresholds identified in the SOP as important factors affecting reliability. Specifically, the amount of DNA collected was substantially below the acceptable reliability thresholds set forth in the Lab's SOP. Despite acknowledging this, the expert testified that the DNA analysis conducted and the opinions rendered were nonetheless still reliable because the methods applied were generally accepted in the field and technically compliant with the Lab's SOP for DNA analysis. This is wrong – the method used was not compliant with the Lab's SOP, "technically" or otherwise.

Additionally, the DNA expert testified that DNA recovered from a window sash at the crime scene came from a single individual rather than a mixture of multiple individuals. Mixtures require more complex statistical methods in order to construct a DNA profile for each contributor, and the results have a higher degree of uncertainty than DNA profiles assumed to be from a single

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[2] *See* Nat'l Research Council of the Nat'l Acad. of Sciences, *Strengthening Forensic Science in the United States: A Path Forward* (2009) ("NAS Report"), https://www.ojp.gov/pdffiles1/nij/grants/228091.pdf; President's Council of Advisors on Sci. & Tech., *Report to the President: Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods* (2016) ("PCAST Report"), https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensic_science_report_final.pdf.

individual. The expert explained that the Lab ran a search of the Combined DNA Index System ("CODIS") (the national DNA database) based on the assumption that the DNA was from a single individual, and that the analysis identified Mr. Rodgers' DNA profile as a match for the window sash DNA. However, the Lab took no steps to attempt to validate that assumption. DNA analysis of mixtures – as opposed to single-source DNA samples – is subjective and can lead to wide variations in results. *See* Itiel E. Dror & Greg Hampikian, *Subjectivity and Bias in Forensic DNA Mixture Interpretation*, 51 Sci. & Just. 204, 205 (2011).

Second, in light of the limitations in the DNA collected, the Lab failed to exercise "extreme caution," in its interpretation of the results, as required by its SOP. As discussed below, the Lab could – and indeed, should – have taken additional steps to test the reliability of the conclusions. It unaccountably failed to do so.

A. DNA Evidence that Does Not Comport with the SOP Must Be Scrutinized.

In forensic DNA analysis, laboratory SOPs are based on empirical validation studies that demonstrate the scope and limits of reliable application.[3] In the United States, SOPs for forensic DNA analysis must comport with national standards established by the Academy Standards Board ("ASB"), a component of the American Academy of Forensic Sciences ("AAFS"). The Federal Bureau of Investigation ("FBI") has implemented requirements for SOPs and other quality assurance components used by laboratories that submit DNA data to CODIS.[4] Among

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[3] *See, e.g.*, ASB Standard 040, Standard for Forensic DNA Interpretation and Comparison Protocols (2019), https://www.aafs.org/asb-standard/standard-forensic-dna-interpretation-and-comparison-protocols; ASB Standard 020, Standard for Validation Studies of DNA Mixtures, and Development and Verification of a Laboratory's Mixture Interpretation Protocol (2018), https://www.aafs.org/asb-standard/standard-validation-studies-dna-mixtures-and-development-and-verification-laboratorys.

[4] FBI Quality Assurance Standards for Forensic Testing Laboratories, https://www.swgdam.org/_files/ugd/4344b0_d73afdd0007c4ed6a0e7e2ffbd6c4eb8.pdf.

other things, these standards require laboratories to base their SOPs on data from empirical validation studies.

Validation studies include both published research and internal validation studies performed by individual laboratories. Both types of validation studies test the reliability of each step in the DNA analysis process and identify factors that affect reliability. Most notably here, empirical validation studies examine the effects of the quality and quantity of DNA samples on reliability and define statistical criteria for the reliable interpretation of DNA profiles.

Using the results from validation studies, individual DNA laboratories develop SOPs that define how standard DNA analysis methodologies are implemented using specific instruments, biochemical reagents, analytical software, and other components used in a specific lab. Using the results of those studies, laboratories determine specific criteria for reliable application of the relevant procedures, including thresholds for the amount of DNA that is required to produce a reliable result, and examples of the types of data that consistently produce reliable results, as demonstrated in the validation studies. Thus, while not the only source, SOPs for forensic DNA analysis provide important evidence of factors that can affect the reliability of the standard DNA methods as applied in a particular case.

B. The DNA Evidence and Expert Testimony Admitted Was Problematic.

1. The DNA Evidence Did Not Meet the Laboratory's SOP as Sufficient for Reliable Analysis and Interpretation.

National standards and generally accepted practices in DNA analysis require that laboratories determine thresholds of this type on the basis of reliability data from internal validation studies. As a result, the thresholds provide an explicit warning that the routine application of analytical procedures and interpretations to samples and data below these thresholds have an elevated risk of producing incorrect conclusions. DNA evidence based on

such samples is therefore unreliable unless the laboratory takes additional steps to validate the results.

The Lab's SOP sets a threshold for the minimum quantity of DNA that is considered sufficient for reliable analysis. Specifically, the Lab's SOP establishes a threshold of 250 picograms per microliter (pg/µl). The DNA sample recovered from the window sash contained approximately 27 pg/µl – almost 10 times less than the Lab's threshold.

This threshold is important because it indicates that, if a sample size is below the identified threshold, lower amounts of DNA have an increasing risk of errors or artifacts in the biochemical reaction used to amplify DNA samples for analysis. The SOP does not prohibit analysis of smaller amounts, but indicates the need for "extreme caution" for any sample below that threshold.

Here, all of the data points used to construct a DNA profile from the window sash sample were substantially below an important statistical threshold. Constructing a DNA profile requires interpretation of a graphic display of the raw DNA data called an electropherogram. In this display, data points are represented by peaks at different positions in the graph. Standard DNA methods use the relative heights of these peaks to determine whether a sample contains DNA from a single individual (a single source) or a mixture of DNA from two or more individuals.

The reliability of this step in the analysis is related to two statistical thresholds that represent the risk of different types of errors in interpreting the data: (i) the analytical threshold, and (ii) the stochastic threshold. The "analytical threshold" defines the minimum peak height in the graph that can reliably identify part of the DNA profile (an allele) rather than an insignificant background pattern in the DNA sample. Statistically, peak heights close to the analytical threshold increase the potential for false positive or false negative assignment of the peak as

either an allele or background. A false positive would mean calling a peak an allele when it is in fact a background peak. A false negative would be failing to correctly identify an allele because the peak is too close to the background. Thus, when the largest peaks are close to the analytical threshold, there is an increased risk of failing to identify alleles from a single individual or from a contributor to a mixture. The "stochastic threshold" is important for distinguishing whether the DNA sample should be interpreted as a single-source profile or a mixture of DNA from more than one person. When major peaks in a DNA profile are below the stochastic threshold, there is an increased chance that other alleles from the same contributor will be missed because of random (stochastic) variation in the way DNA is amplified. These thresholds must be determined on the basis of data from the laboratory's internal validation studies. Statistical analysis of the validation data is used to determine how DNA peak height affects the reliability of identifying alleles that make up the DNA profile. The Lab's SOP specifically states, for example, that "if all the called alleles are below the stochastic threshold and there are indications of a second contributor below the analytical threshold, then the profile will be uninterpretable."[5]

In this case, all of the DNA peaks from the window sash sample were substantially below the stochastic threshold established in the Lab's SOP. Multiple peaks were close to or below the analytical threshold, and the analyst acknowledged that "[i]t's possible" that there was a second contributor. Specifically, the SOP established a stochastic threshold of 350 relative fluorescence units ("RFU"); the largest peak heights in the window sash DNA sample were below 150 RFU, and multiple other peaks were close to or below the analytical threshold of 75 RFU. Explicit warnings in the SOP caution the Lab and trial court that DNA samples and data below the

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5 Trial Transcript Vol. 4 at 626 (December 3, 2021).

indicated thresholds require special care in interpreting that data and in evaluating the reliability of those interpretations.

In addition, the results yielded a partial DNA profile with allele dropout at multiple loci. This means that the results were potentially consistent with both a single source and a DNA mixture from two or more contributors. Nonetheless, the Lab's technical lead for DNA determined that it was "OK to treat [the partial profile] as single-source profile." The Lab's technical lead did not, however, employ any of several possible measures to validate that claim.

2. The Laboratory Failed to Exercise the "Extreme Caution" Required by the SOP.

The DNA evidence was problematic because the Lab failed to exercise the "extreme caution" required by the SOP when analyzing data below the indicated thresholds. Despite explicit warnings in the SOP, the Lab applied methods for routine DNA analysis and interpretation to the non-routine samples and data from the window sash DNA. The State's DNA expert did not describe any precautions taken to ensure that the methods and interpretation of the results were reliable as applied in this case.

While the Lab's SOP does allow for some flexibility in the specific steps taken to evaluate the reliability of non-routine applications, validation studies in the development of national standards and laboratory SOPs offer potential safeguards to undertake in situations that warrant "extreme caution." Among other measures that could help validate the reliability of the results, the Lab could have reanalyzed the data from previous validation studies to establish the thresholds listed in the SOP. The Lab's SOP indicated that thresholds and interpretive criteria described in the SOP were based on internal validation studies. If the previous validation studies did not include data directly comparable to the samples and data in this case, the SOP explicitly points out that the Lab might need to conduct a new validation study to establish the reliability of

the results in this case. The expert's testimony, however, did not include any evidence from validation studies showing that the analytical methods and interpretive criteria described by the expert are reliable when applied with no modification to samples and data far below the indicated thresholds.

Additionally, the Lab could have critically evaluated the alternative explanation that the window sash DNA represented a mixture of DNA from two contributors, but failed to do so. At trial, the State's DNA expert acknowledged that it was "possible" that the DNA was a mixture, but she did not determine the relative likelihood of observing the data assuming a mixture compared to a single source. The Lab could have demonstrated "extreme caution" by consulting a statistician qualified to perform that analysis.

The Lab could have also excluded the victim and her two male children as possible contributors to the DNA profile under the alternative assumption that the window sash DNA is a mixture. The Lab excluded the female victim as a possible contributor and assumed the DNA profile was from a single source because the DNA profile contained Y-chromosome alleles as well as other alleles that did not match the victim. The Lab did not test the two male children living with the victim as possible male contributors.

As explained, the DNA analyst could have taken several measures to validate the reliability of her conclusions. The fact that the Lab did not apply ***any*** extra precautions in this case demonstrates another deficiency with the evidence that warranted further scrutiny by the trial court before that evidence was presented to the jury.

III. THE COURT FAILED TO EXERCISE ITS GATEKEEPING FUNCTION.

In this case, the State presented scientific evidence and expert testimony, in which the Lab's analyst concluded that (1) the window sash DNA could be reliably analyzed as a single-source sample, (2) the victim was excluded as a contributor, (3) the window sash DNA matched

Mr. Rodgers' DNA, and (4) "the probability of selecting an unrelated person at random who could be a contributor of this partial profile is approximately 1 in 1.5 quadrillion." The expert did not estimate the probability that this partial profile was instead a mixture and/or contributed by a male related to the victim or mention any other potential individuals that could have been tested against the sample such as the victim's sons. The expert testified that her application of DNA methods to the facts of this case complied with the Lab's SOP and that her procedures were generally accepted in the field of forensic DNA analysis. The Lab's SOP specifically cautions that the amount and type of DNA obtained in this case sharply increases the risk of an unreliable result and required special precautions to determine whether the application was reliable. The amount of DNA was well below accepted reliable thresholds, and the Lab failed to undertake additional safeguards to validate the results.

The trial court summarily denied Mr. Rodgers' request for a *voir dire* and rejected his request to proffer evidence regarding the expected result of such *voir dire*. While trial courts have considerable discretion with respect to the procedures they may use to investigate reliability, the trial court abused its discretion by failing to make any attempt to scrutinize the reliability of the State's DNA evidence. As discussed in Section II *supra*, the DNA evidence and expert testimony contained several flaws that rendered them unreliable. Given the complexity of the methods at issue and the evidence presented in this case, the trial court should have, at least, accepted the Defense's proffer of evidence before admitting the DNA testimony.

The trial court also abused its discretion in failing to require the State to produce evidence that the DNA evidence was reliable as applied to the facts in this case. As discussed in section II *supra*, minimum thresholds established in a laboratory SOP reflect the results of empirical validation studies describing the effects of sample quantity and data quality on the

reliability of the results based on the methods described in the SOP. Where national standards and a laboratory's SOP identify factors that have been shown to affect the reliability of the results, the *ipse dixit* of the State's expert is not rationally sufficient to show that her methods are reliable when applied below minimum thresholds for reliable application indicated in the SOP. An expert who has applied a method incorrectly may testify in good faith – but incorrectly – that she applied the method correctly.

In the absence of a hearing or other procedure to evaluate the reliability of the DNA analysis in this case, the proffered evidence fails to meet the standard set forth in Rule 702. The trial court therefore erred in admitting the DNA evidence and supporting testimony.

IV. PROBLEMATIC EXPERT TESTIMONY LIKELY AFFECTED THE JURY'S VERDICT.

Forensic expert evidence has significant persuasive power over juries, which vastly overestimate the probative value of scientific evidence.[6] This is especially true for DNA evidence, which is rightly viewed as the "gold standard" in forensic evidence by both experts and laypersons. Studies have shown jurors often give undue weight to DNA evidence as compared to other forms of evidence because of "presumed scientific rigor and accuracy."[7] Indeed, studies show that once DNA evidence is highly persuasive, and when introduced at trial, the probability of conviction increases dramatically.[8] In one study comparing DNA evidence to several other types of evidence showed jurors of all ages view DNA evidence used in trials as the most

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[6] W.C. Thompson and E.J. Newman, *Lay Understanding of Forensic Statistics: Evaluation of Random Match Probabilities, Likelihood Ratios, and Verbal Equivalents*, 39(4) Law & Human Behavior, 332-349 (2015), https://doi.org/10.1037/lhb0000134.

[7] Joel D. Lieberman, *et al.*, *Gold Versus Platinum: Do Jurors Recognize the Superiority and Limitations of DNA Evidence Compared to Other Types of Forensic Evidence*, 14(1) Psychology, Public Policy, & Law 27, 32 (2010), https://doi.org/10.1037/1076-8971.14.1.27.

[8] *Id.* at 35-40, 53.

accurate (95%) and persuasive (94%) type of evidence as compared to other types of scientific evidence.[9] Two other studies showed similar results using different measurements.[10] In hypotheticals where DNA evidence presented did not match the defendant, the DNA evidence led to the fewest convictions overall (25%) as compared to other types of scientific evidence (47%).[11] It is not surprising, therefore, that unreliable forensic evidence has led to a significant number of wrongful convictions.[12]

Where unreliable forensic evidence is admitted at a criminal trial, there is a serious risk that juries will overvalue this evidence and convict innocent people. The Supreme Court "ha[s] recognized the threat to fair criminal trials posed by the potential for incompetent or fraudulent prosecution forensics experts." *Hinton v. Alabama*, 571 U.S. 263, 276 (2014).

Given the importance placed on DNA by laypersons, the jury in this case likely was influenced by the problematic DNA evidence, and the expert's misplaced assurance that her methods followed the Lab's SOP and generally accepted standards in the scientific community. This testimony was, at best, misleading. Even if the expert had explained the limitations of the DNA analysis, jurors lack the knowledge and expertise to appropriately weigh the evidence. Accordingly, the trial court should have excluded the DNA evidence and expert testimony.

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9 *Id.* at 35.

10 *Id.* at 53.

11 *Id.* at 40.

12 *See, e.g.*, NAS Report at 4-5, 42-44; PCAST Report at 25-26; Brandon L. Garrett & Peter J. Neufeld, Invalid Forensic Science Testimony and Wrongful Convictions, 95 Va. L. Rev. 1, 2 (2009).

CONCLUSION

For the foregoing reasons, a new trial should be granted because the trial court failed to apply the required Rule 702 scrutiny when evaluating the reliability of the State's proffered expert evidence.

Respectfully submitted, this 21st day of November, 2022.

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CERTIFICATE OF COMPLIANCE WITH RULE 28(J)

Undersigned counsel hereby certifies that this brief complies with North Carolina Rule of Appellate Procedure 28(j), in that it is printed in 12-point Time New Roman font and contains no more than 3,750 words in the body of the brief, footnotes and citations included, as indicated by the word-processing program used to prepare this brief.

This the 21st day of November, 2022.

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